Research Topics

# Noncommunicable diseases and mental health experiences before and after the COVID-19 pandemic

**Edited by**
Aliya Naheed, Malay K. Mridha, Rahul Shidhaye, Jerome T. Galea,
Hannah Jennings and Annika Sweetland

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# Noncommunicable diseases and mental health experiences before and after the COVID-19 pandemic

**Topic editors**
Aliya Naheed — International Centre for Diarrhoeal Disease Research, Bangladesh
Malay K. Mridha — BRAC University, Bangladesh
Rahul Shidhaye — Pravara Institute of Medical Sciences, India
Jerome T. Galea — University of South Florida, United States
Hannah Jennings — University of York, United Kingdom
Annika Sweetland — Columbia University, United States

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EDITED AND REVIEWED BY
Wulf Rössler,
Charité Universitätsmedizin Berlin, Germany

*CORRESPONDENCE
Rahul Shidhaye
✉ rahulshidhaye@gmail.com
Aliya Naheed
✉ anaheed@icddrb.org

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# Editorial: Noncommunicable diseases and mental health experiences before and after the COVID-19 pandemic

Rahul Shidhaye[1,2]*, Annika C. Sweetland[3], Jerome T. Galea[4], Mir Nabila Ashraf[5], Malay K. Mridha[6], Hannah Maria Jennings[7,8] and Aliya Naheed[5]*

[1]Department of Psychiatry, Pravara Institute of Medical Sciences Ahmednagar, Ahmednagar, India, [2]Department of Health, Ethics, and Society, Care and Public Health Research Institute, Maastricht University, Maastricht, Netherlands, [3]Department of Psychiatry, Columbia Vagelos College of Physicians and Surgeons/New York State Psychiatric Institute, New York, NY, United States, [4]School of Social Work, University of South Florida, Tampa, FL, United States, [5]Health Systems and Population Studies Division, Initiative for Non Communicable Diseases, International Centre for Diarrhoeal Disease Research Bangladesh, Dhaka, Bangladesh, [6]Center for Non-communicable Diseases and Nutrition, James P Grant School of Public Health, BRAC University, Dhaka, Bangladesh, [7]Department of Health Sciences, University of York, York, United Kingdom, [8]Hull York Medical School, York, United Kingdom

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**non-communicable diseases, mental health, COVID-19, comorbidity, health services**

Editorial on the Research Topic
Noncommunicable diseases and mental health experiences before and after the COVID-19 pandemic

Globally, Non-Communicable Diseases (NCDs) such as cardiovascular disease (CVD), diabetes, cancer, and respiratory diseases account for approximately 71% of deaths (1). NCDs disproportionately affect people in Low- and Middle-Income Countries (LMICs) and cause the death of approximately 32 million people per year. Mental illness is another global burden that accounts for around 32.4% of years lived with disability and 13% of disability-adjusted life-years (DALYs) (2).

Additionally, the current COVID-19 pandemic has severe repercussions for people with NCDs (3). Evidence suggests that NCDs such as hypertension and type 2 diabetes are found to be the more frequent co-morbidities with SARS-CoV-2 that require intensive care (4). However, our understanding of the impact of COVID-19 on major NCDs and the depth of evidence regarding an impactful solution to mitigate the burden of NCDs amid the COVID-19 situation is limited.

The aim of this Research Topic was to generate evidence gathered both before and during the COVID-19 pandemic that includes conceptual, epidemiological, intervention, and policy papers to address the related issues of noncommunicable disease (hypertension, diabetes, COPD, etc.) and mental health globally.

The Research Topic includes 13 contributions from 96 authors presenting their research conducted in different parts of the world. The maximum number of papers are from China ($n = 4$), followed by Mozambique ($n = 2$), and one paper each from Bangladesh, Colombia, Ethiopia, Lebanon, Panama, South Korea, and The Netherlands. Mental health comorbidity in patients with pre-existing NCDs during the COVID-19 pandemic is assessed in four papers, one paper deals with the quality-of-care, and the impact of COVID-19 on mental health at population level is presented in four papers. Two papers are about factors affecting access to mental health care and the remaining two papers deal with the consequences of COVID-19 on the mental health of Health Care Providers (HCPs). Below we provide an overview of all the papers included.

## COVID-19 and multimorbidity

Mental health of individuals with pre-existing NCDs was severely affected during COVID-19. Amin et al. describe a high prevalence of depression and anxiety among patients who were hospitalized for heart disease during the pandemic in Dhaka, Bangladesh. Their findings underline the importance of mental health screening of patients with Cardio-Vascular Diseases in order to offer sufficient support. An online cross-sectional survey conducted during April–May 2022 of Chinese women receiving oral chemotherapy for ovarian cancer by Mao et al. found that a higher proportion of these women reported anxiety symptoms and lower quality of life. This could possibly be due to the COVID-19 pandemic situation and the resultant delays in receiving care according to the authors. Similarly, Wang et al. report a high proportion of Chinese patients with advanced melanoma having anxiety, depression, and importantly the fear of progression of cancer.

The impact of COVID-19 on the quality of life of patients with chronic NCDs in Ethiopia is presented by Ayalew et al.. Their findings suggest that female gender and presence of a common mental disorder led to poorer quality of life (QoL) in patients with chronic NCDs. The study also highlights another important finding that lower educational status is significantly associated with better QoL specially during the pandemic which is supported by other studies as well. Determinants of quality-of-care provided to patients with diabetes and hypertension in a fragile context (Lebanon) is described by Saleh et al.. As this study began just before the pandemic started, it captures the impact of COVID-19 on NCD care provision.

## COVID-19 and mental health

The fear of contracting COVID-19 and the measures undertaken to curb the transmission of the infection had a significant impact on the mental health of the population. Analysis of the data from a large Korean Community Health Survey by Han et al. indicates a high level of COVID-19 related anxiety and a negative impact on physical activity, diet, and sleep pattern. Similar psychological response to the pandemic is reported from the diametrically opposite part of the globe, Panama. Oviedo et al. present the findings from a community survey of adults in which, as in the Korean study, they report high levels of stress, anxiety, and depression among a community sample of adults. School/college closure due to COVID-19 affected mental health of children and adolescents. Li describes the role of various risk factors associated with depression and anxiety in college students from Shanghai, China.

Knowledge of the mental health conditions (commonly known as mental health literacy) and perception related to mental health care provision play an important role in access to mental health care. Li et al. explore mental health literacy using a cross-sectional community survey of the residents from Jiangsu province in China during the subsequent waves of the pandemic. To improve the perception of ease to access mental health care, the need for better communication between the State health agencies, health care providers, and the patients with mental health conditions is highlighted by Gómez-Restrepo et al..

Attitude of HCPs toward mental health conditions also plays a role in care provision. Using an explanatory sequential mixed-methods study design, Mandlate et al. discuss knowledge and attitudes about mental health among lay counselors in Mozambique.

## COVID-19 and health care providers

Being on the frontline, HCPs were severely affected physically, psychologically, and socially due to the COVID-19 situation. Czepiel et al. present the findings on an online survey of Dutch HCPs highlighting the subjective experience and mental health conditions reported by these HCPs. Interesting findings from Mozambique are reported by Feliciano et al. as the HCPs there reported a reduction in burnout, which the authors attribute to reduced caseloads during lockdown.

## Challenges and recommendations

This Editorial Board was formed by reviewers from both High and low-and middle-income countries. Despite the huge pool of reviewers and the efficient process of the Frontiers to invite reviewers, one of the challenges we faced was to identify potential reviewers. We highly recommend time and opportunity to create a pool of reviewers, particularly from Low- and Middle-income countries and conduct workshops for capacity building of the young reviewers who can contribute effectively to reviewing the manuscripts in a timely manner.

In the conclusion, this Research Topic has provided an opportunity for researchers to showcase their innovative approach to modern thinking in publishing research, particularly meeting the demand of disseminating new knowledge during the COVID-19 pandemic. More topic areas should be included encouraging the writers to adopt a new way of presenting ideas of thinking critically about how the research evidence compares with pre-COVID vs. post-COVID settings and would be useful to policymakers for adopting rapid solutions in tackling NCD and mental health in a public health crisis such as COVID-19.

## Author contributions

AN initiated the Research Topic. RS, AS, JG, MA, MM, HJ, and AN were the topic editors. RS wrote the first draft. All authors contributed to the manuscript revision, read, and approved the final version.

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## Conflict of interest

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

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# Fear of Progression, Anxiety, and Depression in Patients With Advanced Melanoma in the COVID-19 and Post-COVID-19 Era

*Xiaowen Wang[1]†, Min Li[2]†, Qiong Shi[3], Hongchen Ji[1], Shengnan Kong[1], Lei Zhu[4] and Hong-Mei Zhang[1]**

*[1] Department of Clinical Oncology, Xijing Hospital, Fourth Military Medical University, Xi'an, China, [2] Department of Neurosurgery, Shaanxi Provincial People's Hospital, Xi'an, China, [3] Department of Dermatology, Xijing Hospital, Fourth Military Medical University, Xi'an, China, [4] School of Psychology, Shaanxi Normal University, Xi'an, China*

**Edited by:**
*Rahul Shidhaye,*
*Pravara Institute of Medical Sciences,*
*India*

**Reviewed by:**
*Hever Krüger,*
*Universidad Peruana Cayetano*
*Heredia, Peru*
*Viera Ivankova,*
*Technical University of Košice,*
*Slovakia*

***Correspondence:**
*Hong-Mei Zhang*
*zhm@fmmu.edu.cn*

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

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**Background:** The novel coronavirus disease 2019 (COVID-19) pandemic causes great disruption to cancer care services, which might bring about psychological problems and further lower both physical and mental life quality in cancer patients. Until now, very few studies focused on the psychological distress of patients with advanced melanoma before or during the epidemic. This study aimed to elucidate the fear of progression (FoP), anxiety, depression, and related independent predictors in patients with advanced melanoma during the COVID-19 outbreak.

**Methods:** Two hundred and seventy-three patients with unresectable stage III or metastatic melanoma were recruited from February 2020 to November 2021, and completed the Fear of Progression Questionnaire-Short Form (FoP-Q-SF), State Trait Anxiety Inventory (STAI-6), and Patient Health Questionnaire (PHQ-9).

**Results:** One hundred and seventy-four (64.7%) patients experienced heighted FoP (FoP-Q-SF: 39.9 ± 11.0), 198 (72.5%) patients reported elevated anxiety (STAI-6: 13.1 ± 3.0), and 62 (22.7%) patients had increased depression (PHQ-9: 6.4 ± 6.1). In multivariate analysis, illness duration ($OR = 0.987$ for FoP; $OR = 0.984$ for depression), cancer stage ($OR = 14.394$ for anxiety) and disease progression ($OR = 1.960$ for FoP; $OR = 23.235$ for anxiety; $OR = 1.930$ for depression) were independent predictors for FoP, anxiety or depression. Additionally, the high levels of FoP, anxiety and depression were significantly positive correlated with each other ($r = 0.466$ for FoP and anxiety; $r = 0.382$ for FoP and depression; $r = 0.309$ for anxiety and depression).

**Conclusion:** Our study indicates that FoP, anxiety and depression are persisting among patients with advanced melanoma in the COVID-19 and post-COVID-19 era. Effective psycho-oncological interventions are needed for melanoma patients with psychological distress during the ongoing COVID-19 pandemic.

**Keywords: fear of progression, anxiety, depression, melanoma, COVID-19**

## INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (1), has occurred in 237 countries, areas or territories and turned into a global public health crisis (2). Globally, as of 17 December 2021, there have been 271,963,258 confirmed cases of COVID-19, including 5,331,019 deaths (2). The COVID-19 pandemic continues to create significant challenges globally (3), not only to effectively handle the COVID-19 pandemic but also to manage other diseases especially cancer (4). Previous studies suggest that cancer patients might be particularly susceptible to COVID-19 and have a poorer prognosis because of their immunosuppressive condition caused by the cancer itself and anticancer treatments, such as surgery, chemotherapy, radiotherapy, targeted therapy, or immunotherapy (5). A major consideration of cancer care is to balance the need of cancer management against the risk of patient exposure and infection in the face of the COVID-19 pandemic (4). In order to reduce or avoid cross infection, many hospitals have taken mandatory actions to limit outpatient visits and inpatient admissions (6, 7). The pandemic causes great disruption to the full spectrum of medical cancer care services, including cancer diagnoses, treatments and follow-up (8).

Melanoma is a malignant neuroendocrine tumor of neural crest and mainly occurs in skin and mucosa. The morbidity and mortality of melanoma has increased dramatically around the world (9). There were 324,635 new cases of melanoma, the equivalent of about 889 new cases each day worldwide in 2020 (9). An estimated 57,043 people died from melanoma worldwide in 2020, corresponding to almost 156 deaths per day (9). The median overall survival time of patients with metastatic melanoma is only six to 8 months (9). Immune checkpoint inhibitors and targeted therapy have improved survival outcomes of melanoma patients, however, the prognosis of patients with advanced melanoma remains unoptimistic (10, 11). Recent researches demonstrate the unfavorable effects of COVID-19 on advanced melanoma care (12–15). During the COVID-19 pandemic, the diagnose, start of systemic treatment and treatment courses for advanced melanoma were frequently postponed (12). Attentionally, along with the epidemic, patients were diagnosed with poorer tumor characteristics (12). Forced delays or interruptions of cancer management might increase the risk of cancer deterioration and therefore bring about physical and psychological problems in patients with melanoma.

Previous reviews denote that about 30% of melanoma patient suffered from heightened psychological distress during the time of diagnosis and treatment (16, 17). Fear of cancer recurrence, anxiety and depression are highly common psychological symptoms (18, 19). Fear of cancer recurrence is defined as worry, or concern about cancer relapse or fear of progression (FoP), with prevalence rates of 31–52% (18). Anxiety is characterized by an emotional state consisting of feelings of apprehension and tension and arousal of the autonomic nervous system, with prevalence rates of 9.8–19% (19, 20). Depression includes a depressed mood and/or loss of interest or pleasure in normal activities, with additional symptoms including worthlessness, guilt, concentration problems and changes in appetite, energy and sleep, with prevalence rates of 8–24.6% (19, 21). Untreated negative psychological symptoms could further lower both physical and mental life quality of cancer patients (22), which might be worse in those patients who undergo anti-cancer treatments.

Given the strong effect of COVID-19 pandemic on cancer care, cancer patients are more susceptible to emotional attack without enough attention and adequate psychological support. Before the epidemic, very few studies focused on the mental state and independent predictors in patients with advanced melanoma. Currently, little is known about the psychological distress in melanoma patients during the public crisis. This cross-sectional study focused on the negative psychological symptoms of patients with advanced melanoma in the COVID-19 and post-COVID-19 era. We assessed the prevalence of FoP, anxiety and depression in patients with advanced melanoma. Furthermore, we explored the association of demographic and illness-related factors with the levels of FoP, anxiety, and depression. Third, we examined the correlationship between FoP, anxiety, and depression in melanoma patients. The present study is needed to provide a basis for psychological intervention.

## METHODS

### Sample and Procedure

To investigate the influence of COVID-19 outbreak on the mental state of patients with advanced melanoma, a cross-sectional single center study was performed in a general Hospital named Xijing hospital of the Fourth Military Medical University. Eligible melanoma patients were recruited consecutively from February 2020 to November 2021. Patients were eligible if they were diagnosed with advanced melanoma. Patients were excluded if they had severe physical impairment (with an Eastern Cooperative Oncology Group performance-status score greater than or equal to 2) and/or severe cognitive impairment. Patient recruitment flowchart is shown in **Figure 1**. In total of 396

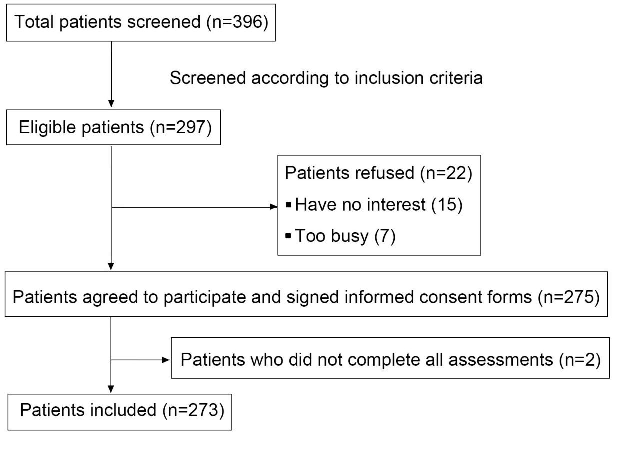

**FIGURE 1 |** Recruitment flowchart.

patients, 297 patients were eligible and 275 patients agreed and signed an informed consent. The reasons for refusal were: not interested in the study (15 patients) and too busy (7 patients). Finally, 273 patients completed the questionnaires. The response rate was 91.9%. No patients received a diagnosis of COVID-19 infection in the study population confirmed by SARS-CoV-2 nucleic acid tests. The study was approved by the Committee for Ethics in Medical Investigations of the Forth Military Medical University and was conducted according to the Declaration of Helsinki Principles. All patients signed an informed consent provided electronically prior to registration, and eligible patients completed the questionnaires through online platform.[1]

## Population Characteristics

Socio-demographic characteristics (e.g., age, gender, educational level, marital status, and salary) were obtained through a self-report questionnaire. The clinical characteristics (e.g., diagnosis time, cancer stage, cancer recurrence or progression, and current treatment) were collected from patients and confirmed through medical record of hospital. Educational level was classified into three levels: low (primary schooling and lower vocational education), middle (secondary schooling and middle vocational education) and high (university education and higher vocational education).

## Fear of Progression

FoP was measured with the Fear of Progression Questionnaire-Short Form (FoP-Q-SF) (23). Each item was rated on a 5-point Likert scale from 1 (never) to 5 (very often). The total score ranges from 12 to 60. A cut-off score of $\geq$34 indicates clinical FoP. The Chinese version of scale has good reliability and validity in Chinese cancer patients (Cronbach $\alpha = 0.883$) (24).

## Anxiety

Anxiety was measured with the six-item short form of State Trait Anxiety Inventory (STAI-6) (25). Questions were answered on a 4-point Likert scale from 1 (not at all) to 4 (very much). Total scores range from 6 to 24, with higher scores indicating greater anxiety. A score $\geq$ 12 indicates significant anxiety. This scale has good reliability and validity in cancer patients (Cronbach $\alpha$: 0.77–0.83) (26).

## Depression

Depressive symptoms were measured with the nine-item short form of Patient Health Questionnaire (PHQ-9) (27). Each item was answered on a 4-point Likert scale from 0 (never) to 3 (nearly every day). Total scores ranged from 0 to 27, with cut-off scores of 10 or higher for a diagnosis of major depression. Previous research in cancer patients has shown good reliability and validity (Cronbach $\alpha$: 0.89–0.92) (28).

## Statistical Analysis

Statistical analyses were two-sided and performed by SPSS software (Version 26.0, SPSS Inc.). First, test of normality was performed by one-sample Kolmogorov-Smirnov test. Descriptive statistics were used to describe the demographic and clinical characteristics and psychological symptoms of study population, defined as mean with standard deviation (SD) or frequency with percentage. Second, continuous variables were not normally distributed, univariate analysis for factors associated with FoP, anxiety or depression was performed using Mann–Whitney *U* tests or Kruskal–Wallis tests. Third, independent predictors of high FoP, anxiety, or depression were tested in multivariate logistic regression. Finally, correlation was used to detect the relationship between FoP, anxiety, and depression by Spearman's correlation. Statistical significance was defined as $P < 0.05$.

# RESULTS

## Study Population

A total of 273 patients with advanced melanoma were enrolled in the present study. The socio-demographic and medical characteristics of participants are shown in **Table 1**. The mean age was 56.9 years ($SD = 13.2$), 56.0% were female, 42.1% had low-level education, 41.8% had low salary (<¥3,000), and majority were married (93.4%). Most patients were in stage IV (81.3%), and 18.7% were in stage III. About 53.1% of the patients had tumor recurrence or progression, most type of progression was distant metastasis (57.2%). Majority (97.8%) were receiving medical treatment, 92.7% were under immunotherapy, 15.4% were under targeted therapy, and 1.1% were under chemotherapy (**Table 1**).

## Prevalence of Fear of Progression, Anxiety, and Depression

When using the FoP-Q-SF to detect FoP, the mean level of FoP was 39.9 ± 11.0, with 64.7% (174 patients) reporting elevated FoP. Using the STAI-6 to measure anxiety, the average level of anxiety was 13.1 ± 3.0, with 72.5% (198 patients) reporting elevated anxiety. Using the PHQ-9 to assess depressive symptoms, the mean score of depression was 6.4 ± 6.1, with 22.7% (62 patients) reporting elevated depression. 14.7% (40 patients) had concurrent FoP, anxiety and depression, 35.5% (97 patients) had concurrent FoP and anxiety, 2.2% (6 patients) had concurrent FoP and depression, 4.0% (11 patients) had concurrent anxiety and depression, 11.4% (31 patients) only had FoP, 18.3% (50 patients) only had anxiety, 1.8% (5 patients) only had elevated depression, and 12.1% (33 patients) did not report elevated FoP, anxiety and depression.

## Univariate Analysis

As shown in **Table 2**, high FoP was significantly associated with patient's education ($P = 0.022$), disease duration ($P = 0.009$) and cancer recurrence or progression ($P = 0.002$). Patients who had low-level education, short disease duration and cancer progression (especially distant metastasis) tended to report high levels of FoP. Additionally, clinical anxiety was mainly associated with patient's education ($P = 0.004$), salary ($P = 0.024$), cancer stage ($P = 0.001$), and cancer recurrence or progression

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[1] www.wjx.cn

**TABLE 1 |** Patient characteristics (*n* = 273).

| Patient characteristics | No. | (%) |
|---|---|---|
| Age (years ± SD; range) | 56.9 ± 13.2 (16–86) | |
| **Gender** | | |
| Male | 120 | (44.0) |
| Female | 153 | (56.0) |
| **Marital status** | | |
| Single | 10 | (3.7) |
| Married | 255 | (93.4) |
| Divorced/Widowed | 8 | (3.0) |
| **Education** | | |
| Low | 115 | (42.1) |
| Middle | 65 | (23.8) |
| High | 93 | (34.1) |
| **Salary** | | |
| <¥3,000 | 114 | (41.8) |
| ¥3,000–5,000 | 77 | (28.2) |
| ¥5,000–10,000 | 63 | (23.1) |
| >¥10,000 | 19 | (7.0) |
| Months after diagnosis (months ± SD; range) | 21.6 ± 29.3 (1–196) | |
| **Cancer stage** | | |
| Unresectable III | 51 | (18.7) |
| IV | 222 | (81.3) |
| **Disease progression** | | |
| Yes | 145 | (53.1) |
| No | 128 | (46.9) |
| **Types of disease progression** | | |
| Local | 51 | (35.2) |
| Distant | 83 | (57.2) |
| Local + distant | 11 | (7.6) |
| **Type of ongoing medical treatment** | | |
| Chemotherapy | 3 | (1.1) |
| Targeted therapy | 42 | (15.4) |
| Immunotherapy | 253 | (92.7) |
| No | 6 | (2.2) |

($P < 0.001$), those patients with low education level, low income, stage IV of cancer, and cancer progression (especially local recurrence and distant metastasis) had high levels of anxiety. Furthermore, depression scores were higher in patients who had short disease duration ($P = 0.033$) and cancer recurrence or progression ($P = 0.018$) in comparison with their counterparts. No significant differences in FoP, anxiety, or depression were observed for other variables such as age, gender, marital status, investigation time, and treatments.

## Multivariate Analysis

In multivariate logistic regression analysis, cancer recurrence or progression ($OR = 1.960$, $P = 0.014$ for FoP; $OR = 23.235$, $P < 0.001$ for anxiety; $OR = 1.930$, $P = 0.035$ for depression) was confirmed to be independently associated with higher FoP, anxiety and depression levels. Short disease duration ($OR = 0.987$, $P = 0.006$ for FoP; $OR = 0.984$, $P = 0.030$ for depression) was found to be independent factor of higher FoP and depression levels. Moreover, patients who were under stage IV of melanoma ($OR = 14.394$, $P < 0.001$) were more likely to report higher anxiety level (**Table 3**). The score of FoP was significantly positive correlated with anxiety ($r = 0.466$, $P < 0.001$) and depression ($r = 0.382$, $P < 0.001$). The score of anxiety and depression were found to be significantly positive correlated with each other ($r = 0.309$, $P < 0.001$).

# DISCUSSION

The present study is one of the first cross-sectional studies to examine the psychological outcomes in patients with advanced melanoma during the COVID-19 pandemic. Our results showed that patients with advanced melanoma experienced high levels of FoP, anxiety and depression, which was persisting in the COVID-19 and post-COVID-19 era. We also found that FoP, anxiety, and depression were significantly positive correlated with each other, and disease duration, cancer stage, and cancer progression were independent predictors for these negative psychological symptoms in patients with advanced melanoma.

In these unselected inpatients with advanced melanoma, we found that 64.7% reported increased FoP, 72.5% experienced anxious symptoms, and 22.7% had elevated depression. Previous studies reported a wide variation of prevalence of psychological distress in melanoma patients, with the prevalence of FoP ranging from 0 to 77%, anxiety ranging from 15 to 49%, and depression ranging from 5 to 28% (29–37). Most studies focused on patients with early-stage melanoma, but only a few studies reported the psychological symptoms in patients with metastatic melanoma in small sample size (38–40). Recent researches demonstrate that the COVID-19 pandemic has induced increased levels of psychological distress among cancer patients. Wang et al. (41) showed that during the COVID-19 pandemic, 23.4% of Chinese cancer patients had depression, and 17.7% had anxiety. Frey et al. (42) also showed that 51.4% of cancer patients reported anxiety and 26.5% reported depression in the Unite State during the epidemics. Romito et al. (43) found that 36% of cancer patients had anxiety, 31% had depression during the first phase of the lockdown period in Italy. Chen et al. (44) found that 282 (86.5%) Chinese cancer patients reported FoP under the outbreak of COVID-19. Three other studies showed high levels of FoP in breast cancer patients with prevalence ranging from 17.2 to 84.1% (45–47). The highest prevalence of FoP was found in a recent study among hematological cancer patients showing that nearly all participants (127/134, 95%) reported clinical FoP (48). Until now, only one study assessed impact of COVID-19 on anxiety levels among cancer patients including 26 (8.5%) melanoma patients (49). Therefore, our study first implies that FoP, anxiety and depression in patients with advanced melanoma indeed aggravate during the COVID-19 pandemic.

Our multivariate analysis further confirms that disease duration, cancer stage and cancer progression are independent predictors for psychological symptoms in patients with advanced melanoma. Consistent with our results, Bell et al. (31) found evidence of high FoP levels in patients with new or recurrent melanoma. Hinnen et al. (29) reported that patients with melanoma of a higher stage were more likely to report

**TABLE 2 |** Factors associated with fear of progression, anxiety and depression.

| | Fear of progression | | FoP-Q-SF ≥ 34 | | Anxiety | | STAI-6 ≥ 12 | | Depression | | PHQ-9 ≥ 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Mean ± SD** | ***P*** | **N** | **%** | **Mean ± SD** | ***P*** | **N** | **%** | **Mean ± SD** | ***P*** | **N** | **%** |
| Age, y | | 0.424 | | | | 0.796 | | | | 0.692 | | |
| ≤56 | 42.9 ± 11.1 | | 71 | 61.2% | 13.5 ± 3.1 | | 84 | 72.4% | 7.0 ± 6.3 | | 28 | 24.1% |
| >56 | 42.9 ± 10.2 | | 103 | 65.6% | 13.5 ± 2.9 | | 114 | 72.6% | 7.1 ± 6.6 | | 34 | 21.7% |
| Gender | | 0.804 | | | | 0.773 | | | | 0.914 | | |
| Male | 39.7 ± 12.0 | | 70 | 58.3% | 13.2 ± 3.2 | | 87 | 72.5% | 6.2 ± 5.6 | | 22 | 18.3% |
| Female | 40.0 ± 10.2 | | 104 | 68.0% | 13.0 ± 2.9 | | 111 | 72.5% | 6.5 ± 6.5 | | 40 | 26.1% |
| Marital status | | 0.421 | | | | 0.306 | | | | 0.230 | | |
| Single | 41.5 ± 12.4 | | 6 | 60.0% | 13.7 ± 1.9 | | 10 | 100.0% | 5.1 ± 5.9 | | 1 | 10.0% |
| Married | 39.7 ± 11.0 | | 162 | 63.5% | 13.0 ± 3.1 | | 181 | 71.0% | 6.5 ± 6.1 | | 60 | 23.5% |
| Divorced/Widowed | 44.3 ± 9.7 | | 6 | 75.0% | 14.6 ± 2.3 | | 7 | 87.5% | 4.5 ± 7.3 | | 1 | 12.5% |
| Education | | **0.022*** | | | | **0.004**** | | | | 0.562 | | |
| Low | 41.3 ± 10.2 | | 77 | 67.0% | 13.6 ± 3.0 | | 88 | 76.5% | 6.5 ± 5.6 | | 27 | 23.5% |
| Middle | 41.1 ± 11.0 | | 43 | 66.2% | 13.4 ± 3.1 | | 50 | 76.9% | 6.4 ± 6.3 | | 16 | 24.6% |
| High | 37.3 ± 11.6 | | 54 | 58.1% | 12.3 ± 2.9 | | 60 | 64.5% | 6.1 ± 6.6 | | 19 | 20.4% |
| Salary | | 0.265 | | | | **0.024*** | | | | 0.110 | | |
| <¥3,000 | 40.8 ± 10.1 | | 76 | 66.7% | 13.7 ± 3.0 | | 90 | 78.9% | 6.8 ± 6.1 | | 29 | 25.4% |
| ¥3,000–5,000 | 40.6 ± 10.5 | | 51 | 66.2% | 13.0 ± 2.9 | | 57 | 74.0% | 7.5 ± 7.4 | | 25 | 32.5% |
| ¥5,000–10,000 | 37.6 ± 12.0 | | 36 | 57.1% | 12.1 ± 3.1 | | 38 | 60.3% | 4.7 ± 4.0 | | 5 | 7.9% |
| >¥10,000 | 38.6 ± 13.9 | | 11 | 57.9% | 12.8 ± 2.4 | | 13 | 68.4% | 4.6 ± 4.7 | | 3 | 15.8% |
| Investigation time | | 0.720 | | | | 0.351 | | | | 0.704 | | |
| 2020.02–2020.12 | 39.7 ± 11.0 | | 71 | 61.2% | 13.4 ± 2.9 | | 90 | 77.6% | 6.8 ± 6.8 | | 28 | 24.1% |
| 2021.01–2021.11 | 40.0 ± 11.0 | | 103 | 65.6% | 12.9 ± 3.2 | | 108 | 68.8% | 6.0 ± 5.5 | | 34 | 21.7% |
| Months after diagnosis, m | | **0.009**** | | | | 0.145 | | | | **0.033*** | | |
| ≤ 21 | 41.1 ± 10.6 | | 132 | 70.2% | 13.4 ± 3.0 | | 141 | 75.0% | 6.8 ± 6.2 | | 46 | 24.5% |
| > 21 | 37.1 ± 11.5 | | 42 | 49.4% | 12.5 ± 3.1 | | 57 | 67.1% | 5.4 ± 5.8 | | 16 | 18.8% |
| Cancer stage | | 0.104 | | | | **0.001**** | | | | 0.625 | | |
| Unresectable III | 37.5 ± 10.3 | | 31 | 60.8% | 12.2 ± 2.0 | | 34 | 66.7% | 6.0 ± 5.8 | | 12 | 23.5% |
| IV | 40.4 ± 11.1 | | 143 | 64.4% | 13.3 ± 3.2 | | 164 | 73.9% | 6.4 ± 6.2 | | 50 | 22.5% |
| Disease progression | | **0.002**** | | | | **0.000***** | | | | **0.018*** | | |
| Yes | 41.8 ± 11.3 | | 100 | 69.0% | 14.5 ± 2.6 | | 126 | 86.9% | 7.2 ± 6.4 | | 38 | 26.2% |
| No | 37.7 ± 10.3 | | 74 | 57.8% | 11.4 ± 2.6 | | 72 | 56.3% | 5.4 ± 5.6 | | 24 | 18.8% |
| Types of disease progression | | **0.002**** | | | | **0.000***** | | | | 0.054 | | |
| Local | 37.5 ± 10.3 | | 31 | 60.8% | 12.1 ± 2.0 | | 33 | 64.7% | 5.9 ± 5.9 | | 12 | 23.5% |
| Distant | 44.5 ± 11.2 | | 62 | 74.7% | 15.7 ± 2.0 | | 82 | 98.8% | 8.3 ± 6.8 | | 25 | 30.1% |
| Local + distant | 42.0 ± 10.7 | | 7 | 63.6% | 16.7 ± 1.8 | | 11 | 100.0% | 4.6 ± 4.5 | | 1 | 9.1% |
| Chemotherapy | | 0.064 | | | | 0.801 | | | | 0.286 | | |
| Yes | 28.0 ± 6.2 | | 3 | 100.0% | 13.0 ± 1.7 | | 3 | 100.0% | 2.7 ± 2.3 | | 0 | 0.0% |
| No | 40.0 ± 11.0 | | 174 | 64.4% | 13.1 ± 3.1 | | 195 | 72.2% | 6.4 ± 6.1 | | 62 | 23.0% |
| Target therapy | | 0.500 | | | | 0.512 | | | | 0.280 | | |
| Yes | 39.0 ± 11.8 | | 25 | 59.5% | 13.0 ± 2.8 | | 28 | 66.7% | 7.4 ± 6.6 | | 15 | 35.7% |
| No | 40.0 ± 10.9 | | 149 | 64.5% | 13.1 ± 3.1 | | 170 | 73.6% | 6.2 ± 6.0 | | 47 | 20.3% |
| Immunotherapy | | 0.131 | | | | 0.055 | | | | 0.561 | | |
| Yes | 39.6 ± 10.8 | | 160 | 63.2% | 13.0 ± 3.0 | | 181 | 71.5% | 6.4 ± 6.1 | | 57 | 22.5% |
| No | 43.5 ± 12.4 | | 14 | 70.0% | 14.4 ± 2.8 | | 17 | 85.0% | 6.0 ± 6.6 | | 5 | 25.0% |

*FoP-Q-SF, Fear of Progression Questionnaire-Short Form; STAI-6, six-item short form of State Trait Anxiety Inventory; PHQ-9, nine-item short form of Patient Health Questionnaire.*

**P < 0.05; **P < 0.01; ***P < 0.001.*

*Bold indicates P-value less than 0.05.*

elevated FoP scores. Wagner et al. (33) assessed demographic factors (e.g., women sex and being employed) associated with severity of FoP in patients with stage IA malignant melanoma. Moreover, previous researches showed that melanoma patients with advanced disease and short illness duration were more likely to report anxiety and depression (16, 36, 40, 50), which are similar to our results. Other sociodemographic factors (e.g., women, younger age, unmarried state, low education,

**TABLE 3 |** Multiple logistic regression for fear of progression, anxiety, and depression.

| Variable | Exp (B) | 95%CI lower | 95%CI upper | *P* |
|---|---|---|---|---|
| **Fear of progression** | | | | |
| **Education** | | | | |
| Low | Ref | | | |
| Middle | 1.046 | 0.539 | 2.030 | 0.894 |
| High | 0.724 | 0.405 | 1.294 | 0.276 |
| Months after diagnosis (m) | 0.987 | 0.978 | 0.996 | **0.006**** |
| **Disease progression** | | | | |
| No | Ref | | | |
| Yes | 1.960 | 1.147 | 3.349 | **0.014*** |
| **Anxiety** | | | | |
| **Education** | | | | |
| Low | Ref | | | |
| Middle | 1.360 | 0.593 | 3.116 | 0.468 |
| High | 1.038 | 0.435 | 2.479 | 0.933 |
| **Salary** | | | | |
| <¥3,000 | Ref | | | |
| ¥3,000–5,000 | 0.834 | 0.376 | 1.850 | 0.655 |
| ¥5,000–10,000 | 0.466 | 0.183 | 1.184 | 0.108 |
| >¥10,000 | 0.734 | 0.193 | 2.796 | 0.651 |
| **Cancer stage** | | | | |
| Unresectable III | Ref | | | |
| IV | 14.394 | 3.929 | 52.730 | **0.000***** |
| **Disease progression** | | | | |
| No | Ref | | | |
| Yes | 23.235 | 6.955 | 77.625 | **0.000***** |
| **Depression** | | | | |
| Months after diagnosis (m) | 0.984 | 0.969 | 0.998 | **0.030*** |
| **Disease progression** | | | | |
| No | Ref | | | |
| Yes | 1.930 | 1.047 | 3.561 | **0.035*** |

**$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.*
*Bold indicates P-value less than 0.05.*

and unemployment) were found to be strongly associated with high anxiety and depression in melanoma patients (16, 51). Numerous studies investigated factors associated with psychological distress in melanoma patients, however, very few studies used multivariate analysis to elucidate independent predictors of FoP, anxiety and depression. Our results from multivariate analysis highlight a need for paying close attention to the psychological distress of melanoma patients with short disease duration, cancer progression and advanced disease under the COVID-19 outbreak.

A key finding of our study is that we found that mental distress of patients with advanced melanoma did not diminish over time during the COVID-19 and post-COVID-19 era, since no significant differences in FoP, anxiety or depression were observed for investigation time in the present study. In addition, FoP, anxiety and depression were significantly positive correlated with each other in melanoma patients with advanced stage during the epidemic. These findings clearly emphasize a need of mental care of melanoma patients under the further attack of COVID-19 worldwide or future global health threats. Clinicians and psychologists urgently need to re-organize healthcare systems to offer essential medical and psychological services to melanoma patients throughout the COVID-19 pandemic. A high quality of psycho-oncological care may help people to better cope with cancer during the epidemic. Several interventions have been developed to address psychological distress of melanoma patients. A psychoeducational intervention comprised a psychoeducational booklet and three individual telephone-based psychotherapeutic sessions, which was effective to reduce FoP of early-stage melanoma patients with high-risk recurrence (30). A stepped-care model was an acceptable and feasible intervention to treat FoP in patients with metastatic melanoma, for those with subthreshold FoP were offered self-management, and for those with clinical FoP were provided with individual treatment (39). Consider high risk of person-to-person transmission of COVID-19, the current developments in non-contact intervention may be novel, safe and efficient ways of psychological care. Internet cognitive behavioral therapy, delivered online via a website and/or app, is used to provide information and support to cancer patients, survivors, and carers on managing unhelpful thinking and behaviors, normalizing feelings, and alleviating FoP, anxiety and depression (52–56). Moreover, Royce et al. (57) reported that most patients wished for a telemedical consultation, which might be a solution to facilitate patients' access to health benefits and respect physical distancing. Our study and previous studies imply that it is necessary to proceed contact-free psychosocial education or cognitive behavioral therapy to reduce symptoms of FoP, anxiety and depression in patients with advanced melanoma and to guide people smoothly and safely through the epidemic.

The current study has several limitations. The first is that this study focused on Chinese cancer patients, findings cannot be generalized to other populations in other countries. Second, the cross-sectional design of this study made it impossible to compare these data with pre-pandemic distress status for the same cohort. To a certain extent, stratified analysis according to investigation time reflected the influence of different epidemic stage on the results, but it is still necessary to compare COVID-19 and post-COVID-19 era in patients with two interventions. Third, patients presented with advanced stage and recurrent disease, which probably led to higher baseline levels of distress of these patients. Increased mental distress was primarily collateral effects to the disease itself, which was exacerbated due to the impact of COVID-19 pandemic on medical management. Moreover, the current study did not explore the mental status of outpatients and caregivers. Future studies are needed to examine these factors and confirm these results.

The present research indicated that there was a large proportion of melanoma patients with high FoP, anxiety and depression in mainland China during the COVID-19 pandemic. Our study further explored the independent predictors of FoP, anxiety, and depression, such as illness duration, cancer stage, and disease progression. Particularly, these negative psychological symptoms of patients with advanced melanoma were positive correlated with each other and did not diminish over time in the COVID-19 and post-COVID-19 era. These findings emphasize the importance of developing psycho-oncological interventions targeting patients with advanced melanoma in the face of the epidemic in a longer run. Future study is needed to further examine the mental health problems, associated factors and effective interventions among patients with advanced melanoma during the COVID-19 pandemic.

## CONCLUSION

This study is one of the first to provide essential information about psycho-oncological needs of patients with advanced melanoma under the COVID-19 attack. Our study showed that high FoP, anxiety and depression were frequently reported problems among patients with advanced melanoma, which were significantly positive correlated with each other and persisting in the COVID-19 and post-COVID-19 era. Illness duration, cancer stage and disease progression were independent predictors for these negative psychological symptoms in patients with advanced melanoma. A better understanding of these findings could enable oncologists to develop and improve appropriate evidence-based psychological care for melanoma patients that targets particular symptoms during the ongoing COVID-19 pandemic.

## DATA AVAILABILITY STATEMENT

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

## ETHICS STATEMENT

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

## AUTHOR CONTRIBUTIONS

XW, ML, LZ, and H-MZ were responsible for study conception and design. XW, HJ, SK, and QS were responsible for acquisition of data. XW and ML were responsible for data analysis. XW, ML, HJ, SK, QS, and LZ were responsible for drafting. XW, ML, and H-MZ were responsible for revision of the manuscript. All authors approved the submitted version for publication.

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# The Association Between Exposure to COVID-19 and Mental Health Outcomes Among Healthcare Workers

**Diana Czepiel[1,2], Hans W. Hoek[1,3,4], Afra van der Markt[5], Bart P. F. Rutten[6], Wim Veling[3], Frederike Schirmbeck[7], Franco Mascayano[4,8], Ezra S. Susser[4,8] and Els van der Ven[2]***

*[1] Parnassia Groep, Parnassia Psychiatric Institute, The Hague, Netherlands, [2] Faculty of Behavioral and Movement Sciences, Vrije Universiteit Amsterdam, Amsterdam, Netherlands, [3] University of Groningen, University Medical Center Groningen, University Center of Psychiatry, Groningen, Netherlands, [4] Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, United States, [5] Department of Psychiatry, Amsterdam Public Health Research Institute, Amsterdam University Medical Center, Vrije Universiteit Amsterdam, Amsterdam, Netherlands, [6] Department of Psychiatry and Neuropsychology, School for Mental Health and Neuroscience, Maastricht University Medical Centre, Maastricht, Netherlands, [7] Academic Medical Center, Department of Psychiatry, University of Amsterdam, Amsterdam, Netherlands, [8] Division of Behavioral Health Services and Policies, New York State Psychiatric Institute, New York, NY, United States*

Due to the unprecedented impact of the COVID-19 pandemic on health care systems, there has been great interest in the mental wellbeing of healthcare workers. While most studies investigated mental health outcomes among frontline vs. non-frontline healthcare workers, little is known about the impact of various work-related variables. The present study aimed to examine the association between work-related [i.e., having contact with COVID-19 patients, being redeployed due to the pandemic and availability of sufficient personal protective equipment (PPE)] and subjective (i.e., worries about getting infected or infecting others) exposures and self-reported mental health outcomes (i.e., psychological distress, depressive symptoms, and posttraumatic stress symptoms). Between February and May 2021, 994 healthcare workers employed at a variety of healthcare settings in the Netherlands filled out an online survey as part of the COVID-19 HEalth caRe wOrkErS (HEROES) study. Mental health outcomes were measured using the General Health Questionnaire-12, the Patient Health Questionnaire-9, and the Primary Care PTSD Screen for DSM-5. Approximately 13% reported depressive symptoms, 37% experienced psychological distress, and 20% reported posttraumatic stress symptoms. Multilevel linear models consisted of three levels: individual (work-related and subjective exposures), healthcare center (aggregated redeployment and availability of sufficient PPE), and regional (cumulative COVID-19 infection and death rates). Worries about infection were associated with all three mental health outcomes, whereas insufficient PPE was associated with psychological distress and depressive symptoms. There were no differences in outcomes between healthcare centers or provinces with different COVID-19 infection and death rates. Our findings highlight the importance of adequate PPE provision and the subjective experience of the COVID-19 pandemic. These factors should be part of interventions aimed at mitigating adverse mental health outcomes among healthcare workers during the COVID-19 pandemic.

**Keywords: COVID-19, depression, healthcare workers (HCWs), mental health, personal protective equipment (PPE), posttraumatic stress, psychological distress**

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***Edited by:***
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*Ameya Prasad Bondre,*
*Indian Institute of Technology Bombay, India*

****Correspondence:***
*Els van der Ven*
*e.m.a.vander.ven@vu.nl*

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# INTRODUCTION

The COVID-19 pandemic has had an unprecedented worldwide impact on the social, economic, and psychological domain. Several studies have demonstrated high levels of adverse mental health outcomes globally, including symptoms of anxiety, psychological distress, depression and posttraumatic stress disorder (PTSD), in particular among groups who have been highly affected by the pandemic such as COVID-19 patients, patients with mental health problems and healthcare workers (HCW's) (1–5).

Evidence from previous pandemics, such as the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003, as well as from the current COVID-19 pandemic, suggests that various exposures related to the pandemic put HCW's at an increased risk of manifesting mental health problems compared to the general population. Objective factors include for instance contact with COVID-19 patients, insufficient availability of personal protective equipment (PPE), and redeployment (5–12). The availability of sufficient PPE is a prerequisite for HCW's to be able to carry out their work-related tasks safely. Nevertheless, great shortages of PPE have been reported since the beginning of the pandemic (13). Previous research suggests that HCW's are more likely to exhibit mental health problems when they perceive the provided PPE to be insufficient (11), while sufficient availability of PPE has been shown to have a protective role against symptoms of depression, anxiety and PTSD (11, 14). Redeployment has been identified as another significant risk factor for adverse mental health outcomes (11) particularly when combined with insufficient support and PPE (15).

Besides objective exposures of this nature, it is of potential importance to examine subjective exposures in order to understand mental health outcomes during the COVID-19 pandemic. It has been found that perceived risk related to a high-impact event, such as an epidemic, is more strongly associated with mental health problems, compared to the direct exposure to the event (16). Similar findings have been reported during the COVID-19 pandemic, with fear of getting infected and of infecting loved ones being significant factors related to mental health problems (5, 7, 9, 17–19).

Few studies, however, have investigated how these objective and subjective exposures relate to mental health outcomes among different groups of HCW's. A large number of studies have treated HCW's as one homogenous group, despite that the nature of their work and the degree of their exposure to COVID-19 can differ significantly. Various studies have shown that frontline workers, namely those having direct contact with COVID-19 patients, such as HCW's working in emergency, intensive care and infectious disease units, have a greater chance of manifesting mental health problems during the COVID-19 pandemic compared to non-frontline colleagues (1, 7, 20). Other studies, however, have found that frontline HCW's are not at an increased risk for adverse mental health outcomes (5), as well as that frontline and non-frontline HCW's report similar levels of psychological distress (21). It has been also demonstrated that non-clinical HCW's have been experiencing mental health problems since the beginning of the pandemic, some of which at higher levels compared to frontline HCW's or clinical HCW's (9, 22, 23). This emphasizes the need to examine the effects of the COVID-19 pandemic among HCW's working at different positions and in various health care settings.

There is also limited research about the putative role of region-level factors. Regional differences have been reported in the prevalence of mental health problems in HCW's. For example, HCW's in African and in Latin American countries have been found to report higher rates of depression, anxiety and psychological distress compared to those in the US, Europe and Asian countries (20, 24). HCW's in Australia reported low rates of depression and anxiety compared to the general population or other essential workers during the pandemic (25). In addition, it has been demonstrated that HCW's working in regions with high COVID-19 infection rates may have more mental health problems than those working in regions with relatively low rates (9, 26, 27). Nevertheless, findings from general population surveys suggest that local infection rates are merely modestly associated with mental health outcomes (28). These findings highlight the regional variations in the impact of the COVID-19 pandemic on the mental health of HCW's.

It is of great importance that HCW's have access to the material and psychosocial resources needed to navigate their high-stress working environment, even more so during a pandemic, in order for the healthcare sector to continue functioning properly. It is essential to understand which work-related factors are associated with adverse mental health outcomes among HCW's during different phases of the pandemic. Such insights may inform interventions that aim to mitigate adverse psychological outcomes following the COVID-19 pandemic and promote mental wellbeing of HCW's during the pandemic and during future crises of a similar nature.

The current study therefore aims to investigate the relationship between work-related exposures (i.e., having contact with COVID-19 patients, availability of sufficient PPE, and redeployment), subjective exposures (i.e., worries about infection), and mental health outcomes among HCW's in the Netherlands, a country heavily impacted by the COVID-19 pandemic at the time of data collection. We include clinical HCW's working at the front line and in other departments, as well as non-clinical HCW's. We also explore whether individual differences in mental health outcomes can be explained by higher-level factors such as type of healthcare center or regional COVID-19 infection and/or death rates. We expect HCW's who report worrying about infection, having had contact with COVID-19 patients, considering the available PPE to be insufficient and being redeployed as a result of the pandemic to report higher levels of depressive symptoms, psychological distress and posttraumatic stress symptoms (PTSS). Furthermore, we anticipate that HCW's employed at healthcare centers with higher rates of redeployment and poorer availability of PPE, and those working in regions with higher COVID-19 infection and/or death rates to report more adverse mental health outcomes.

# MATERIALS AND METHODS

## Setting

The study was conducted in the Netherlands, which has a public healthcare system financed by healthcare insurances (29). During participant recruitment the Netherlands was facing the third wave of the pandemic. The Dutch government has followed a relatively liberal policy at the beginning of the pandemic to control the spread of COVID-19 (29). However, in December 2020 there was a complete lockdown in place including a curfew. In January 2021, the government launched its vaccination program against COVID-19. In March 2021 the COVID-19 infections reached a peak and they began to recede in May 2021 (30). Furthermore, there were substantial regional differences in terms of infection, hospitalization, and mortality rates. During the period of data collection, the provinces in the South and South-West of the country (including South Holland, Overijssel, Limburg and North Brabant) were the ones most heavily impacted, whereas the provinces of Groningen and Friesland were the least impacted. An overview of the COVID-19 infection and death rates for the months of January, March and May 2021 per province can be found in **Supplementary Table 1** (31).

## Study Design and Participants

This cross-sectional study forms part of the international COVID-19 HEalth caRe wOrkErS (HEROES) study aimed to evaluate the impact of the COVID-19 pandemic on the mental health of HCW's (32). The current study used data from a sample consisting of clinical and non-clinical workers (e.g., nurses, physicians, psychologists, dentists, managers and administrative stuff, security and cleaning stuff) employed at a wide range of healthcare centers in the Netherlands (e.g., hospitals, elderly homes, rehabilitation centers, ambulance service). The inclusion criteria were: being of legal age and working in a healthcare center that provided care to suspected (patients with symptoms similar to COVID-19 but without a positive test issued by the municipal health service) or confirmed cases of COVID-19 (patients with a positive test issued by the municipal health service). The sample (N=994) was recruited between February and May 2021. Most HCW's included in the study worked in Friesland (province in North Netherlands), Limburg (province in South Netherlands) or South Holland (province in West Netherlands).

Participants were recruited based on non-probability sampling either directly through the healthcare center at which they were employed or through health organization networks. More specifically, the study coordinator approached healthcare settings, explaining the specific aims and general procedures of the study and asked for assistance in recruiting potential participants. Ten healthcare facilities in three different regions of the Netherlands were recruited in order to ensure variation in local COVID-19 infection rates and/or COVID-19 deaths. These were not randomly selected within each region, but included based on two conditions. Participating healthcare centers were required to provide data on denominators, so that response rates could be calculated, and to have a contact person within the facility who would facilitate the distribution of the questionnaires among its HCW's. The requested data on denominators included the number of employed clinical and non-clinical workers, in total and stratified by gender. If the contact person agreed to support the study, a link to the digital platform describing the study and voluntary participation was forwarded to all workers of the facility *via* their work email address or *via* the healthcare center's internal communication system. The target population included both clinical and non-clinical HCW's. All HCW's registered within the facility would receive the questionnaire. However, the quick turnover of personnel could result in HCW's with a temporary contract or those employed *via* a recruitment agency being less likely to receive the questionnaire. More details about the recruitment method are provided in the HEROES protocol paper (32).

## Instruments

### Psychological Distress

For the assessment of general psychological distress we used the Dutch version of the GHQ-12 (33), a well-validated scale which is often used as a screening instrument for psychiatric disorders (34). It is a self-report, unidimensional measure, consisting of 12 items evaluating the presence of symptoms during the past week. Half of the items are positively phrased (e.g., "During the past week, have you lost sleep due to being worried?"), whereas the other half is negatively phrased (e.g., "During the past week, have you felt capable of making decisions?"). All items are rated on a four-point Likert scale, ranging from 0 ("not at all"/ "much less than usual") to 3 ["(much) more than usual"]. Participants' score was calculated by reverse coding the negatively phrased items and summing up all items using the Likert scoring method (0–1–2–3). The internal consistency in the current study was good ($\alpha = 0.89$) (35).

### Depressive Symptoms

To assess depressive symptoms we used the Dutch version of the Patient Health Questionnaire (PHQ)-9, a well-validated self-report measure often used as a screening instrument for depression (36). It contains 9 items corresponding to the symptoms of major depressive disorder according to the Diagnostic and Statistical Manual of Mental Disorders-IV (37). The items are rated on a four-point Likert scale based on how often participants have experienced the given symptom over the last 2 weeks (e.g., "During the past 2 weeks, have you felt little interest or pleasure in doing things?"). Answers range from 0 ("not at all") to 3 ("nearly every day"). All items were summed up to calculate a total score, which is regularly used as a severity measure (38). The internal consistency in the current study was good ($\alpha = 0.85$) (35).

### Posttraumatic Stress Symptoms (PTSS)

In order to assess PTSS related to COVID-19 we used the Dutch version of a validated screening instrument, i.e., the Primary Care PTSD Screen for DSM-5 (PC-PTSD-5) (39) with one main alteration. The introductory item on exposure to traumatic events was omitted, given that the traumatic event of interest was the COVID-19 pandemic, and the wording of the remaining 5 items was changed to reflect that [i.e., replacing the word "event(s)" with the word "pandemic"]. Participants were asked to respond to 5 items measuring the presence of PTSS over the past month (e.g., "In the past month, have you had nightmares about the pandemic or thoughts about the pandemic when you did not want to?"). Each item is rated on a dichotomous scale (yes/no). The total score of the questionnaire was used in order to capture symptom severity and maximize variation. The internal consistency in the current study was acceptable ($\alpha = 0.63$) (35).

### COVID-19 Work-Related Exposures

*Ad-hoc* items were used to measure work-related exposure to COVID-19. Having contact with COVID-19 patients was measured with the following item: "During the past week, have you been close to patients who were suspected or confirmed cases of COVID-19?" (dichotomous variable: yes/no). Availability of sufficient PPE was measured with the following item: "Do you believe that the personal protective equipment you have access to are sufficient to avoid getting the virus?" (0 = "No, they are completely insufficient" to 3 "Yes, they are sufficient"). Redeployment was measured with the following item: "In the past 3 months, have you been assigned to a new team and/or assigned new functions?" (dichotomous variable: yes/no).

Other relevant workplace-related variables included healthcare center type (i.e., emergency care, programmed care, non-hospital intramural care, patient transportation, support & auxiliary services, other), province where the workplace is situated and participant's current job (i.e., physicians, nursing staff, other clinical specialists and managers, support, and ancillary staff, and other HCW's). The specific grouping of HCW's professions in broader job categories can be found in **Supplementary Table 2**. Finally, region-level data regarding COVID-19 infection and death rates per province were obtained through online resources (40). We included cumulative rates reported on the start date of the recruitment (February 15th, 2021) to capture the cumulative burden that HCW's experienced since the beginning of the pandemic.

### COVID-19 Subjective Exposures (Worries About Infection)

Subjective exposure to COVID-19 (worries about infection) included the following items: (1) "In the past 3 months, how worried have you been about getting COVID-19?" (0 = "not at all" to 3 = "extremely"); (2) "In the past 3 months, how worried have you been about infecting your loved ones with COVID-19?" (0 = "not at all" to 3 = "extremely"). In the current study these two items were collapsed to create one composite score.

## Statistical Analyses

Intercorrelations among the main study variables were explored using Spearman's ranked-order correlation coefficients. Complete and non-complete cases were compared in terms of confounding variables and mental health outcomes. Wilcoxon rank-sum tests were used for continuous variables and Pearson's chi-square tests with Bonferroni-adjusted significance tests for categorical variables. Potential confounding variables were determined using directed acyclic graphs (DAG's), following the methodology suggested by Ferguson and colleagues (41). The open-source platform dagitty.net (42) was used to create the DAG's, which can be found in the **Supplementary Material**. The identified potential confounding variables which were included at the first level of the multilevel analyses were age, gender, completed education, current job, having someone under care, as well as the existence of a previously known chronic physical illness and the existence of previously known mental health problems.

We used multiple imputation by chained equations (MICE) to deal with missing data (43). The number of imputations was set to 20, based on the suggestions by Graham and colleagues (44), while the maximum number of iterations was set to 20 based on reached convergence. Predictors of missingness were added to the model according the guidelines for MICE (45). Visual and numerical inspection of the imputed data did not show deviations any problematic variables according to the rule of thumb described by Stuart and colleagues (46).

We used multilevel linear regression models to examine the association between having contact with COVID-19 patients, worries about infection, redeployment, availability of sufficient PPE, and mental health outcomes among HCW's, as well as to explore whether individual differences in mental health outcomes could be explained by higher-level factors. Prior to performing the multilevel analyses, lower-level continuous predictors were group-mean centered, whereas the third-level predictors were grand-mean centered. In addition, redeployment and availability of sufficient PPE were aggregated at the healthcare center level to be used as healthcare center-level variables. For each of the three mental health outcomes, a multilevel model was estimated, with healthcare center type and workplace location as random effects. At the individual level (level 1) the identified potential confounders and the individual predictors (contact with COVID-19 patients, worries about infection, being redeployed and availability of sufficient PPE) were added as fixed effects, at the healthcare center-level (level 2) aggregated redeployment and aggregated sufficient PPE were added as fixed effects, and at the work location level (level 3) the cumulative COVID-19 infection and death rates were added as fixed effects. All analyses were conducted using IBM SPSS Statistics software (version 26).

## Ethical Considerations

This study was performed in accordance with the guidelines outlined by Dutch legislation. The Medical Ethical boards of the Maastricht University Medical Center and the Amsterdam Medical Center assessed the study protocol. Both concluded that the study was exempt from ethical approval in the Netherlands given that the participants were not considered patients or identifiable individuals providing sensitive information following the Medical Research Involving Human Subjects Act (WMO). All participants provided written informed consent to participate in the study. At completion of the questionnaire detailed resources were provided on services (e.g., helplines, mental health services) for psychological support. Participants were urged to contact their general practitioner in case they reported mental health problems. It must be noted that the Netherlands has a public healthcare system in which it is mandatory to be registered with a general practitioner. In addition, Dutch healthcare centers are legally obliged to hire a physician caring for employees.

**TABLE 1 |** Descriptive statistics for confounding and outcome variables for complete cases and non-complete cases.

| | **Complete cases ($n = 581$)** | **Non-complete cases ($n = 403$)** | **$\chi^2$/*Ws*** |
|---|---|---|---|
| Age, Mdn (IQR) | 45 (33–55) | 47 (36–55) | 108,765.000, $p = 0.058$ |
| Gender, *n* (%) | | | 4.523, $p = 0.104^{\dagger}$ |
| Female | 466 (80.2)$^{a}$ | 339 (82.5)$^{a}$ | |
| Male | 114 (19.6)$^{a}$ | 68 (16.5)$^{a}$ | |
| Other | 1 (0.2)$^{a}$ | 4 (1)$^{a}$ | |
| Completed education, *n* (%) | | | 29.519, $p < 0.001$ |
| (Incomplete) primary school | 2 (0.3)$^{a}$ | 7 (1.8)$^{b}$ | |
| Secondary school | 14 (2.4)$^{a}$ | 25 (6.5)$^{b}$ | |
| Technical-professional training | 152 (26.6)$^{a}$ | 136 (35.3)$^{b}$ | |
| Undergraduate degree | 262 (45.8)$^{a}$ | 153 (39.7)$^{a}$ | |
| Postgraduate studies | 142 (24.8)$^{a}$ | 64 (16.6)$^{b}$ | |
| Someone under care, *n* (%) | | | 0.003, $p = 0.957$ |
| No | 360 (62.4)$^{a}$ | 239 (62.6)$^{a}$ | |
| Yes | 217 (37.6)$^{a}$ | 143 (37.4)$^{a}$ | |
| Current job, *n* (%) | | | 6.144, $p = 0.189$ |
| Physicians | 109 (18.8)$^{a}$ | 44 (16.7)$^{a}$ | |
| Nursing staff | 228 (39.2)$^{a}$ | 116 (44.1)$^{a}$ | |
| Other clinical specialists and managers | 117 (20.1)$^{a}$ | 40 (15.2)$^{a}$ | |
| Support & ancillary staff | 93 (16)$^{a}$ | 40 (15.2)$^{a}$ | |
| Other HCW's | 34 (5.9)$^{a}$ | 23 (8.7)$^{a}$ | |
| Chronic physical illness, *n* (%) | | | 4.646, $p = 0.031$ |
| No | 455 (81)$^{a}$ | 117 (73.1)$^{b}$ | |
| Yes | 107 (19)$^{a}$ | 43 (26.9)$^{b}$ | |
| Previous mental health problems, *n* (%) | | | 0.234, $p = 0.628$ |
| No | 528 (94)$^{a}$ | 151 (95)$^{a}$ | |
| Yes | 34 (6)$^{a}$ | 8 (5)$^{a}$ | |
| Psychological distress, Mdn (IQR) | 11 (8–16) | 12 (8.5–17) | 50,045.000, $p = 0.067$ |
| Depressive symptoms, Mdn (IQR) | 3 (1–6) | 4 (1–7) | 44,523.500, $p = 0.241$ |
| PTSS, Mdn (IQR) | 1 (0–2) | 2 (0–3) | 42,634.000, $p = 0.007$ |

*someone under care, having a minor; older adult; or individual with a disability under care; Values not sharing the same subscript are significantly different according to post hoc Bonferroni corrections.*

$^{\dagger}$*Likelihood ratio is reported instead of chi square, because more than 20% of cells had an expected count <5.*

## RESULTS

The response rate in the current study ranged from 2 to 13% among healthcare centers with higher observed response rates among women compared to men. Upon inspection of the data for systematic errors, participants who did not have an ID-number (n = 59) and who gave informed consent but left the study before responding to the first item (n = 29) were removed. This was considered to be due to technical errors and thus missing at random, because several healthcare centers have protected servers which were initially blocking the HEROES questionnaire. Compared to complete cases (participants who had no missing data on the main variables of interest), non-complete cases (participants who had at least one missing item in any of the main variables of interest) had a lower completed education level, were more likely to have a chronic physical illness and had a significantly higher score on the PTSD screening instrument (see **Table 1**). The percentage of missing values across variables ranged from 0.20% to 33.90%. Denominator data indicated that women, nurses, and physicians were more likely to participate in the study.

Participants' median age was 46 years (IQR = 34–55). Among HCW's in the current study, 13% reported symptoms of depression (cutoff score $\geq$ 10), 37% experienced psychological distress (cutoff score $\geq$ 14), and 20% reported PTSS (cutoff score $\geq$ 3). Remaining characteristics for the whole sample and stratified by the exposure variables can be found in **Table 2**, whereas intercorrelations between the main study variables and their score ranges can be found in **Table 3**.

Multilevel regression analyses indicated a significant association between worries about infection and all mental health outcomes, including self-reported psychological distress ($\beta = 0.80$, $p < 0.001$), symptoms of depression ($\beta = 0.79$, $p < 0.001$), and PTSS ($\beta = 0.33$, $p < 0.001$). Further, availability of sufficient PPE was significantly negatively associated

**TABLE 2 |** Participants' characteristics [*n* (%)] for the whole sample and stratified by reported contact with COVID-19 patients, worries about infection, sufficient PPE, and redeployment.

| | | **Contact with COVID-19 patients** | **Worries about infection** | **Sufficient PPE** | **Redeployment** |
|---|---|---|---|---|---|
| | **All (*N* = 994)** | **Yes (*n* = 351)** | **Yes (*n* = 263)** | **Yes (*n* = 512)** | **Yes (*n* = 143)** |
| Gender [a] | | | | | |
| Female | 805 (81) | 260 (74.1) | 215 (81.7) | 414 (80.9) | 118 (82.5) |
| Male | 182 (18.3) | 91 (25.9) | 47 (17.9) | 97 (18.9) | 24 (16.8) |
| Other | 5 (0.5) | 0 (0) | 1 (0.4) | 1 (0.2) | 1 (0.7) |
| Missing | 2 (0.2) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Completed education | | | | | |
| (Incomplete) primary schooling | 9 (0.9) | 1 (0.3) | 2 (0.8) | 2 (0.4) | 3 (2.1) |
| Secondary school | 39 (3.9) | 6 (1.7) | 8 (3) | 9 (1.8) | 1 (0.7) |
| Technical-professional training | 288 (29) | 88 (25.1) | 76 (28.9) | 144 (28.1) | 24 (16.8) |
| Undergraduate degree | 415 (41.8) | 174 (49.6) | 126 (47.9) | 229 (44.7) | 70 (49) |
| Postgraduate studies | 206 (20.7) | 75 (21.4) | 49 (18.6) | 114 (22.3) | 44 (30.8) |
| Missing | 37 (3.7) | 7 (2) | 2 (0.8) | 14 (2.7) | 1 (0.7) |
| Healthcare center type | | | | | |
| Emergency care | 88 (8.9) | 68 (19.4) | 28 (10.6) | 61 (11.9) | 18 (12.6) |
| Programmed care | 381 (38.3) | 168 (47.9) | 122 (46.4) | 215 (42) | 69 (48.3) |
| Non-hospital intramural care | 46 (4.6) | 8 (2.3) | 18 (6.8) | 26 (5.1) | 10 (7) |
| Patient transportation | 98 (9.9) | 67 (19.1) | 26 (9.9) | 64 (12.5) | 7 (4.9) |
| Support & auxiliary services | 124 (12.5) | 21 (6) | 33 (12.5) | 72 (14.1) | 13 (9.1) |
| Other | 110 (11.1) | 19 (5.4) | 34 (12.9) | 70 (13.7) | 23 (16.1) |
| Missing | 147 (14.8) | 0 (0) | 2 (0.8) | 4 (8) | 3 (2.1) |
| Current job | | | | | |
| Physicians | 153 (15.4) | 57 (16.2) | 36 (13.7) | 96 (18.8) | 39 (27.3) |
| Nursing staff | 344 (34.6) | 175 (49.9) | 117 (44.5) | 205 (40) | 61 (42.7) |
| Other clinical specialties & managers | 157 (15.8) | 80 (22.8) | 54 (20.5) | 102 (19.9) | 20 (14) |
| Support & ancillary staff | 133 (13.4) | 32 (9.1) | 39 (14.8) | 76 (14.8) | 16 (11.2) |
| Other HCW's | 57 (5.7) | 7 (2) | 17 (6.5) | 33 (6.4) | 7 (4.9) |
| Missing | 150 (15.1) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Work location[a] | | | | | |
| Friesland | 144 (14.5) | 61 (17.4) | 52 (19.8) | 79 (15.4) | 18 (12.6) |
| South Holland | 210 (21.1) | 111 (31.6) | 66 (25.1) | 127 (24.8) | 38 (26.6) |
| Limburg | 246 (24.7) | 52 (14.8) | 71 (27) | 115 (22.5) | 40 (28) |
| Other | 394 (39.6) | 127 (36.2) | 74 (28.1) | 191 (37.3) | 47 (32.9) |
| Missing | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Chronic physical illness | | | | | |
| No | 572 (57.5) | 268 (76.4) | 191 (72.6) | 385 (75.2) | 99 (69.2) |
| Yes | 150 (15.1) | 63 (17.9) | 61 (23.2) | 101 (19.7) | 28 (19.6) |
| Missing | 272 (27.4) | 20 (5.7) | 11 (4.2) | 26 (5.1) | 16 (11.2) |
| Previous mental health problems | | | | | |
| No | 679 (68.3) | 311 (88.6) | 236 (89.7) | 456 (89.1) | 115 (80.4) |
| Yes | 42 (4.2) | 20 (5.7) | 15 (5.7) | 29 (5.7) | 12 (8.4) |
| Missing | 273 (27.5) | 20 (5.7) | 12 (4.6) | 27 (5.3) | 16 (11.2) |

*All percentages are valid percentages.*

*For ease of interpretation the continuous exposure variables were classified as yes/no. The classification was performed as follows: participants were classified as worrying about infection if they had a score* $\geq$ *2 on either worries about getting infected and/or worries about infecting others; participants were classified as considering the provided PPE as sufficient if they had answered "Yes, they are sufficient". In the current table only the "yes" category is reported due to space limitations.*

[a] *It was chosen to report descriptive statistics for three of the twelve provinces in the Netherlands, namely for one with the lowest (Friesland) and two with the highest (South Holland and Limburg) cumulative infection rate at the time when participant recruitment begun.*

**TABLE 3 |** Intercorrelations and ranges for the main study variables.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Range |
|---|---|---|---|---|---|---|---|---|
| 1. Contact with COVID-19 patient(s) | – | | | | | | | Yes/no |
| 2. Worries about infection | 0.09* | – | | | | | | 0–6 |
| 3. Sufficient PPE | 0.03 | −0.17** | – | | | | | 0–3 |
| 4. Redeployment | −0.04 | 0.03 | 0.01 | – | | | | Yes/no |
| 5. Psychological distress | 0.02 | 0.20** | −0.17** | 0.02 | – | | | 0–36 |
| 6. Depressive symptoms | −0.01 | 0.24** | −0.17* | 0.07 | 0.75** | – | | 0–27 |
| 7. PTSS | 0.06 | 0.28** | −0.15** | 0.03 | 0.37** | 0.38** | – | 1–5 |

*$p < 0.005$, **$p < 0.001$.

**TABLE 4 |** Three-level multilevel models for psychological distress, depressive symptoms and PTSS.

| | Psychological distress | | Depressive symptoms | | PTSS | |
|---|---|---|---|---|---|---|
| **Variables** | **β (95% CI)** | **SE** | **β (95% CI)** | **SE** | **β (95% CI)** | **SE** |
| Intercept | 15* (2.02–27.97) | 6.57 | 7.25 (−1.58–16.07) | 4.48 | 3.08* (0.49–5.68) | 1.31 |
| Individual level | | | | | | |
| Female | 0.50 (−0.63–1.63) | 0.57 | 0.54 (−0.28–1.36) | 0.42 | 0.18 (−0.05–0.42) | 0.12 |
| Other gender | 0.28 (−6.68–7.24) | 3.52 | −91 (−5.99–4.18) | 2.57 | 1.00 (−0.85–2.84) | 0.92 |
| Postgraduate studies | 0.39 (−4.24–5.01) | 2.32 | 0.86 (−2.49–4.20) | 1.68 | −31 (−1.40–0.77) | 0.54 |
| Undergraduate degree | −0.00 (−4.37–4.36) | 2.20 | 0.78 (−2.54–4.10) | 1.66 | −0.02 (−1.13–1.08) | 0.55 |
| Technical- professional training | −0.30 (−4.80–4.20) | 2.26 | 0.80 (−2.61–4.21) | 1.71 | −0.16 (−1.25–0.93) | 0.54 |
| Secondary school | 2.08 (−2.85–7.00) | 2.48 | 2.56 (−0.82–5.94) | 1.71 | −0.07 (−1.26–1.12) | 0.60 |
| Physicians | 0.70 (−1.482.88) | 1.10 | −1.46 (−2.93–0.00) | 0.74 | −0.45 (−0.92–0.02) | 0.24 |
| Nursing staff | 1.39 (−0.36–3.13) | 0.89 | −0.77 (−2.04–0.50) | 0.65 | −0.23 (−0.63–0.14) | 0.20 |
| Other clinical specialists and managers | 1.07 (−0.70–2.85) | 0.90 | −0.56 (−1.85–0.74) | 0.66 | −0.33 (−0.74–0.08) | 0.21 |
| Support & auxiliary staff | 0.69 (−1.10–2.48) | 0.91 | −0.92 (−2.28–0.43) | 0.69 | −0.19 (−0.63–0.25) | 0.22 |
| Having someone under care | −0.25 (−1.04–0.54) | 0.40 | −0.01 (−0.62–0.59) | 0.31 | 0.06 (−0.12–0.24) | 0.09 |
| Chronic physical illness | 1.63** (0.63–2.62) | 0.51 | 0.77 (−0.01–1.56) | 0.40 | 0.18 (−0.04–0.41) | 0.11 |
| Previous mental health problems | 0.80 (−0.87–2.47) | 0.83 | 1.18 (−0.42–2.78) | 0.79 | −0.05 (−0.47–0.36) | 0.20 |
| Age | −0.01 (−0.05–0.02) | 0.02 | −0.01 (−0.04–0.02) | 0.01 | −0.00 (−0.01–0.01) | 0.00 |
| Contact with COVID patient(s) | −1.25 (−1.13–0.88) | 0.51 | −0.10 (−0.84–0.63) | 0.37 | 0.14 (−0.07–0.36) | 0.11 |
| Being worried about infection | 0.80** (0.49–1.11) | 0.16 | 0.79 ** (0.57–1.00) | 0.11 | 0.33 ** (0.26–0.40) | 0.03 |
| Sufficient PPE | −0.80* (−1.37-−0.23) | 0.29 | −0.48 * (−0.93–0.04) | 0.23 | −0.10 (−0.22–0.02) | 0.06 |
| Redeployed | −0.07 (−1.16–1.03) | 0.56 | 0.53 (−0.26–1.32) | 0.40 | 0.04 (−0.20–0.29) | 0.12 |
| Healthcare center level | | | | | | |
| Sufficient PPE aggregated | −1.02 (−5.04–2.99) | 2.03 | −1.27 (−3.87–1.33) | 1.32 | −0.59 (−1.33–0.14) | 0.37 |
| Redeployment aggregated | −7.42 (−21.07–6.23) | 6.92 | −0.80 (−10.79–9.19) | 5.06 | 0.09 (−2.68–2.87) | 1.40 |
| Regional level | | | | | | |
| Infection rates | −0.06 (−0.15–0.04) | 0.05 | 0.00 (−0.06–0.07) | 0.03 | −0.01 (−0.02–0.01) | 0.01 |
| Death rates | 1.98 (−1.69–5.64) | 1.87 | 0.69 (−1.67–3.06) | 1.20 | 0.23 (−0.29–0.75) | 0.26 |

*Having someone care, having a minor; older adult; or individual with a disability under care.*
*$p < 0.05$, **$p < 0.001$.

with psychological distress (β = −0.80, $p = 0.006$) and symptoms of depression (β = −0.48, $p = 0.033$), whereas having a physical illness was only significantly related to self-reported psychological distress (β = 1.63, $p = 0.001$). We did not find more adverse mental health outcomes among HCW's who were redeployed or in contact with COVID-19 patients. Regarding higher-level exposures, we found no major impact of aggregated redeployment, aggregated availability of sufficient PPE, COVID-19 infection rates or COVID-19 death rates on any of the mental health outcomes. Also, no differences in mental health outcomes were found in terms of the examined confounders or between HCW's employed at different positions.

The three-level multilevel models are presented in **Table 4**, whereas the most parsimonious multilevel models (with merely the confounders and individual level variables) are presented in **Supplementary Table 3**.

## DISCUSSION

In this Dutch cohort of HCW's assessed between February and May 2021 during the third wave of the COVID-19 pandemic, 13% of the HCW's reported symptoms of depression, 37% reported psychological distress and 20% reported PTSS. We observed strong associations between worries about infection and all mental health outcomes, including self-reported psychological distress, symptoms of depression and PTSS. Availability of sufficient PPE was negatively related to self-reported psychological distress and symptoms of depression. We did not find more adverse mental health outcomes among HCW's who were redeployed or in contact with COVID-19 patients. We also did not find any differences in mental health outcomes among HCW's employed in different healthcare centers or at different positions. Regarding higher-level exposures, we found no strong association of neither aggregated redeployment or availability of sufficient PPE at the healthcare center level, nor of COVID-19 infection or death rates at the regional-level with any of the mental health outcomes.

The proportion of mental health problems among HCW's reported in the current study are in line with the ranges reported in other European countries (10, 47) and in several meta-analyses of studies conducted in different global regions [13.3–41.1% for mild anxiety/psychological distress (8, 20, 21, 48–51), 16–31.4% for depressive symptoms (8, 21, 48–51), and 20.2–21.9% for PTSS (48, 50, 51)]. Previous studies reported an ∼26% increase in depressive and anxiety symptoms among the general population globally since the beginning of the pandemic (52), highlighting the widespread impact of the COVID-19 pandemic on mental health. It is noteworthy, however, that there are substantial regional differences in the extent to which mental health problems have increased, which varies from 12% in Southeast Asia, East Asia, and Oceania to 37% in North Africa and Middle East in the case of depressive symptoms, and from 14% in Southeast Asia, East Asia, and Oceania to 35% in South Asia in the case of anxiety symptoms (52).

The pattern of findings suggests that in this study, the subjective experience of the pandemic, had the largest impact on the mental wellbeing of HCW's. This contradicts studies demonstrating that frontline HCW's, who have direct contact with COVID-19 patients, experience more mental health problems compared to other HCW's (1, 7, 20). It is, nevertheless, in line with studies that have highlighted fear of getting infected and of infecting loved ones as risk factors for mental health problems among HCW's (14, 22). The current findings also coincide with a wider body of literature highlighting the subjective appraisal of crises and traumatic life events as drivers of negative outcomes (53).

Another salient finding was that insufficient availability of PPE was associated with more psychological distress and depressive symptoms. This coincides with several studies illustrating the negative association between PPE provision and mental health problems, such as anxiety, depression, and PTSS (8, 11, 14, 22, 27). It has also been found that HCW's who report insufficient availability of PPE worry more about getting infected and about infecting their loved ones (54, 55). This implies that availability of sufficient PPE might protect against the effect of worries about infection on the mental wellbeing of HCW's, as they feel safer and properly protected. Together with our findings highlighting the role of the subjective experience, we may hypothesize that HCW's who have insufficient access to PPE experience a lack of control increasing worries of infection which may, in turn, exacerbate psychological distress and symptoms of depression.

We also found that chronic physical illness is related to psychological distress. This is in line with literature suggesting that it constitutes a risk factor for poor mental health during the pandemic (22), as well as with studies showing that HCW's (5), COVID-19 patients (27) and the general population (56) with a pre-existing chronic physical illness are experiencing high levels of anxiety. Chronic physical illness may be considered a significant daily life burden, which is in itself associated with mental health problems (57). However, it can lead to a cumulative burden, considering that HCW's with a chronic physical illness belong to a high-risk group for COVID-19.

Contrary to our hypotheses, no differences in mental health outcomes were found between different healthcare centers or provinces. This seems consistent with the finding that only worries about infection, as opposed to being in contact with COVID-19 patients, was associated with psychological distress, depressive symptoms, and PTSS. Mental health problems did not appear to be directly related to exposure to higher local infection and death rates. This does not support studies in which HCW's working in areas with high infection rates reported more stress and anxiety (26). These findings were, however, mainly reported at the beginning of the pandemic, whereas it has been found that for instance local infection rates in the US are merely modestly associated with mental health outcomes (28).

This is one of the first studies investigating mental health outcomes among HCW's in a multilevel model with various objective and subjective COVID-19 related exposures at the individual, institutional and regional level. We advanced the current evidence on the impact of the COVID-19 pandemic on the mental health of HCW's by demonstrating that the subjective experience of the pandemic, as expressed by worries about infection and considering PPE to be sufficient, more so than objective COVID-19 exposures, were important factors for various adverse mental health outcomes. In the interpretation of these findings, there are several limitations that need to be considered. First, the current study was based on convenience sampling and had low response rates which may suggest selection of the population and limited generalizability to the broader group of HCW's. The limited available information on the denominator population indicated that women, nurses, and physicians were more likely to participate in the study. Second, there was a substantial percentage of missingness for our variables of interest which could have obscured the relations between the studied variables. Third, the study's design was cross-sectional, and we had no available data about the mental health of HCW's prior to the pandemic. Because of the study design we were unable to establish any causal relations. Fourth, several non-standardized questions were created *Ad-hoc* to measure the main exposures in the current study and we adjusted the PTSS instrument to make it specific for the pandemic. Consequently, our results cannot be directly compared to other studies. Fifth, we had access to data on COVID-19 infection and death rates at the provincial level. These may conceal pronounced differences in impact of COVID-19 between healthcare centers in the same province. Lastly, we cannot draw any conclusions about possible presence of PTSD as we only used a screening instrument to examine PTSS. Importantly, the percentage of HCW's reporting PTSS may be overestimated considering that the pandemic was still ongoing during the recruitment period. Such symptoms should be monitored in the course of time to assess the possible manifestation of PTSD symptoms. Future studies may use a longitudinal design and structured interviews to determine the presence of clinically significant mental health problems. In addition, new research should include healthcare center-specific data that illustrate the burden at the institutional level.

### Conclusion and Implications

The current study demonstrated that worries about infection and availability of sufficient PPE was more strongly associated with adverse mental health outcomes among HCW's than the objective exposure to the COVID-19 pandemic in terms of being in contact with COVID-19 patients and being redeployed due to the pandemic. Being alert of early symptoms of mental health problems might guide the implementation of preventive and treatment interventions. At the individual level, screening for HCW's who are worrying about infection could help identify individuals who might profit from evidence-based psychological interventions. At the institutional and public health level, sufficient PPE may constitute a modifiable factor for potentially protecting against the adverse effects of the pandemic on HCW's. Stockpiling PPE and putting adequate and fitting PPE at the disposal of HCW's may protect not only their physical, but also their mental wellbeing.

## DATA AVAILABILITY STATEMENT

Code used for the analyses in this paper is available on request. For use of the HEROES-NL data, proposals can be sent to e.m.a.vander.ven@vu.nl.

## ETHICS STATEMENT

Ethical approval was not provided for this study on human participants because both the Medical Ethical Boards of the Maastricht University Medical Center and the Amsterdam Medical Center, who assessed the study protocol, concluded that the study was exempt from ethical approval in the Netherlands, given that the participants were not considered patients or identifiable individuals providing sensitive information, following the Medical Research Involving Human Subjects Act (WMO). The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

DC, HH, and EV were responsible for the study conceptualization, supervision, and writing the original manuscript draft. AM, WV, HH, BR, FS, and EV were involved in collecting and coordinating data collection at different healthcare centers. ES and FM initiated the international HEROES study and set up the study framework. All authors contributed to the interpretation of results, reviewed preliminary versions of the manuscript, and approved the final version.

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## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.896843/full#supplementary-material

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# Assessment of Depression and Anxiety Among Admitted People With Heart Disease Conditions: A Cross-Sectional Hospital-Based Study in a Bangladeshi Population During the COVID-19

*Mohammad Ashraful Amin*[1,2], *Mohsin Ahmed*[3], *Sabrina Nahin*[4] *and Nadira Sultana Kakoly*[1*]

*[1] Department of Public Health, North South University, Dhaka, Bangladesh, [2] Public Health Professional Development Society (PPDS), Dhaka, Bangladesh, [3] Department of Cardiology, National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh, [4] Department of Physiology, Green Life Medical College Hospital, Dhaka, Bangladesh*

**Objective:** Depression and anxiety are widespread and chronic among patients with heart disease. We wanted to determine the proportion of heart patients with depression and anxiety levels as well as factors contributing toward depression and anxiety among hospitalized heart disease patients in Dhaka, Bangladesh during the COVID-19 era.

**Methods:** The study comprised a total of 384 participants with a confirmed heart disease diagnosis. We conducted a cross-sectional study from 5th March to 27th June 2021. The hospital-based study admitted patients sequentially with a new or pre-existing heart disease diagnosis to one of Dhaka's two leading hospitals. The Hospital Anxiety and Depression Scale screened all individuals for depression and anxiety.

**Result:** Most of the respondents (88.2%) were male and within the age categories of 51–60 years (32.81%). 96.6% of the patients were married, 30% had no income, 36.6% had only completed classes 1–5, and ∼47% resided in rural areas. Approximately 36% of the study participants were former smokers, with 31% current smokers. Borderline abnormal and abnormal levels of anxiety and borderline abnormal and abnormal levels of depression were found in (23.9%, 49.4%) and (55.7%, 13.3%), respectively, of hospitalized patients. Age, residence, profession, monthly income, and chronic disease were significant predictors of anxiety, while only gender remained significantly associated with depression.

**Conclusion:** Hospitalized Bangladeshi patients with heart disease had moderate levels of depression and anxiety. There is a need to develop a quick screening approach in hospitals dealing with hospitalized patients with heart disease to identify those needing extra evaluation and care.

**Keywords: anxiety, cardiovascular diseases, COVID-19, depression, Hospital Anxiety and Depression Scale (HADS), risk factors**

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*Hannah Jennings,*
*University of York, United Kingdom*

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*Papiya Mazumdar,*
*University of Leeds, United Kingdom*
*Olamide Todowede,*
*University of Nottingham,*
*United Kingdom*

***Correspondence:**
*Nadira Sultana Kakoly*
*Nadira.Kakoly@northsouth.edu*

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# INTRODUCTION

Cardiovascular disease (CVD) is responsible for more deaths each year than any other cause, accounting for 32% of worldwide fatalities. Three-quarters of CVD deaths occur in low-and middle-income nations (1, 2). Non-communicable diseases (NCDs) account for an estimated 59% of total deaths in Bangladesh—around 886,000 annual deaths (1). Bangladesh is experiencing a colossal threat of NCDs, where 30% of all NCD mortality cases are accounted for by CVD (3).

Psychiatric morbidities, such as depression and anxiety, are prevalent in patients with heart disease (4). For several decades, clinicians recognized anxiety and depression in patients with heart problems, including patients with heart attack, heart failure, as well as systemic hypertension, particularly in those patients hospitalized in the coronary care unit (4–7). It is anticipated that by 2020, ischemic heart disease and depression will become the first and second contributors to health impairment and mortality globally (8). According to a research brief provided by the World Health Organization (WHO), the global prevalence of anxiety and depression surged by a massive 25% in the first year of the COVID-19 pandemic. Although the situation had improved by the end of 2021, far too many people continue to be unable to receive the care and assistance they require for both pre-existing and newly established mental health issues (9).

Despite anxiety is a natural and anticipated reaction to a heart attack or the dangers of living with a chronic condition, persistent or severe anxiety is not normal and has significant health implications for individuals (5, 10–12). Detection and treatment of the psychiatric condition (anxiety and depression) in patients affected with coronary artery disease (CAD) have been shown to enhance the CAD patients' survival rate and life expectancy (7). Potential risk adjustments, prescription medications, and recovery plans can be best adhered to by patients receiving care for their depression and anxiety (13).

Major depressive disorder (MDD), basically limited to depression, is a frequently diagnosed psychiatric condition with more than 300 million people globally affected and has been linked with an elevated risk of coronary heart disease (CHD) (14). In CVD patients, the prevalence of depression has been found to be around 15–30% (14), which is two to three percentage points higher than in the average community. However, healthcare systems have not been adapted adequately, with fewer than 15% of heart patients identified and treated for depression (15). Depression can lead to poor drug compliance, and the cardiovascular consequences of poor compliance have a bad prognosis. As a result, individuals with known CAD and psychiatric illnesses should be assessed (16) which can enhance the psychological health benefits of individuals with or at risk of cardiovascular disease.

In other countries, psychological problems are stigmatized (17). The incidence of anxiety and depression among heart patients in low-income countries is little known (18), including in Bangladesh. A countrywide survey found that Bangladesh has a high prevalence of mental health problems and inadequate mental health facilities (19). In Bangladesh, despite a rise in their incidence, mental illnesses remain undiagnosed, evaluated, or managed, and cardiovascular disease is still the primary cause of death. Unmet mental health requirements may be a significant roadblock to optimal heart disease patient management (20–23). Given the gaps in knowledge and significant health consequences, the current study aims to determine the proportion of heart patients with depression and anxiety levels as well as factors contributing toward depression and anxiety among hospitalized heart disease patients in Dhaka, Bangladesh.

# MATERIALS AND METHODS

## Study Design and Population

A hospital-based cross-sectional study was conducted. Two central cardiology hospitals, one government and one private hospital in Dhaka, Bangladesh, were selected for this study.

Patients were selected based on the pre-requirements of being aged between 18 and 80 years and having a confirmed or suspected heart disease diagnosis requiring hospitalization between March to June 2021. Our outcome variables included systemic hypertension, CAD, MI (Both ST elevation and non-ST elevation), angina, Heart failure, cardiac arrhythmia, valve pathology, as well as any other type of heart disease. Medical records from the hospital were used to validate heart disease diagnoses. Hospitalized heart disease patients routinely admitted with a history of pre-existing heart disease or newly diagnosed patients with heart disease admitted to the Cardiology Unit of the hospital were enrolled in the study. Those patients seen in an outdoor cardiac department in the hospital were excluded. We also excluded participants if they had a previously normal cardiac catheterization (CATH), an acute or previous stroke, end-stage renal disease (including dialysis patients), troubles with the nervous system (dementia, Alzheimer's disease, epilepsy, Parkinson's disease), mental retardation, a severe and frequently major psychological disorder, or any other serious clinically diagnosed mental health disorder. The study's objectives were communicated to admitted patients, and those who decided to participate gave their signed informed consent. A BMDC (Bangladesh Medical and Dental Council certified), the nationally recognized doctor, selected eligible patients during patient admission based on inclusion criteria. Later on, interviews were done based on a questionnaire and validated scale for this study. Patients were only enrolled once they had recovered from their acute crises and could consent (**Figure 1**). Hospital records and medical information were also used to collect data. Patients were interviewed while undergoing therapy (after CATH) or after treatment within 1 week of admission to the hospital.

Zigmond and Snaith (24) invented the Hospital Anxiety and Depression Scale (HADS), which is widely used worldwide. The Hospital Anxiety and Depression Scale (HADS) measured anxiety and depression. The HADS scale, a self-reported assessment instrument, was applied to detect anxiety and depressive symptoms among hospitalized admitted indoor cardiology patients using a Bengali version of the scale (25). This questionnaire has the HADS-A and HADS-D subscales, measuring anxiety and depressive symptoms. Seven items were used to measure depression, and seven items were used to

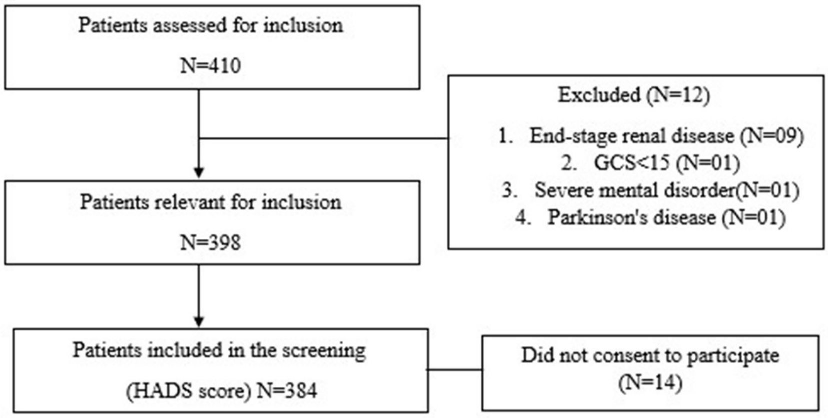

**FIGURE 1 |** Flowchart of patients assessed for inclusion, excluded, and included patients, HADS, Hospital Anxiety and Depression Scale.

measure anxiety. Each questionnaire topic was given a severity rating based on a four-point Likert scale ranging from 0 (not at all) to 4 (intense). Each sub-scale has the highest score of 21, and the full scale has a total score of 42, which might indicate emotional disorder; subscale scores range from 0 (no symptoms) to 21 (maximum of symptoms). A classification scheme can also be used to grade the evaluation: a score of 0–7 implies no clinical symptoms, 8–10 indicates moderate depression or anxiety, and a score of 11–21 shows diagnostic depression or anxiety (26). All major European languages and Arabic, Hebrew, Chinese, Japanese, and Urdu have HADS score translations; interpretations of other languages are also possible. The Bengali version of the HADS scale, a self-reported screening tool, was subsequently used in Bangladesh to assess anxiety and depression symptoms across various patients (27, 28). In study, The HADS translation from English to Bangla was evaluated by five independent reviewers fluent in both English and Bangla. On a scale of one to four, the comparability of the translation was assessed, with higher numbers indicating better comparability (25). We also conducted a pilot study with 20 hospital patients to determine the validity and reliability of the HADS score for the Bangla version. Three hundred eighty-four patients were identified as potential respondents (**Figure 1**).

This scale has been evaluated in various medical settings and has a high level of reliability (mean Cronbach's alpha = 0.83 for HADS-A and mean Cronbach's alpha = 0.82 for HADS-D) (29). HADS-D had a Cronbach's alpha of 0.71, whereas HADS-A had a Cronbach's alpha of 0.70 in this analysis.

## ETHICS STATEMENT

All participants signed a permission form and provided their informed consent. North-South University's Institutional Review Board/Ethical Review Committee also provided ethical approval for this project (2021-IRB-0502).

## STATISTICAL ANALYSIS

The proportion of heart patients with depression and anxiety levels and predictors of depression and anxiety among heart disease hospitalized patients were the key outcome measures. To summarize the patient's demographic characteristics, anxiety, and depression, descriptive statistics such as frequency, percentage and standard deviation were calculated. The Chi-square test assessed the relationship between anxiety and depression levels and socioeconomic and demographic variables. Fisher's exact test was used to assess the association for any contingency table less than five cell frequency.

The relationship between predictors and depression or anxiety was investigated using binary logistic regression. Multiple regression was used to adjust for those predictors significantly associated with the binary model. We reported odds ratios (ORs) and 95% confidence intervals (CIs) of indicators associated with mild and severe levels of depression or anxiety. All *p*-values $<0.05$ were considered as statistically significant. STATA (V16) was used to manage the data and conduct analyses. Internal consistency of the various scales was assessed using Cronbach alpha.

## RESULTS

From March 2021 to June 2021, all patients who met the inclusion criteria were included in the study. We enrolled 384 heart disease patients from two hospitals, one govt Hospital—the National Institute of Cardiovascular Diseases (NICVD) and another private medical college & hospital. Among these two hospitals, 337 patients were enrolled from NICVD and 47 patients from private medical colleges & hospitals.

## SOCIO-DEMOGRAPHIC FACTORS

Demographic characteristics are presented in **Table 1**. Among the 384 patients, 88.2% were males and within the age groups of 51–60 years (32.81%). Most participants were married (96.6%), with 27.4% in the business profession. 30% of patients had no income and 36.6% had only education of up to class five. Most of the study population lived in rural areas (46.61%) (**Table 1**).

## BEHAVIOR FACTORS

Almost 36% of those who were enrolled, were former smokers, with 31% current smokers. Alcohol usage was few, with 97% of

**TABLE 1 |** Socio-demographic and lifestyle characteristics of variables of the respondents, ($N = 384$).

| Variables | Total number of participants ($N = 384$) | Percentage (%) |
|---|---|---|
| **Age** | | |
| Up to 40 years | 63 | 16.41 |
| 41–50 years | 106 | 27.60 |
| 51–60 years | 126 | 32.81 |
| 61 to above years | 89 | 23.18 |
| **Gender** | | |
| Male | 339 | 88.28 |
| Female | 45 | 11.72 |
| **Religion** | | |
| Muslim | 350 | 91.15 |
| Hindu | 31 | 8.07 |
| Others | 03 | 0.78 |
| **Residence** | | |
| Urban | 159 | 41.41 |
| Rural | 179 | 46.61 |
| Semi-rural | 46 | 11.98 |
| **Monthly income** | | |
| 1-<10,000 taka | 73 | 19.01 |
| 10,000–20,000 taka | 93 | 24.22 |
| 20,001–50,000 taka | 85 | 22.14 |
| >50,000 taka | 17 | 4.43 |
| No income | 116 | 30.21 |
| **Marital status** | | |
| Married | 371 | 96.61 |
| Unmarried | 12 | 3.13 |
| Divorced/widow | 01 | 0.26 |
| **Occupation** | | |
| Unemployment | 52 | 13.54 |
| Government job | 11 | 2.86 |
| Private job | 94 | 24.48 |
| Businessman | 105 | 27.34 |
| Farmer | 47 | 12.24 |
| Retired | 33 | 8.59 |
| Housewife | 42 | 10.94 |
| **Education** | | |
| No formal education | 44 | 11.46 |
| Class 1–5 | 140 | 36.46 |
| Class 6–10 | 125 | 32.55 |
| Class 11–12 | 43 | 11.20 |
| Graduation | 26 | 6.77 |
| Post-graduation | 06 | 1.56 |
| **Division** | | |
| Dhaka | 239 | 62.24 |
| Chittagong | 74 | 19.27 |
| Khulna | 15 | 3.91 |
| Sylhet | 12 | 3.13 |
| Rajshahi | 10 | 2.60 |
| Rangpur | 15 | 3.91 |
| Barishal | 09 | 2.34 |
| Mymensingh | 10 | 2.60 |
| **BMI** | | |
| Underweight <18.5 | 17 | 4.43 |
| Normal 18.5–25 | 164 | 42.71 |
| Overweight 25–30 | 108 | 28.13 |
| Obese 30–40 | 95 | 24.74 |

subjects reporting no alcohol intake. Around 53% of patients were either overweight or obese (**Table 1**).

## CLINICAL FACTORS

The primary heart disease diagnoses among the patients were STEMI (46.6%), NSTEMI (17.2%), old MI (18.5%), and other diagnoses around (18%), including mitral or aortic valve stenosis, valve disease and heart block. Diagnosed patients had comorbidities such as chronic disease of systemic hypertension 17.71%, Diabetes mellitus 13.54%, and a combination of both 9.90% (**Table 2**).

### The Prevalence of Heart Disease Patients With Different Levels of Depressive and Anxiety

Even with mild symptoms, a HADS score of more than eight appears to be the best cut-off point for screening for anxiety and depression. Depressive symptoms were categorized as borderline abnormal and abnormal, and anxiety symptoms were categorized as borderline abnormal and abnormal anxiety symptoms. A total of 24% and 49% suffered from borderline abnormal and abnormal anxiety, respectively, and 56% and 14% had borderline abnormal and clinical depression, respectively (**Table 3**).

Males had borderline abnormal and abnormal anxiety in around 24% and 51% of cases, respectively, and females had borderline abnormal and abnormal anxiety in about 25% and 36% of cases. Male respondents revealed a higher abnormal degree of depression than female, with 5% in females and 15% in males. Similarly, graduate respondents and Government service holders had elevated levels of abnormal depression than other respondents. Interestingly homemakers also displayed a significant degree of borderline depression compared to other professions. In terms of income, persons earning 20,001–50,000 tk had the largest number (30%) of abnormal degree depression, while those who did not earn had the lowest number (5%) (**Table 4**).

### Factors Associated With Depression and Anxiety

We found an association between anxiety and BMI ($p = 0.008$), area of residence ($p = 0.031$), an education level ($p = 0.049$) and smoking history ($p = 0.013$). People in the group with an income

**TABLE 2 |** Clinical diagnosis and cardiac symptoms of the respondents, ($N = 384$).

| Clinical diagnosis | Total number of participants $N = 384$ | Percentage (%) |
|---|---|---|
| STEMI | 179 | 46.61 |
| NSTEMI | 66 | 17.19 |
| Old MI | 71 | 18.49 |
| RMI | 15 | 3.91 |
| Unstable angina | 74 | 19.27 |
| Stable angina | 11 | 2.86 |
| Systemic hypertension | 99 | 25.78 |
| Diabetes mellitus | 84 | 21.88 |
| ALVF | 59 | 15.36 |
| Complete heart block | 15 | 3.91 |
| H/O PCI | 17 | 4.43 |
| H/O CABG | 07 | 1.82 |
| Heart valve disease | 26 | 6.77 |
| Arrhythmia | 17 | 4.43 |
| ICM | 18 | 4.69 |
| **Symptoms** | | |
| Chest pain | 309 | 80.47 |
| Dyspnea | 51 | 13.28 |
| Cough | 48 | 12.50 |
| Palpitation | 41 | 10.68 |
| Edema | 15 | 3.91 |
| Orthopnea | 12 | 3.13 |
| Vomiting | 16 | 4.17 |
| Insomnia | 24 | 6.25 |
| No | 46 | 11.98 |

**TABLE 3 |** Proportion of heart patients with depression and anxiety levels patients among hospitalized, ($N = 384$).

| Anxiety Level | Total number of participants ($N = 384$) | Percentage (%) |
|---|---|---|
| Normal | 102 | 26.56 |
| Borderline abnormal | 92 | 23.96 |
| Abnormal | 190 | 49.48 |
| **Depression level** | | |
| Normal | 119 | 30.99 |
| Borderline abnormal | 214 | 55.73 |
| Abnormal | 51 | 13.28 |

of more than >50000 bdt were found to have less anxiety than those in the other groups. However, these findings were only significant among patients who had an ECG finding indicating STEMI ($p = 0.001$) and NSTEMI cardiac diagnosis ($p = 0.003$) (**Table 4**).

However, there was an association between depression with age ($p = 0.000$), years of education ($p = 0.002$), occupation ($p = 0.001$) and individual monthly income ($p = 0.000$) on bi-variate analysis Post-graduation group had the highest level (83.33%) of abnormal level of anxiety. In terms of education, persons who had completed their post-graduation without depression also had the highest rate of depression (67%), and aberrant depression was more common in the graduating group (31%) (**Table 4**). Those variables with $p$-values <0.05 were incorporated into the multivariable model.

For multivariable analysis, both anxiety and depression were categorized into two groups: one normal group and the other abnormal group (combination of both borderline abnormal and abnormal) (**Table 4**). Multivariable logistic regression found residence, age, profession, and income to be statistically significantly associated with anxiety after controlling for the other factors found to be significant at the univariate level. In the case of depression, multivariable logistic regression revealed only gender as being significantly associated after controlling for confounders (**Table 5**).

## DISCUSSION

The prevalence of depression and anxiety level was moderately high in this study. An abnormal degree of anxiety affected 49.5%, whereas borderline anxiety affected 23.9% of the study population. This conclusion resembles that of the Brazilian population (30), where it was found that 48.4% of CAD patients were anxious. Anxiety levels among CAD patients were slightly more pronounced in our study, which might be related to unemployment following sickness, level of illiteracy, a lack of knowledge about the prognosis of CAD, or even lack of counseling resources in a developing country context. In our study, around 55.7% of patients had borderline depression, and 13.2% had abnormal depression, whereas studies in Brazil (30) and Germany (31) revealed that 26.4 and 5.9% of CAD patients, respectively, had depression. Depression was found to be much higher among CAD patients in our study which could be due to a lack of information and limited access to quality health care, including the huge out of pocket expenditure.

The sex of patients was also shown to be substantially related to their degree of anxiety with males having a higher level of anxiety than females. Similar findings were seen in Brazil (32), but a study from America (33) found that female CAD patients had more significant anxiety than males. Furthermore, our study linked family income and occupation status to CAD patients' anxiety levels, with patients whose yearly family income was insufficient funds experiencing higher anxiety levels. However, research from Pakistan (34) found no link between anxiety and CAD patients' socioeconomic levels. The disparity in results might be attributed to differences in sample size of the study population.

Our study also indicated that anxiety levels were related to age, with 23% lower anxiety levels in the younger (41–50) group than in the 61 and above age group. Our findings are consistent with research done in the United States (33), which also found that age was strongly related to anxiety levels. Patients with comorbid conditions such as HTN and DM were at 2.8 times higher risk than patients having no comorbidity. Our findings are consistent with research done in India that found a strong link between CAD patients' anxiety

**TABLE 4 |** Association of the level of anxiety and depression with different variables.

| **Variables** | **Category** | **Anxiety** | | | | **Depression** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **Normal** | **Borderline abnormal** | **Abnormal** | ***p*** | **Normal** | **Borderline abnormal** | **Abnormal** | ***p*** |
| Gender | Female | 18 (40.00) | 11 (24.44) | 16 (35.56) | 0.065 | 8 (17.78) | 35 (77.78) | 2 (4.44) | **0.006** |
| | Male | 84 (24.78) | 81 (23.89) | 174 (51.33) | | 111 (32.74) | 179 (52.80) | 49 (14.45) | |
| Age | Up to 40 | 17 (26.98) | 16 (25.40) | 30 (47.62) | 0.207 | 26 (41.27) | 27 (42.86) | 10 (15.87) | **0.000*** |
| | 41–50 | 31 (29.25) | 17 (16.04) | 58 (54.72) | | 40 (37.74) | 41 (38.68) | 25 (23.58) | |
| | 51–60 | 27 (21.43) | 33 (26.19) | 66 (52.38) | | 34 (26.98) | 82 (65.08) | 10 (7.94) | |
| | 61 to above | 27 (30.34) | 26 (29.21) | 36 (40.45) | | 19 (21.35) | 64 (71.91) | 6 (6.74) | |
| Religions | Islam | 92 (26.29) | 83 (23.71) | 175 (50.00) | 0.817 | 109 (31.14) | 196 (56.00) | 45 (12.86) | 0.670 |
| | Hinduism | 10 (32.26) | 8 (25.81) | 13 (41.94) | | 10 (32.26) | 16 (51.61) | 5 (16.13) | |
| | Buddhism | 0 (0.00) | 1 (50.00) | 1 (50.00) | | 0 (0.00) | 1 (50.00) | 1 (50.00) | |
| | Christianity | 0 (0.00) | 0 (0.00) | 1 (100.00) | | 0 (0.00) | 1 (100.00) | 0 (0.00) | |
| BMI (kg/m$^2$) | Underweight | 6 (35.29) | 7 (41.18) | 4 (23.53) | **0.008*** | 5 (29.41) | 12 (70.59) | 0 (0.00) | 0.145 |
| | Normal | 47 (28.66) | 34 (20.73) | 83 (50.61) | | 54 (32.93) | 84 (51.22) | 26 (15.85) | |
| | Overweight | 18 (16.67) | 24 (22.22) | 66 (61.11) | | 25 (23.15) | 69 (63.89) | 14 (12.96) | |
| | Obese | 31 (32.63) | 27 (28.42) | 37 (38.95) | | 35 (36.84) | 49 (51.58) | 11 (11.58) | |
| Residence | Rural | 53 (29.61) | 44 (24.58) | 82 (45.81) | **0.031*** | 59 (32.96) | 100 (55.87) | 20 (11.17) | 0.226 |
| | Semi-Urban | 6 (13.04) | 7 (15.22) | 33 (71.74) | | 13 (28.26) | 22 (47.83) | 11 (23.91) | |
| | Urban | 43 (27.04) | 41 (25.79) | 75 (47.17) | | 47 (29.56) | 92 (57.86) | 20 (12.58) | |
| Year of education | No formal education | 12 (27.27) | 13 (29.55) | 19 (43.18) | 0.064 | 16 (36.36) | 26 (59.09) | 2 (4.55) | **0.002*** |
| | Class 1-5 | 33 (23.57) | 27 (19.29) | 80 (57.14) | | 38 (27.14) | 91 (65.00) | 11 (7.86) | |
| | Class 6-10 | 42 (33.60) | 36 (28.80) | 47 (37.60) | | 37 (29.60) | 67 (53.60) | 21 (16.80) | |
| | Class 11-12 | 10 (23.26) | 11 (25.58) | 22 (51.16) | | 18 (41.86) | 16 (37.21) | 9 (20.93) | |
| | Graduation | 5 (19.23) | 4 (15.38) | 17 (65.38) | | 6 (23.08) | 12 (46.15) | 8 (30.77) | |
| | Post-Graduation | 0 (0.00) | 1 (16.67) | 5 (83.33) | | 4 (66.67) | 2 (33.33) | 0 (0.00) | |
| Profession | Housewife | 18 (42.86) | 9 (21.43) | 15 (35.71) | 0.365 | 7 (16.67) | 33 (78.57) | 2 (4.76) | **0.001*** |
| | Govt. Employee | 3 (27.27) | 3 (27.27) | 5 (45.45) | | 2 (18.18) | 6 (54.55) | 3 (27.27) | |
| | Private Service | 24 (25.53) | 22 (23.40) | 48 (52.06) | | 35 (37.23) | 40 (42.55) | 19 (20.21) | |
| | Business | 23 (21.90) | 23 (21.90) | 59 (56.19) | | 35 (33.33) | 51 (48.57) | 19 (18.10) | |
| | Farmer | 14 (29.79) | 14 (29.79) | 19 (40.43) | | 19 (40.43) | 25 (53.19) | 3 (6.3) | |
| | Retired | 8 (24.24) | 5 (15.15) | 20 (60.61) | | 8 (24.24) | 24 (72.73) | 1 (3.03) | |
| | Unemployment | 12 (23.08) | 16 (30.77) | 24 (46.15) | | 13 (25.00) | 35 (67.31) | 4 (7.69) | |
| Marital status | Married | 99 (26.68) | 86 (23.18) | 186 (50.13) | 0.140 | 116 (31.27) | 204 (54.99) | 51 (13.75) | 0.506 |
| | Single | 3 (25.00) | 6 (50.00) | 3 (25.00) | | 3 (25.00) | 9 (75.00) | 0 (0.00) | |
| | Widowed | 0 (0.00) | 0 (0.00) | 1 (100.00) | | 0 (0.00) | 1 (100.00) | 0 (0.00) | |
| Personal monthly income (BDT) | No | 38 (32.76) | 31 (26.72) | 47 (40.52) | 0.117 | 26 (22.41) | 84 (72.41) | 6 (5.17) | **0.000*** |
| | 1–≤10,000 | 19 (26.03) | 15 (20.55) | 39 (53.42) | | 19 (26.03) | 45 (61.64) | 9 (12.33) | |
| | 10,001–20,000 | 20 (21.51) | 21 (22.58) | 52 (55.91) | | 41 (44.09) | 41 (44.09) | 11 (11.83) | |
| | 20,001–50,000 | 19 (22.35) | 18 (21.18) | 48 (56.47) | | 27 (31.76) | 33 (38.82) | 25 (29.41) | |
| | >50,000 | 6 (35.29) | 7 (41.18) | 4 (23.53) | | 6 (5.04) | 11 (5.14) | 0 (0.00) | |
| Division | Dhaka | 60 (25.10) | 55 (23.01) | 124 (51.88) | 0.825 | 35 (14.65) | 70 (29.29) | 134 (56.07) | 0.345 (f) |
| | Chittagong | 19 (25.68) | 21 (28.38) | 34 (45.95) | | 6 (8.11) | 23 (31.08) | 45 (60.81) | |
| | Khulna | 6 (40.00) | 5 (33.33) | 4 (26.67) | | 2 (13.33) | 5 (33.33) | 8 (53.33) | |
| | Rangpur | 5 (33.33) | 4 (26.67) | 6 (40.00) | | 4 (26.67) | 6 (40.00) | 5 (33.33) | |
| | Sylhet | 4 (33.33) | 1 (8.33) | 7 (58.33) | | 4 (33.33) | 3 (25.00) | 5 (41.67) | |
| | Rajshahi | 2 (20.00) | 3 (30.00) | 5 (50.00) | | 0 (0.00) | 5 (50.00) | 5 (50.00) | |
| | Mymensingh | 4 (40.00) | 1 (10.00) | 5 (50.00) | | 0 (0.00) | 3 (30.00) | 7 (70.00) | |
| | Barishal | 2 (22.22) | 2 (22.22) | 5 (55.56) | | 0 (0.00) | 4 (44.44) | 5 (55.56) | |
| Smoking history | Current smoker | 22 (18.03) | 24 (19.67) | 76 (62.30) | **0.013*** | 40 (32.79) | 64 (52.46) | 18 (14.75) | 0.691 |
| | Former smoker | 40 (28.99) | 37 (26.81) | 61 (44.20) | | 46 (33.33) | 76 (55.07) | 16 (11.59) | |
| | Never smoker | 40 (32.26) | 31 (25.00) | 52 (42.74) | | 33 (26.61) | 74 (59.68) | 17 (13.28) | |

*(Continued)*

**TABLE 4** | Continued

| Variables | Category | Anxiety | | | | Depression | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **Normal** | **Borderline abnormal** | **Abnormal** | ***p*** | **Normal** | **Borderline abnormal** | **Abnormal** | ***p*** |
| Alcohol consumption | No | 100 (26.95) | 89 (23.72) | 185 (49.33) | 0.841 | 117 (31.28) | 208 (55.61) | 49 (13.10) | 0.663 |
| | yes | 2 (20.00) | 3 (30.00) | 5 (50.00) | | 2 (20.00) | 6 (60.00) | 2 (20.00) | |
| Drug abuse | No | 101 (26.79) | 91 (24.14) | 185 (49.07) | 0.502 | 115 (30.50) | 213 (56.50) | 49 (13.00) | 0.081 |
| | yes | 1 (14.29) | 1 (14.29) | 5 (71.43) | | 4 (57.14) | 1 (14.29) | 2 (28.57) | |
| Chronic disease | DM | 13 (25.00) | 12 (23.08) | 27 (51.92) | **0.050*** | 22 (42.31) | 23 (44.23) | 7 (13.73) | 0.115 |
| | Hypertension | 17 (25.00) | 21 (30.88) | 30 (44.12) | | 21 (30.88) | 39 (57.35) | 8 (11.76) | |
| | Both HTN and DM | 15 (39.47) | 13 (34.21) | 10 (26.32) | | 6 (15.79) | 29 (76.32) | 3 (7.89) | |
| | None | 57 (25.22) | 46 (20.35) | 123 (54.42) | | 119 (30.99) | 214 (55.73) | 33 (14.60) | |
| STEMI | No | 60 (29.27) | 60 (29.21) | *85 (41.46)* | **0.001*** | 59 (28.79) | 121 (59.02) | 25 (12.20) | 0.379 |
| | Yes | 42 (23.46) | 32 (17.88) | *105 (58.66)* | | 60 (33.52) | 93 (51.96) | 26 (14.53) | |
| NSTEMI | No | 90 (28.30) | 82 (25.79) | 146 (45.91) | **0.003*** | 119 (30.99) | 180 (56.60) | 41 (12.89) | 0.739 |
| | Yes | 12 (18.18) | 10 (15.15) | 44 (66.67) | | 22 (33.33) | 34 (51.52) | 10 (15.15) | |
| Old MI | No | 81 (25.88) | 70 (22.36) | 162 (51.76) | 0.144 | 96 (30.67) | 174 (55.59) | 43 (13.74) | 0.849 |
| | Yes | 21 (29.58) | 22 (30.99) | 28 (39.44) | | 23 (32.39) | 40 (56.34) | 8 (11.27) | |
| Recent MI | No | 99 (26.83) | 89 (24.12) | 181 (49.05) | 0.703 | 112 (30.35) | 209 (56.64) | 48 (13.01) | 0.154 |
| | Yes | 3 (20.00) | 3 (20.00) | 9 (60.00) | | 7 (46.67) | 5 (33.33) | 3 (20.00) | |
| Systemic hypertension | No | 73 (25.61) | 65 (22.81) | 147 (51.58) | 0.373 | 94 (32.98) | 156 (54.74) | 35 (12.28) | 0.294 |
| | Yes | 29 (29.29) | 27 (27.27) | 43 (43.43) | | 25 (25.25) | 58 (58.59) | 16 (16.16) | |
| Diabetes mellitus | No | 80 (26.67) | 66 (22.00) | 154 (51.33) | 0.207 | 93 (31.00) | 166 (55.33) | 41 (13.67) | 0.908 |
| | Yes | 22 (26.19) | 26 (30.95) | 36 (42.86) | | 26 (30.95) | 48 (57.14) | 10 (11.90) | |
| ALVF | No | 82 (25.23) | 83 (25.54) | 160 (49.23) | 0.162 | 100 (30.77) | 178 (54.77) | 47 (14.46) | 0.290 |
| | Yes | 20 (33.90) | 9 (15.25) | 30 (50.85) | | 19 (32.20) | 36 (61.02) | 4 (6.78) | |
| Unstable angina | No | 86 (27.74) | 68 (21.94) | 156 (50.32) | 0.148 | 103 (33.23) | 168 (54.19) | 39 (12.58) | 0.144 |
| | Yes | 16 (21.62) | 24 (32.43) | 34 (45.95) | | 16 (21.62) | 46 (62.16) | 12 (16.22) | |
| Stable angina | No | 99 (26.54) | 90 (24.13) | 184 (49.33) | 0.896 | 116 (31.10) | 209 (56.03) | 48 (12.87) | 0.379 |
| | Yes | 3 (27.27) | 2 (18.18) | 6 (54.55) | | 3 (27.27) | 5 (45.45) | 3 (27.27) | |
| Heart valve disease | No | 91 (25.42) | 85 (23.74) | 182 (50.84) | 0.096 | 109 (30.45) | 198 (55.31) | 51 (14.25) | 0.077 |
| | Yes | 11 (42.31) | 7 (26.92) | 8 (30.77) | | 10 (38.46) | 16 (61.54) | 0 (0.00) | |

*MI, Myocardial infarction; STEMI, ST-elevation myocardial infarction; NSTEMI, Non-ST-Elevation Myocardial Infarction; ALVF, Acute Left Ventricular Failure; BMI, Body mass index; OR, Odds Ratio; CI, Confidence Interval; BDT, Bangladesh taka.*

**Significant outcomes were indicated by bold values.*

and their comorbid illness. We did not find any predictors strongly predicting depression after controlling for confounders in our study.

There is limited information about anxiety and depression in hospitalized cardiology departments particularly during the COVID-19 era which itself could add to the anxiety and depression experienced by patients and limited to no prospective evidence about heart disease patient mental well-being in Bangladesh. Our study provides essential information on undiagnosed anxiety and depression among heart disease patients admitted to a Bangladeshi hospital. The study also suggests the potential for further research studies to evaluate the clinical significance of anxiety and depression on individuals with cardiovascular disease, including prognosis and management of CVD.

## STRENGTH AND LIMITATION

It is the first study in Bangladesh to assess the mental health status of hospitalized heart disease patients. However, the cross-sectional form of the study makes it very difficult to establish valid inferences. A long-term follow-up should be conducted to see if the study's findings are consistent in similar settings and have any bearing on the management and prognosis of heart disease. Including an interaction term in multivariable regression would be more informative, but due to the limited sample size, this could not be done. In addition, and our main goal was to assess the prevalence and predictors of anxiety and depression among hospitalized heart disease patients which has been presented taking into consideration major confounders.

Despite its widespread use, the HADS has significant drawbacks. For starters, a cutoff score of 11 on the HADS

**TABLE 5 |** Factors associated with anxiety and depression in multivariable logistic regression.

| Variables | Category | Anxiety | | | | Depression | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **Crude OR (95%CI)** | ***p*-value** | **Adjusted OR (95%CI)** | ***p*** | **Crude OR (95%CI)** | ***p*-value** | **Adjusted OR (95%CI)** | ***p*** |
| Gender | Male | 0.52 (0.27–0.99) | 0.050 | 1.46 (0.09–23.9) | 0.788 | | | 1.46e−06 (0) | 0.006* |
| | Female | Ref | Ref | Ref | | Ref | Ref | ref | |
| Age | Up to 40 | 0.74 (0.38–1.43) | 0.380 | 0.65 (0.29–1.46) | 0.300 | 0.38 (0.1–1.11) | 0.079 | 0.60 (0.18–1.99) | 0.410 |
| | 41–50 | 0.56 (0.31–0.99) | 0.048 | 0.46 (0.23–0.93) | 0.033* | 0.23 (0.90–0.60) | 0.003 | 0.39 (0.14–1.09) | 0.075 |
| | 51–60 | 0.61 (0.35–1.06) | 0.085 | 0.52 (0.27–1.02) | 0.057 | 0.84 (0.29–2.39) | 0.743 | 1.21 (0.39–3.78) | 0.737 |
| | 61 to above | Ref | Ref | Ref | | Ref | Ref | Ref | Ref |
| Residence | Rural | 1.05 (0.68–1.62) | 0.802 | 1.11 (0.66–1.86) | 0.691 | | | | |
| | Semi-urban | 0.35 (0.17–0.71) | 0.004 | 0.42 (0.19–0.93) | 0.034* | | | | |
| | Urban | Ref | Ref | Ref | | | | | |
| Year of education | No formal education | | | | | Ref | Ref | Ref | |
| | Class 1–5 | | | | | 0.56 (0.11–2.62) | 0.460 | 0.59 (0.12–2.97) | 0.515 |
| | Class 6–10 | | | | | 0.24 (0.05–1.05) | 0.058 | 0.27 (0.05–1.33) | 0.116 |
| | Class 11–12 | | | | | 0.18 (0.04–0.89) | 0.035 | 0.32 (0.05–1.85) | 0.204 |
| | Graduation | | | | | 0.11 (0.20–0.56) | 0.008 | 0.21 (0.03–1.30) | 0.094 |
| | Post-graduation | | | | | 1 | - | 1 | - |
| Profession | Housewife | 2.30 (0.76–2.91) | 0.027 | 0.42 (0.02–9.85) | 0.593 | 4.42 (0.98–19.89) | 0.053 | 2.90e (0) | 0.982 |
| | Govt. employee | 1.53 (0.37–1.85) | 0.498 | 2.35 (0.57–9.56) | 0.232 | 0.59 (0.14–2.43) | 0.464 | 0.54 (0.10–2.83) | 0.474 |
| | Private service | 1.22 (0.44–5.36) | 0.469 | 1.41 (0.74–2.68) | 0.294 | 0.87 (0.43–1.77) | 0.705 | 0.86 (0.38–1.92) | 0.719 |
| | Business | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| | Farmer | 1.89 (1.10–4.83) | 0.074 | 1.88 (0.82–4.32) | 0.132 | 3.24 (0.91–11.54) | 0.070 | 1.85 (0.45–7.51) | 0.389 |
| | Retired | 0.83 (0.37–1.85) | 0.655 | 0.42 (0.02–9.85) | 0.009* | 7.06 (0.91–54.99) | 0.062 | 2.16 (0.17–26.24) | 0.544 |
| | Unemployment | 1.49 (0.79–2.92) | 0.237 | 0.20 (0.04–1.00) | 0.051 | 2.65 (0.85–8.24) | 0.092 | 0.60 (0.05–6.63) | 0.679 |
| Personal monthly income (BDT) | No | Ref | Ref | ref | | Ref | Ref | ref | |
| | 1–≤10,000 | 0.59 (0.32–1.07) | 0.084 | 0.16 (0.04–0.67) | 0.012* | 0.38 (0.13–1.14) | 0.085 | 0.34 (0.04–2.64) | 0.307 |
| | 10,001–20,000 | 0.54 (0.30–0.93) | 0.027 | 0.11 (0.02–0.55) | 0.006* | 0.41 (0.14–1.14) | 0.000 | 0.604 (0.06–5.87) | 0.684 |
| | 20,001–50,000 | 0.52 (0.30–0.93) | 0.027 | 0.11 (0.02–0.53) | 0.006* | 0.13 (0.05–0.34) | 0.000 | 0.21 (0.02–2.00) | 0.178 |
| | >50,000 | 2.21 (0.68–7.20) | 0.187 | 0.40 (0.05–2.77) | 0.355 | 1 | – | 1 | - |
| Smoking history | Current smoker | 0.45 (0.27–0.75) | 0.002 | 0.60 (0.32–1.14) | 0.123 | | | | |
| | Former smoker | 0.94 (0.57–1.54) | 0.812 | 1.11 (0.60–2.06) | 0.727 | | | | |
| | Never smoker | Ref | Ref | ref | Ref | | | | |
| Chronic disease | DM | 1.10 (0.60–2.02) | 0.744 | 1.44 (0.71–2.94) | 0.307 | | | | |
| | Hypertension | 1.51 (0.87–2.61) | 0.137 | 1.54 (0.83–2.87) | 0.170 | | | | |
| | Both HTN and DM | 3.34 (1.55–7.20) | 0.002 | 2.85 (1.22–6.65) | 0.015* | | | | |
| | None | Ref | Ref | Ref | Ref | | | | |
| STEMI | No | Ref | Ref | Ref | Ref | | | | |
| | Yes | 0.49 (0.33–0.75) | 0.001 | 0.59 (0.40–1.18) | 0.180 | | | | |
| NSTEMI | No | Ref | Ref | Ref | Ref | | | | |
| | *Yes* | 0.42 (0.24–0.74) | 0.003 | 0.66 (0.33–1.34) | 0.259 | | | | |

*MI, Myocardial infarction; STEMI, ST-elevation myocardial infarction; NSTEMI, Non-ST-Elevation Myocardial Infarction; ALVF, Acute Left Ventricular Failure; OR, Odds Ratio; CI, Confidence Interval; BDT, Bangladesh taka.*

**Significant results.*

depression subscale (HADS-D) has been found to have a sensitivity of just 38% for diagnosing clinical depression, implying that most of the depression in the study's population went undiscovered (35). In addition, unlike other self-report questionnaires such as the Patient Health Questionnaire (PHQ), the HADS does not capture somatic symptoms, including fatigue and sleeplessness. Over 30 years ago, the idea was that physical instead of mental disorders could cause fatigue and insomnia (35).

## CONCLUSION

Our findings indicate that health care providers, particularly cardiologists and nurses, should take extra care to detect and evaluate all heart disease patients for level of anxiety and depression in a clinical setting. There is a need to develop a quick screening approach in hospitals dealing with cardiovascular inpatients to identify those needing extra evaluation and care.

## 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 North-South University's Institutional Review Board/Ethical Review Committee also provided ethical approval for this project (2021-IRB-0502). The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

Conceptualization: MAm, MAh, and NK. Data curation: MAm. Formal analysis and methodology: MAm and SN. Project administration and visualization: MAh and NK. Writing—original draft: MAm and NK. Writing—review and editing: MAm, SN, and NK. All authors approved the submitted version for publication.

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# Investigation of Mental Health Literacy and Status of Residents During the Re-Outbreak of COVID-19 in China

*Shiming Li*[1†], *Bingbing Guo*[2†], *Xiao Lu*[3], *Queping Yang*[1], *Haohao Zhu*[1*], *Yingying Ji*[1*] *and Ying Jiang*[1*]

[1] *The Affiliated Wuxi Mental Health Center of Nanjing Medical University, Wuxi Tongren International Rehabilitation Hospital, Wuxi, China,* [2] *The Affiliated Wuxi Maternity and Child Health Care Hospital of Nanjing Medical University, Wuxi, China,* [3] *Department of Rehabilitation Medicine, The First Affiliated Hospital of Nanjing Medical University, Nanjing, China*

**Introduction:** The current field of research on the impact of COVID-19 on mental health was mostly limited to the evaluation of the first round of the epidemic, few reports focused on the impact of the re-emergence of COVID-19. This study aimed to investigate the mental health literacy and status of residents during the re-outbreak of COVID-19 in China.

**Methods:** The basic information sheet, health literacy survey scale, physical health questionnaire-9 (PHQ-9), generalized anxiety disorder-7 (GAD-7), insomnia severity index (ISI), and Alzheimer dementia 8 (AD8) were applied to evaluate the mental health literacy, mental health status and elderly cognitive function, and $\chi 2$ test was applied for analysis of the difference between different groups.

**Results:** A total of 2,306 participants were involved in this study, of which 734 people completed the mental health literacy survey. The qualified rate of mental health literacy was 6.4%. The difference is statistically significant. A total of 1,015 people completed the survey of mental health status, the prevalence of depressive symptoms was 8.87%, the monthly income of different families ($\chi 2 = 13.96$, $P = 0.01$), the self-assessed health status ($\chi 2 = 128.56$, $P < 0.05$), the presence or absence of chronic diseases ($\chi 2 = 4.78$, $P = 0.03$), among all which the difference was statistically significant; the prevalence of anxiety symptoms was 3.84%, different regions ($\chi 2 = 12.26$, $P < 0.05$), occupations ($\chi 2 = 11.65$, $P < 0.05$), household monthly income ($\chi 2 = 12.65$, $P = 0.01$), self-rated health status ($\chi 2 = 151.11$, $P < 0.05$), and chronic diseases ($\chi 2 = 7.77$, $P = 0.01$), among all which the differences were statistically significant. The prevalence of insomnia symptoms was 7.98%, different age ($\chi 2 = 18.45$, $P < 0.05$), region ($\chi 2 = 5.11$, $P = 0.02$), monthly household income ($\chi 2 = 12.68$ $P = 0.01$), and self-assessed health status ($\chi 2 = 91.71$, $P < 0.05$), in which there was a statistically significant difference between those with or without chronic diseases ($\chi 2 = 3\ 3.25$, $P < 0.05$). A total of 557 elderly people over 65 years old completed the cognitive dysfunction screening, in which the prevalence of cognitive dysfunction was 17.41%, and the difference was statistically significant at the different self-assessed health status ($\chi 2 = 96.24$, $P < 0.05$) and with or without chronic diseases ($\chi 2 = 107.09$, $P < 0.05$).

**Edited by:**
Aliya Naheed,
International Centre for Diarrhoeal
Disease Research, Bangladesh

**Reviewed by:**
Faiza Aslam,
Rawalpindi Medical
University, Pakistan
Papiya Mazumdar,
University of Leeds, United Kingdom

***Correspondence:**
Haohao Zhu
zhuhaohao233@163.com
Yingying Ji
miaomiao19870@163.com
Ying Jiang
jiangying911010@163.com

† These authors have contributed
equally to this work

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**Conclusion:** The mental health literacy and status of residents have not improved significantly during the second outbreak of the epidemic, indicating that under the normalization of epidemic prevention and control, more attention should be paid to the mental health of residents, and targeted health education and psychological intervention should be carried out to avoid relative adverse events.

**Keywords: mental health literacy, mental health status, re-outbreak, COVID-19, residents**

## INTRODUCTION

The COVID-19 caused by SARS-CoV-2 has spread around the world and the WHO has declared the COVID-19 as a "public health emergency of international concern" (1). The raging virus, the isolation measures adopted by various countries and the interruption of normal life have caused public panic and psychological problems (2–4). A meta-analysis of studies in different countries showed that the average prevalence of depression, anxiety, distress, and insomnia caused by the COVID-19 was 31.4, 31.9, 41.1, and 37.9%, respectively (5). More than half of a total of 1,210 respondents to an online survey conducted in China 2 weeks after the outbreak of COVID-19 rated the psychological impact of the outbreak as moderate or severe, with 36.4% of anxiety, 32.4% of stress, and 31.3% of depression (6); in the follow-up survey after 4 weeks, the levels of depression, anxiety and stress all remained elevated or at the same level (7). An online questionnaire survey in Liaoning Province showed that most of the 263 participants felt the pressure brought about by the epidemic, and more than half of them felt fear and anxiety due to the epidemic (8).

In China, through the joint efforts of the government and the masses, the rebound and import of new cases of COVID-19 have been controlled, and China has entered the stage of normalized epidemic prevention, which is also called the "post-epidemic era." In the post-epidemic era, although public physical health is gradually recovering, the adverse mental health outcomes caused by the epidemic may still persist or even worsen (9, 10). Studies have shown that psychological problems such as anxiety, depression, and post-traumatic stress disorder (PTSD) are still very common within a period of time after major emergencies such as public health emergencies, and the prevalence of PTSD can even reach 33.3% (11), therefore, more attention should be paid to the public mental health under the post-epidemic era.

Besides, although the prevention and control of COVID-19 in China are in the post-epidemic era, there were outbreaks in some areas from time to time. For example, the COVID-19 outbroke again in Nanjing and Yangzhou, Jiangsu Province in July 2021 (12, 13). Compared with the first-round outbreak of the epidemic in Jiangsu Province, the understanding of the epidemic was more scientific, and the government agencies were more fully prepared for epidemic prevention and control. However, due to the re-emergence of the epidemic, the recovered life and work were disrupted again, with a negative psychological impact on residents, making them feel hopeless, helpless, panic, and even have symptoms such as anxiety, depression, and insomnia (14, 15). The current field of research on the impact of COVID-19 on mental health was mostly limited to the evaluation of the first round of the epidemic, few reports focused on the impact of the re-emergence of the COVID-19. Through a cross-sectional study, the mental health status, and its influencing factors of residents during the re-emergence of the COVID-19 in the Jiangsu Province were discussed, in order to provide a scientific basis for the administrative department to intervene in the mental health impact of the localized COVID-19 outbreak.

## METHODS

### Participants

From 15 July 2021 to 20 November 2021, random cluster sampling was applied to determine the three cities from Jiangsu Province as the survey areas. According to the number of permanent residents, each city randomly selected two streets by stratification, three communities (village neighborhood committees) were selected for each street, 56 households were randomly selected in each community, and 1–2 permanent residents over the age of 18 were randomly selected from the household as the survey participants. In this survey, 2,328 questionnaires were distributed, and 2,306 valid questionnaires were recovered, with an effective rate of 99.05%.

### Questionnaire and Evaluation Criteria

The basic information scale, mental health literacy questionnaire, physical health questionnaire-9 (PHQ-9), generalized anxiety disorder-7 (GAD-7), insomnia severity index (ISI), and Alzheimer dementia 8 (AD8) in the "Jiangsu Province Mental Health Promotion Action Baseline Investigation Plan" were applied to investigate the mental health state of the residents. The basic information scale includes the following: gender, age, educational level, marriage, occupation, region, self-reporting chronic diseases (diabetes and hypertension), and other demographic data. The mental health literacy questionnaire is divided into three parts: judgment questions, self-assessment questions, and case analysis questions. There are 20 judgment questions in total, mainly including the common knowledge related to mental health, five points for correct answers, 0 points for wrong answers or unknowing, out of 100 points, of which ten questions (1, 3, 5, 7, 8, 9, 10, 15, 16, 19) aim to express the correct mental health knowledge, the others are wrong mental health knowledge; the second part of the self-assessment questions are mainly about self-behaviors in life and views on mental health, containing a total of eight questions with the total score of 8–32 points; the third part of the case analysis questions is divided into two groups with potential mental health problems, each group contains four questions, with the total score of 40 points; the qualifying criteria of mental health literacy are judgment questions $\geq$80 points, self-assessment questions $\geq$24 points, and case analysis questions $\geq$28 points. PHQ-9 contains nine items, each item scored 0–3, with 5–9 divided into mild depression, 10–14 moderate depression, 15–19 moderately severe depression, and 20–27 severe depression (16). GAD-7 contains seven items, each item is scored by 3-grade, and the higher scores indicated the more severe symptoms (17). There are seven items included in ISI with each item scored from 0 to 4, of which $\geq$7 indicates the presence of insomnia symptoms (18). AD8 score $\geq$2 points could be considered cognitive dysfunction (19).

## Investigation Method and Quality Control

The investigation team was composed of public health personnel, mental health prevention and control personnel, and members of the care and support team for the household survey based on the selected list. In terms of quality control, the content of the questionnaire was verified by experts from the Jiangsu Provincial Mental Health Project Working Group, and an implementation plan was issued. Before the survey was carried out, provincial and municipal household survey training was organized. During the investigation, the questionnaires were quality-controlled by two deputy chief physicians of the Wuxi Mental Health Center.

## Statistical Analysis

To establish the database, EpiData 3.1 was used, while SPSS 22 was applied for statistical analysis. Quantitative data were described by M, and qualitative data were described by n (%); the $\chi 2$ test was used for the analysis of the difference between different groups. $p < 0.05$ was considered to be statistically significant.

# RESULTS

## Basic Information

A total of 2,328 questionnaires were distributed, 22 unqualified questionnaires were removed, and the final questionnaire effectiveness rate was 99.05%. Among them, there were 738 mental health literacy questionnaires including 4 removed unqualified questionnaires (effective rate 99.46%), of which 49.86% were men (366/734) and 50.14% were women (368/734), aged from 18 to 89 years old, with the median age of 53 years old. There were 1,025 questionnaires on mental health status, containing 10 unqualified questionnaires, with an effective rate of 99.02%, and 51.03% were men (518/1,015) and 48.97% were women (497/1,015), aged 19–92 years old with the median age of 55 years old. The other 565 questionnaires focused on the cognitive dysfunction screening over the age of 65, with the excluded 8 unqualified questionnaires and 98.58% effective rate, with men accounting for 47.94% (267/557) and women accounting for 52.06% (290/557), aged 65–98 years old, and the median age of 85 years old.

## Qualified Rate of Mental Health Literacy

The qualified rate of mental health literacy in this study was 6.40% (47/734). Univariate analysis showed that there were statistically significant differences among different age ($\chi 2 = 23.96$, $P < 0.05$) and educational level ($\chi 2 = 23.96$, $P < 0.05$), **Table 1**.

**TABLE 1** | The mental health literacy of residents.

| Factors | No. | Qualified number | Qualified rate(%) | $\chi^2$ | *P* |
|---|---|---|---|---|---|
| **Gender** | | | | 0.60 | 0.44 |
| Male | 366 | 26 | 7.10 | | |
| Female | 368 | 21 | 5.71 | | |
| **Age** | | | | 23.96 | <0.0001 |
| 18–30 | 49 | 9 | 18.37 | | |
| 31–40 | 125 | 14 | 11.20 | | |
| 41–50 | 154 | 11 | 7.14 | | |
| 51–60 | 172 | 7 | 4.07 | | |
| >60 | 234 | 6 | 2.56 | | |
| **Education level** | | | | 24.28 | <0.0001 |
| Junior high school and below | 404 | 15 | 3.72 | | |
| High school or secondary school | 159 | 8 | 5.03 | | |
| College | 94 | 11 | 11.70 | | |
| Undergraduate and above | 77 | 13 | 16.88 | | |
| **Area** | | | | 0.72 | 0.40 |
| City | 494 | 29 | 5.87 | | |
| Rural | 240 | 18 | 7.50 | | |

## Prevalence of Depression and Anxiety Symptoms

The prevalence of depressive symptoms was 8.87% (90/1,015), and the prevalence of anxiety symptoms was 3.84% (39/1,015). The monthly household income ($\chi 2 = 13.96$, $P = 0.01$), self-assessed health status ($\chi 2 = 128.56$, $P < 0.05$) and the chronic disease ($\chi 2 = 4.78$, $P = 0.03$) were statistically significant. Univariate analysis of anxiety symptoms showed that the differences between different regions ($\chi 2 = 12.26$, $P < 0.05$), occupation ($\chi 2 = 11.65$, $P < 0.05$), monthly household income ($\chi 2 = 12.65$, $P = 0.01$), self-assessed health status ($\chi 2 = 151.11$, $P < 0.05$), and the presence of chronic diseases ($\chi 2 = 7.77$, $P = 0.01$) were statistically significant, **Table 2**.

## Prevalence of Insomnia Symptoms

The prevalence of insomnia symptoms in this study was 7.98% (81/1,015). The univariate analysis of insomnia symptoms showed that the differences between different age ($\chi 2 = 18.45$, $P < 0.05$), region ($\chi 2 = 5.11$, $P = 0.02$), monthly household income ($\chi 2 = 12.68$ $P = 0.01$), self-assessed health status ($\chi 2 = 91.71$, $P < 0.05$), and the presence of chronic diseases ($\chi 2 = 33.25$, $P < 0.05$) were statistically significant, **Table 3**.

## Prevalence of Cognitive Dysfunction in the Elderly Over 65 Years Old

The prevalence of cognitive dysfunction in the elderly over 65 years old was 17.41% (97/557). Univariate analysis showed that

**TABLE 2 |** The mental health status of residents.

| Factors | No. | Depression |  |  |  | Anxiety |  |  |  |
|---|---|---|---|---|---|---|---|---|---|
|  |  | No. | Rate (%) | $\chi^2$ | *P* | No. | Rate (%) | $\chi^2$ | *P* |
| **Gender** |  |  |  | 0.18 | 0.67 |  |  | 0.01 | 0.98 |
| Male | 518 | 34 | 6.56 |  |  | 20 | 3.86 |  |  |
| Female | 497 | 56 | 11.27 |  |  | 19 | 3.82 |  |  |
| **Age** |  |  |  | 6.75 | 0.15 |  |  | 1.98 | 0.74 |
| 18–30 | 63 | 10 | 15.87 |  |  | 1 | 1.59 |  |  |
| 31–40 | 150 | 12 | 8.00 |  |  | 4 | 2.67 |  |  |
| 41–50 | 189 | 13 | 6.88 |  |  | 9 | 4.76 |  |  |
| 51–60 | 230 | 16 | 6.96 |  |  | 9 | 3.91 |  |  |
| >60 | 383 | 39 | 10.18 |  |  | 16 | 4.18 |  |  |
| **Education level** |  |  |  | 2.47 | 0.48 |  |  | 7.62 | 0.05 |
| Junior high school and below | 159 | 15 | 9.43 |  |  | 12 | 7.55 |  |  |
| High school or secondary school | 410 | 36 | 8.78 |  |  | 13 | 3.17 |  |  |
| College | 236 | 16 | 6.78 |  |  | 9 | 3.81 |  |  |
| Undergraduate and above | 210 | 23 | 10.95 |  |  | 5 | 2.38 |  |  |
| **Area** |  |  |  | 2.86 | 0.09 |  |  | 12.26 | <0.0001 |
| City | 679 | 53 | 7.81 |  |  | 16 | 2.36 |  |  |
| Rural | 336 | 37 | 11.01 |  |  | 23 | 6.85 |  |  |
| **Profession** |  |  |  | 8.04 | 0.15 |  |  | 11.65 | 0.04 |
| Professionals & technical | 155 | 16 | 10.32 |  |  | 5 | 3.23 |  |  |
| Business/service | 98 | 12 | 12.24 |  |  | 3 | 3.06 |  |  |
| Farmer | 98 | 7 | 7.14 |  |  | 5 | 5.10 |  |  |
| Worker | 402 | 25 | 6.22 |  |  | 9 | 2.24 |  |  |
| Retire | 45 | 6 | 13.33 |  |  | 5 | 11.11 |  |  |
| Other | 217 | 24 | 11.06 |  |  | 12 | 5.53 |  |  |
| **Marital status** |  |  |  | 0.90 | 0.64 |  |  | 0.65 | 0.72 |
| Unmarried | 52 | 6 | 11.54 |  |  | 1 | 1.92 |  |  |
| Married | 899 | 77 | 8.57 |  |  | 35 | 3.89 |  |  |
| Divorced/widowed | 64 | 7 | 10.94 |  |  | 3 | 4.69 |  |  |
| **Chronic disease** |  |  |  | 4.78 | 0.03 |  |  | 7.77 | 0.01 |
| No | 584 | 42 | 7.19 |  |  | 14 | 2.40 |  |  |
| Yes | 431 | 48 | 11.14 |  |  | 25 | 5.80 |  |  |
| **Monthly household income (yuan)** |  |  |  | 13.96 | 0.01 |  |  | 12.65 | 0.0073 |
| 0–1499 | 64 | 7 | 10.94 |  |  | 1 | 1.56 |  |  |
| 1,500–2,999 | 171 | 27 | 15.79 |  |  | 13 | 7.60 |  |  |
| 3,000–4,999 | 378 | 29 | 7.67 |  |  | 10 | 2.65 |  |  |
| 5,000–7,999 | 284 | 21 | 7.39 |  |  | 14 | 4.93 |  |  |
| >8,000 | 118 | 6 | 5.08 |  |  | 1 | 0.85 |  |  |
| **Drinking** |  |  |  | 1.12 | 0.29 |  |  | 0.93 | 0.34 |
| No | 838 | 78 | 9.31 |  |  | 30 | 3.58 |  |  |
| Yes | 176 | 12 | 6.82 |  |  | 9 | 5.11 |  |  |
| **Smoking** |  |  |  | 0.64 | 0.43 |  |  | 0.55 | 0.46 |
| No | 778 | 66 | 8.48 |  |  | 28 | 3.60 |  |  |
| Yes | 236 | 24 | 10.17 |  |  | 11 | 4.66 |  |  |
| **Self-assessed health status** |  |  |  | 128.56 | <0.05 |  |  | 151.11 | <0.0001 |
| Good | 354 | 14 | 3.95 |  |  | 5 | 1.41 |  |  |
| Better | 345 | 18 | 5.22 |  |  | 4 | 1.16 |  |  |
| General | 284 | 40 | 14.08 |  |  | 17 | 5.99 |  |  |
| Relative poor | 27 | 14 | 51.85 |  |  | 10 | 37.04 |  |  |
| Poor | 4 | 4 | 100.00 |  |  | 3 | 75.00 |  |  |

**TABLE 3 |** The status of insomnia among residents.

| Factors | No. | No. of insomniacs | Rate (%) | $\chi^2$ | *P* |
|---|---|---|---|---|---|
| **Gender** | | | | 0.60 | 0.44 |
| Male | 518 | 38 | 7.34 | | |
| Female | 497 | 43 | 8.65 | | |
| **Age** | | | | 18.45 | <0.0001 |
| 18–30 | 63 | 2 | 3.17 | | |
| 31–40 | 150 | 3 | 2.00 | | |
| 41–50 | 189 | 12 | 6.35 | | |
| 51–60 | 230 | 18 | 7.83 | | |
| >60 | 383 | 46 | 12.01 | | |
| **Education level** | | | | 13.56 | <0.0001 |
| Junior high school and below | 159 | 21 | 13.21 | | |
| High school or secondary school | 410 | 34 | 8.29 | | |
| College | 236 | 20 | 8.47 | | |
| Undergraduate and above | 210 | 6 | 2.86 | | |
| **Area** | | | | 5.11 | 0.02 |
| City | 679 | 45 | 6.63 | | |
| Rural | 336 | 36 | 10.71 | | |
| **Profession** | | | | 9.89 | 0.08 |
| Professionals & technical | 155 | 11 | 7.10 | | |
| Business/service | 98 | 7 | 7.14 | | |
| Farmer | 98 | 13 | 13.27 | | |
| Worker | 402 | 24 | 5.97 | | |
| Retire | 45 | 7 | 15.56 | | |
| Other | 217 | 19 | 8.76 | | |
| **Marital status** | | | | 2.85 | 0.24 |
| Unmarried | 52 | 1 | 1.92 | | |
| Married | 899 | 74 | 8.23 | | |
| Divorced/widowed | 64 | 6 | 9.38 | | |
| **Chronic disease** | | | | 33.25 | <0.0001 |
| No | 584 | 22 | 3.77 | | |
| Yes | 431 | 59 | 13.69 | | |
| **Monthly household income (yuan)** | | | | 12.68 | 0.01 |
| 0–1499 | 64 | 8 | 12.50 | | |
| 2,500–2,999 | 171 | 23 | 13.45 | | |
| 3,000–4,999 | 377 | 28 | 7.43 | | |
| 5,000–7,999 | 284 | 17 | 5.99 | | |
| >8,000 | 118 | 5 | 4.24 | | |
| **Drinking** | | | | 2.28 | 0.13 |
| No | 838 | 62 | 7.40 | | |
| Yes | 176 | 19 | 10.8 | | |
| **Smoking** | | | | 0.75 | 0.39 |
| No | 778 | 59 | 7.58 | | |
| Yes | 236 | 22 | 9.32 | | |
| **Self-assessed health status** | | | | 91.71 | <0.0001 |
| Good | 354 | 11 | 3.11 | | |
| Better | 345 | 19 | 5.51 | | |
| General | 284 | 36 | 12.68 | | |
| Relative poor | 27 | 13 | 48.15 | | |
| Poor | 4 | 2 | 50.00 | | |

**TABLE 4 |** The cognitive dysfunction of residents over 65 years old.

| Factors | No. | No. with cognitive impairment | Rate (%) | $\chi^2$ | *P* |
|---|---|---|---|---|---|
| **Gender** | | | | 2.11 | 0.15 |
| Male | 267 | 53 | 19.85 | | |
| Female | 290 | 44 | 15.17 | | |
| **Age** | | | | 7.24 | 0.12 |
| 65–70 | 267 | 53 | 19.85 | | |
| 71–80 | 204 | 26 | 12.75 | | |
| >80 | 86 | 18 | 20.93 | | |
| **Education level** | | | | 2.47 | 0.48 |
| Junior high school and below | 226 | 60 | 26.55 | | |
| High school or secondary school | 158 | 13 | 8.23 | | |
| College | 138 | 16 | 11.59 | | |
| Undergraduate and above | 35 | 8 | 22.86 | | |
| **Area** | | | | 1.63 | 0.20 |
| City | 377 | 71 | 18.83 | | |
| Rural | 180 | 26 | 14.44 | | |
| **Marital status** | | | | 3.58 | 0.62 |
| Unmarried | 12 | 4 | 33.33 | | |
| Married | 358 | 73 | 20.39 | | |
| Divorced/widowed | 187 | 20 | 10.70 | | |
| **Chronic disease** | | | | 107.09 | <0.0001 |
| No | 367 | 20 | 5.45 | | |
| Yes | 190 | 77 | 40.53 | | |
| **Self-assessed health status** | | | | 96.24 | <0.0001 |
| Good | 101 | 23 | 22.77 | | |
| Better | 236 | 38 | 16.10 | | |
| General | 184 | 20 | 10.87 | | |
| Relative poor | 28 | 12 | 42.86 | | |
| Poor | 8 | 4 | 50.00 | | |

the self-assessed health status ($\chi 2 = 96.24$, $P < 0.05$) and the presence of chronic diseases ($\chi 2 = 107.09$, $P < 0.05$) were significantly associated with cognitive dysfunction, **Table 4**.

## DISCUSSION AND CONCLUSION

The outbreak of the emergent public health event of COVID-19 has brought a huge impact on the development of society, not only on the economy and development of the society but also on the mental health of the residents. With the joint efforts of the whole society, the epidemic has been effectively controlled, the order of the whole society has gradually recovered, and the public's psychological condition has also been eased with the effective prevention and control of the epidemic. However, the re-outbreak of the epidemic in China caused the entire city to be shut down again, and the psychological state of the public was affected again with even more helpless and desperate than the first time, which caused more serious psychological problems. In the background of the outbreak of epidemics in Nanjing and Yangzhou, Jiangsu Province, this study conducted a survey on the mental health status of residents in Jiangsu. Through the self-made mental health literacy questionnaire, a mental health literacy survey was carried out in Jiangsu and found that the qualified rate of mental health literacy was 6.40%, which was significantly lower than the 69.50% qualified rate of the residents' mental health literacy survey carried out in Guiyang in 2021 (20). Residents with younger age and higher education have a more comprehensive understanding of mental health knowledge, a wider range of ways to accept mental health-related knowledge, and easier acceptance and understanding of mental health-related knowledge. The results indicated that the mental health literacy of residents has not been alleviated due to the understanding of the epidemic, scientific prevention and control measures, and the passage of time during the re-outbreak of COVID-19, therefore, there is still an urgent need to pay attention to and intervene in the mental health of residents.

The results of the mental health status of residents showed that the prevalence of depressive symptoms was 8.87%, which was lower than that during the first-round outbreak of COVID-19 with the prevalence of moderately and severely depressive symptoms of 17.47% (3), but the prevalence of depressive symptoms was higher than the 6.8% reported in domestic surveys (8). In terms of depression, residents with different monthly household incomes have different rates of depressive symptoms, higher household incomes mean less impact from the pandemic followed by restrictions on travel and other epidemic prevention, which was consistent with the study (21) found that people with higher household incomes had lower levels of depression. Domestic research (22) found that the detection rate of depressive symptoms in patients with chronic diseases was as high as 44.37%, which was significantly higher than that of ordinary residents. In terms of self-rated health, the prevalence of depressive symptoms was also different, and lower health assessments would lead to poor mental health, resulting in depression and anxiety. The survey found that the prevalence of anxiety symptoms was 3.84%, and the prevalence of anxiety symptoms was lower than the domestic report of 7.60% (7). Studies (23, 24) have revealed that the prevalence of anxiety in rural areas was higher than that in cities, and different occupations will affect the occurrence of anxiety, which was consistent with the results of this study. Different monthly household incomes (25, 26), self-assessed health status, and residents with or without chronic disease were found associated with the occurrence of anxiety symptoms.

This study found that the prevalence of insomnia among residents was 7.98%, which was lower than 23.26% in Beijing (27) and 22.3% in Gansu Province (28). The prevalence of insomnia was different in different regions, age, monthly household income, self-assessed health status, chronic diseases, and other characteristics, which was consistent with other studies, in which lower age and higher monthly household income were the protection factor of insomnia (27, 29). In terms of the cognitive dysfunction in the age of 65 and above, this paper found that the prevalence of cognitive dysfunction in the elderly was 17.41%, which was lower than 20.14% in Xiamen (30) and 18.59% in Nanchang (31), higher than that in Zhangjiakou (12.2%) (32). There were significant differences in the prevalence of cognitive dysfunction among the elderly with different self-rated health statuses and chronic diseases, which were consistent with reported studies that elderly people with stroke and other chronic diseases, or perceived poor health status were more likely to have cognitive impairment (32, 33).

In this study, under the normalization of epidemic prevention and control, mental health literacy and the status survey were conducted among residents in local outbreak areas to better evaluate the mental health problems of residents in relatively developed areas under the repeated impact of the epidemic, but there are also some limitations. The sample size is relatively small, and the impact of other recent life emergency events on the psychology of the respondents has not been fully evaluated. Further investigation in public psychology after the epidemic is still urgently needed.

To sum up, the residents in Jiangsu have a low pass rate of mental health literacy, and the problems of mental health and cognitive dysfunction of the elderly are relatively prominent under the normalization of epidemic prevention and control. It is recommended to carry out targeted health education and mental health services and formulate spiritual health service policies to prevent or mitigate serious mental health problems in the community under COVID-19.

## DATA AVAILABILITY STATEMENT

The dataset generated and analysed during the current study could be available from the corresponding author on reasonable request.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Wuxi Mental Health Center. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

SL and HZ conceived the study. BG, QY, and YJ performed a survey and summary. YJ, XL, and HZ wrote the manuscript. All authors contributed to the article and approved the submitted version.

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EDITED BY
Rahul Shidhaye,
Pravara Institute of Medical Sciences, India

REVIEWED BY
Ibe Michael Usman,
Kampala International University Western Campus, Uganda
Xianjie Jia,
Bengbu Medical College, China

*CORRESPONDENCE
Wei Li
822203867@qq.com

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# Prevalence and risk factors associated with self-reported psychological distress among college students during the omicron outbreak in Shanghai

Wei Li[1,2]*

[1]Department of Geriatric Psychiatry, Shanghai Mental Health Center, Shanghai Jiao Tong University School of Medicine, Shanghai, China, [2]Alzheimer's Disease and Related Disorders Center, Shanghai Jiao Tong University, Shanghai, China

**Background:** More and more attention has been paid to the mental health of students in higher education. The Omicron outbreak has brought renewed attention to this vulnerable group.

**Objective:** To understand the prevalence and influencing factors of anxiety symptoms and depression symptoms of college students in a closed state.

**Methods:** This large cross-sectional study using data from a survey on the mental health of college students in Shanghai (China), conducted by using a stratified cluster random sampling method between March 15th and April 15th, 2022. To estimate results related to regional location, only data from students with Internet protocol addresses and current addresses in Shanghai were included. The main outcome was self-reported psychological distress (including depressive symptoms, anxiety symptoms, and self-assessment of health), measured using the epidemiologic studies depression scale (CES-D), the Spielberger state-trait anxiety inventory (STAI) and self-rated mental health (SRMH), respectively. Moreover, the Simplified Coping Style Scale (SCSS) was also used to assess how participants coped with negative emotions.

**Results:** Among 13,000 college students who completed the survey, 12,124 students were included in the final analysis, and the total effective rate was 93.3%. The prevalence of depressive symptoms and anxiety symptoms were 14.1 and 9.8%, respectively. By using Multivariate logistics regression analysis, we found that being male and negative coping were risk factors for depressive symptoms and anxiety symptoms, while positive coping, such as study or learning, were protective factors. Moreover, linear regression analysis showed that learning or study improved the overall mental health index by improving anxiety or depressive symptoms, and played a partial mediating role.

**Conclusions:** These findings suggest that a significant number of college students, especially boys, will experience emotional problems during the course of closed schools. Therefore, we need to give them proper attention and advise them to adopt positive coping strategies, such as learning or study, to resist bad emotions.

KEYWORDS

**Omicron, anxiety, depression, prevalence, college students**

## Introduction

COVID-19 is a novel acute respiratory infectious disease caused by the infection of novel Coronavirus (2019-COV-2). On 26 November 2021, the World Health Organization (WHO) announced a new 2019-COV-2 variant Omicron (B.1.1.529) (1). Despite its apparent decline in virulence, Omicron is becoming more infectious, thus posing new challenges to epidemic control (2). Prevention and control of COVID-19 remains a public health priority worldwide, and China has adjusted a number of policies to contain the spread of Omicron, such as city closures and travel restrictions (3). Although the above measures are effective, the ongoing epidemic and burdensome measures such as lockdown and stay-at-home orders can also cause certain psychological problems. For example, Choi et al. found that during the omicron epidemic in Hong Kong, the prevalence of anxiety and depression among the general population was 19 and 14% (4), respectively.

Since college students live in groups, there is no doubt that they are a vulnerable group in COVID-19. The inconvenience of life, inability to complete their studies caused by school closures as well as the worry and fear of COVID-19 may also have a certain impact on their psychological and mental state. For example, Chang et al., found that the overall incidence of anxiety and depressive emotions among college students during the COVID-19 outbreak were 26.60 and 21.60%, respectively (5). Fu et al. found that about 41.1% of Chinese college students experienced anxiety symptoms during the COVID-19 epidemic (6). While in Ma et al.' study, they found that the prevalence rates of probable acute stress, depressive and anxiety symptoms among Chinese college students during the COVID-19 outbreak were 34.9, 21.1, and 11.0%, respectively (7).

Since isolation at school is more inconvenient, more susceptible to infection and more vulnerable to adverse external information than isolation at home, our hypothesis is that school isolation may have a more serious psychological impact on college students. Therefore, we carried out this large-scale survey to focus on the school isolation effects on college students' mental state.

## Materials and Methods

### Participants

From March 15th, 2022, to April 15th, 2022, the cluster sampling was used to survey college students (including undergraduate, graduate and doctoral students) over the age of 18 in Shanghai. Structured questionnaires (online) were used to assess the mental health of these students during the Omicron outbreak. The questionnaires were anonymous to ensure the confidentiality and reliability of the data. Inclusion criteria included: (1) age 18 and above; (2) have a smartphone; (3) university education in the Shanghai area; (4) under quarantine at school. Exclusion criteria were as follows: (1) not in Shanghai; (2) non-enrolled students; (3) pre-existing anxiety or depression symptoms; (4) under quarantine at home or elsewhere. Finally, A total of 13,000 college students were given questionnaires (including Shanghai Jiao Tong University, Fudan University, East China University of Science and Technology and other universities, the main way of diffusion was wechat moments forwarding), and 12,124 valid questionnaires were returned, with a total effective rate of 93.3%. Figure 1 lists the research process of the whole study.

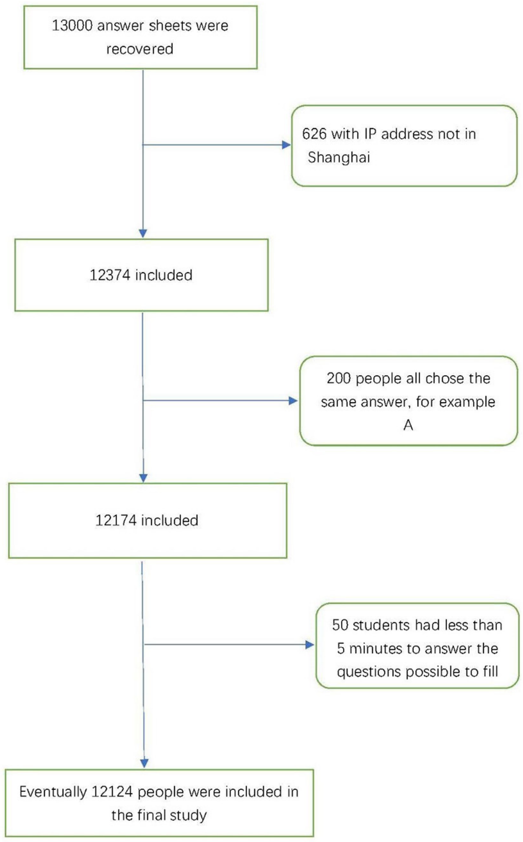


FIGURE 1
A flow chart of the entire study.

Ethical approval was issued by the Ethics Committee of Shanghai Jiao Tong University, and all the participants had given informed consent before the study was initiated.

### Assessment instruments

The study instrument comprised a structured questionnaire that included demographic information (gender, grade, age, special field of study, marital status, only child, and family monthly income) and information about their cognition and preventive behaviors regarding Omicron. Moreover, the participants responded to the Center for Epidemiologic Studies Depression Scale (CES-D), the Spielberger State-Trait Anxiety Inventory (STAI), the Simplified Coping Style Scale (SCSS) and self-rated mental health (SRMH).

### The center for epidemiologic studies depression scale

The Center for Epidemiologic Studies Depression Scale (CES-D) was used to assess depression symptoms (8). It is a self-assessment scale of 20-item with validity of 0.9, reliability of 0.67, each item is rated using a 4-point Likert scale to represent how frequently the symptom occurred in the past week (0 = rarely/<1 day, 1 = sometimes/1–2 days, 2 = often/3–4 days, 3 = most of the time/5–7 days). The score range of CES-D is 0–60, with higher scores indicating a greater degree of depression symptoms. Generally, a cut-off score of ≥16 is considered to have clinically meaningful depressive symptoms (9).

### The spielberger state-trait anxiety inventory

The Spielberger State-Trait Anxiety Inventory (STAI) is a 40-item self-report measure of anxiety using a 4-point Likert-type scale (from 0 to 3 points) for each item. It has two scales: State anxiety and Trait anxiety. Both scales consist of 20 items. The study chooses the State Anxiety Scale (S-Anxiety) evaluates immediate or recent experiences or feelings of fear, tension, anxiety, and neuroticism at a particular time or situation and can be used to evaluate state anxiety in stressful situations (10). Responses to the S-Anxiety scale measure the frequency of feelings "in general": (1) almost always, (2) often, (3) sometimes, and (4) almost never. The range of scores for S-Anxiety is 20–80, and the higher score indicates greater anxiety symptoms (11). So we used 45.13 as the cut-off value to determine whether the subjects had anxiety (12).

### The simplified coping style questionnaire

In 1998, Hu et al. revised the Simplified Coping Style Questionnaire (SCSQ) on the basis of the Ways of Coping Questionnaire (Folkman) (13). SCSQ is a 20-item self-reported questionnaire that includes two dimensions: active coping (12 items) and passive coping (8 items). Responses are asked to provide on a 4-point scale according to how frequently respondents adopt each item, from 1 "never" to 4 "very often". The higher scores represent the greater positive and negative coping styles (14). Previous studies have shown that the Cronbach's α of the SCSS scale is 0.90, which suggests its high reliability and validity (15).

### The self-rated mental health

Self-Rated Mental Health (SRMH) can be used to measure symptoms associated with psychiatric disorders and psychological distress. Responses are asked "How will you rate your overall mental health?" Responses will include five categories: poor, fair, good, very good and excellent. In a short time interval, the test retest reliability range is 0.7–0.8, indicating that the single-question retest reliability is high (16). The higher the SRMH score, the better the mental state of the subject. Moreover, previous studies have also confirmed that SRMH is equally effective across ethnic groups (17).

### Demographic characteristics

Age was defined as a categorical variable with three groups: <18, 18–29, or 30 years or older (their average age was 19.35, 95% confidence interval: 18.71–24.37). Gender was defined as a binary variable for male or female. An only child was defined as having only one child in a family. Learning professional was defined as a categorical variable with 5 groups: humanities and social science, institute of technology, art or sports, medical or others. Grade was defined as a categorical variable with five groups: grade 1, grade 2, grade 3, grade 4, and grade 5. Study was defined as spending most of the day reading or reviewing professional knowledge, while Play gaming was defined as spending most of the day playing mobile phone or computer games.

## Statistical analysis

Descriptive statistics were used to illustrate the demographic and other selected characteristics of the college students. Continuous variables were presented as the mean (SD), while categorical variables were presented as the frequency (%). The one-sample Kolmogorov-Smirnov test was used to test whether the data conformed to normal distribution. The Mann-Whitney *U*-test was used to compare the continuous variables without normal distribution, and the Chi-square test was used to compare categorical variables. Statistically significant variables were screened and included in multivariate logistic regression analyzes (treating the presence of depressive symptoms or anxiety symptoms as a dependent variable, for depressive symptoms, the independent variables included age, male, grade, SRMH, positive coping, negative coping, study and play games; for anxiety symptoms, the independent variables included male, grade, SRMH, positive coping, negative coping, study and play games). Correlation analysis was used to explore the relationship between neuropsychological tests. Moreover, Linear regression model was used to investigate the relationship between SRMH total score, study, CES-D and STAI total score [The regression equation was: (1) $Y = CX + e1$, (2) $M = AX + e2$, (3) $Y = c'X$

TABLE 1 Univariate and multivariate analysis of participants with and without depression or anxiety symptom.

| Variables | CES-D | | | | | STAI | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Univariate analysis | | | Multivariate analysis | | Univariate analysis | | | Multivariate analysis | |
| | Depression ($n = 1,705$) | Non-depression ($n = 10,419$) | *p* | Adjusted OR (95% CI) | *P* | Anxiety ($n = 1,191$) | Non-anxiety ($n = 10,933$) | *p* | Adjusted OR (95% CI) | *p* |
| **Age** | | | | | | | | | | |
| <18 years old, *n* (%) | 23 (1.3) | 121 (1.2) | 0.026* | 0.090 (0.006–1,258) | 0.074 | 14 (1.2) | 130 (1.2) | 0.392 | – | – |
| 18–29 years old, *n* (%) | 1,680 (98.5) | 10,297 (98.8) | | 0.079 (0.006–1.048) | 0.054 | 1,176 (98.7) | 10,801 (98.8) | | | |
| >30 years old, *n* (%) | 2 (0.1) | 1 (0) | | – | – | 1 (0.1) | 2 (0) | | | |
| Male, *n* (%) | 955 (56.0) | 4,576 (43.9) | <0.001* | 1.503 (1.329–1.700) | <0.001* | 620 (52.1) | 4,911 (44.9) | <0.001* | 1.239 (1.080–1.420) | 0.002* |
| An only child, *n* (%) | 534 (31.3) | 3,025 (29.0) | 0.058 | – | – | 342 (28.7) | 3,217 (29.4) | 0.638 | – | – |
| **Learning professional** | | | | | | | | | | |
| Humanities and social science | 109 (6.4) | 723 (6.9) | 0.064 | – | – | 61 (5.1) | 771 (7.1) | 0.131 | – | – |
| Institute of technology | 957 (56.1) | 5,709 (54.8) | | | | 669 (56.2) | 5,997 (54.9) | | | |
| Art or sports | 66 (3.9) | 546 (5.2) | | | | 61 (5.1) | 551 (5.0) | | | |
| Medical | 424 (24.9) | 2,443 (23.4) | | | | 278 (23.3) | 2,589 (23.7) | | | |
| Others | 149 (8.7) | 998 (9.6) | | | | 122 (10.2) | 1,025 (9.4) | | | |
| **Grade** | | | | | | | | | | |
| Grade one | 440 (25.8) | 3,200 (30.7) | <0.001* | 0.946 (0.635–1.411) | 0.787 | 276 (23.2) | 3,364 (30.8) | <0.001* | 0..881 (0.565–1.375) | 0.577 |
| Grade two | 417 (24.5) | 2,711 (26.0) | | 0.982 (0.659–1.465) | 0.930 | 328 (27.5) | 2,800 (25.6) | | 1.154 (0.741–1,795) | 0.526 |
| Grade three | 415 (24.3) | 2,367 (22.7) | | 1.022 (0.685–1.525) | 0.915 | 296 (24.9) | 2,486 (22.7) | | 1.147 (0.736–1,789) | 0.544 |
| Grade four | 391 (22.9) | 1,922 (18.4) | | 1.131 (0.757–1.690) | 0.547 | 262 (22.0) | 2,051 (18.8) | | 1.139 (0.729–1,779) | 0.569 |
| Grade five | 42 (2.5) | 219 (2.1) | | – | – | 29 (2.4) | 232 (2.1) | | – | – |
| SRMH | 87.45 (13.12) | 107.28 (23.18) | <0.001* | 0.948 (0.944–0.952) | <0.001* | 90.53 (15.69) | 106.01 (23.26) | <0.001* | 0.966 (0.962–0.970) | <0.001* |
| Positive coping | 16.51 (5.61) | 19.58 (6.97) | <0.001* | 0.891 (0.880–0.901) | <0.001* | 19.45 (5.63) | 19.11 (7.00) | 0.001* | 0.979 (0.967–0.990) | <0.001* |
| Negative coping | 10.34 (3.52) | 7.12 (4.02) | <0.001* | 1.296 (1.273–1.319) | <0.001* | 11.51 (4.05) | 7.14 (3.88) | <0.001* | 1.299 (1.275–1.323) | <0.001* |
| **How to arrange the time** | | | | | | | | | | |
| Study, *n* (%) | 1,227 (72.0) | 8,706 (83.6) | <0.001* | 0.862 (0.751–0.990) | 0.035* | 886 (74.4) | 9,047 (82.7) | <0.001* | 0.796 (0.680–0.931) | 0.004* |
| Play games, *n* (%) | 1,021 (59.9) | 5,431 (52.1) | <0.001* | 1.114 (0.984–1.261) | 0.089 | 680 (57.1) | 5,772 (52.8) | 0.005* | 1.015 (0.885–1.166) | 0.828 |

In the regression model of depressive symptoms, the existence of depressive symptoms is taken as a dependent variable, and the included independent variables include age, male, grade, going out to reduce, wearing a mask, wash hands more often, Frequent disinfection, Adjust travel time, study, play phone, and play games; In the regression model of anxiety symptoms, the existence of anxiety symptoms is taken as a dependent variable, and the included independent variables include male, grade, going out to reduce, wearing a mask, wash hands more often, Adjust travel time, study, play phone, and play games; CES-D means the Center for Epidemiologic Studies Depression Scale; STAI means the Spielberger State-Trait Anxiety Inventory; SRMH means the Self-Rated Mental Health; *means $p < 0.05$.

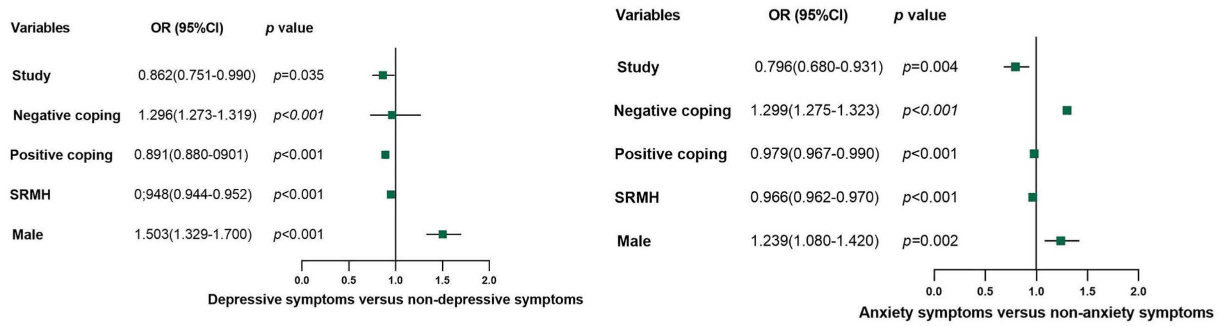


FIGURE 2
Influencing factors that may be associated with depressive symptoms and anxiety symptoms.

+ bM + e3; in model 1, the coefficient C was the total effect of X on Y; in model 2, the coefficient A was the direct effect of X on M; in model 3, The coefficient B was the direct effect of M on Y after controlling the influence of X; The coefficient C 'was the direct effect of X on Y after controlling the influence of M; The coefficient a*b was the mediating effect produced by the mediating variable M, and there was a relationship between a*b = C–C ']. All the statistical analysis was performed using SPSS version 22.0 and a $p$-value$< 0.05$ was considered as significant.

# Results

## Levels of depressive symptoms and anxiety symptoms among college students during the epidemic

Of the 12,124 college students, 1,705 (14.1%) had significant depressive mood, while 1,191 (9.8%) showed significant anxiety symptoms.

## Factors influencing college students' depressive symptoms and anxiety symptoms during the epidemic (univariate analysis)

Using non-parametric or Chi-square tests, we found that age, gender, grade level, SRMH, positive coping, negative coping, study and play games had significant effects ($p < 0.05$) on depression, while being an only child, and learning professional were not associated with depression symptoms ($p > 0.05$). Similarly, gender, grade level, SRMH, positive coping, negative coping, study and play games had significant effects ($p < 0.05$) on anxiety, while age, being an only child and learning professional were not associated with anxiety symptoms ($p > 0.05$). Table 1 presents the results.

## Factors influencing college students' depressive symptoms and anxiety symptoms during the epidemic (multivariate analysis)

By using multiple logistics regression analysis and taking the presence of depressive symptoms or anxiety symptoms as the dependent variable, we found that SRMH ($p < 0.001$, OR = 0.948, 95%confidence interval: 0.944–0.952), positive coping ($p < 0.001$, OR = 0.891, 95%confidence interval: 0.880–0901), study ($p = 0.035$, OR = 0.862, 95%confidence interval: 0.751–0.990) were protective factors for depressive symptoms, while male ($p < 0.001$, OR = 1.503, 95%confidence interval: 1.329–1.700) and negative coping ($p < 0.001$, OR = 1.296, 95%confidence interval: 1.273–1.319) were risk factors. Similarly, we also found that SRMH ($p < 0.001$, OR = 0.966, 95%confidence interval: 0.962–0.970), positive coping ($p < 0.001$, OR = 0.979, 95%confidence interval: 0.967–0.990), study ($p = 0.004$, OR = 0.796, 95%confidence interval: 0.680–0.931) were protective factors for anxiety symptoms, while male ($p = 0.002$, OR = 1.239, 95%confidence interval: 1.080–1.420) and negative coping ($p < 0.001$, OR = 1.229, 95%confidence interval: 1.275–1.323) were risk factors. Table 1 and Figure 2 present the results.

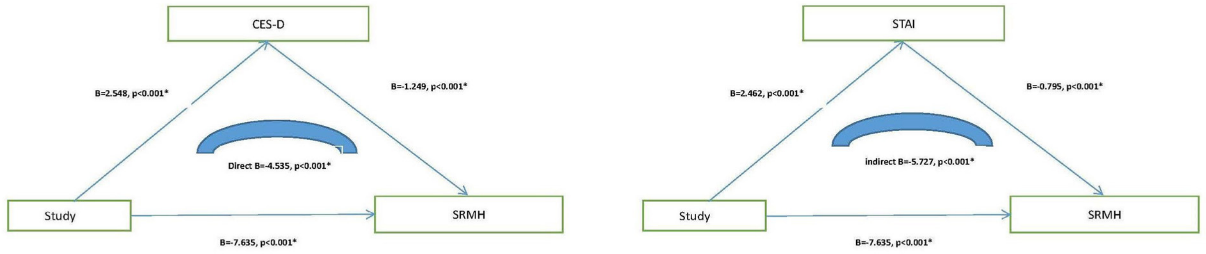
## Correlation analysis between neuropsychological tests

The results of correlation analysis showed that STAI was positively correlated with CES-D ($r = 0.557$, $p < 0.001$) and negative coping ($r = 0.414$, $p < 0.001$), but negatively correlated with positive coping ($r = -0.073$, $p < 0.001$) and SRMH ($r = -0.352$, $p < 0.001$). Moreover, we also found that CES-D was positively correlated with negative coping ($r = 0.350$, $p < 0.001$), but negatively correlated with positive coping ($r = -0.191$, $p < 0.001$) and SRMH ($r = -0.395$, $p < 0.001$). These results

TABLE 2 Correlation between neuropsychological tests.

| Variables | Variables | STAI | CES-D | Positive coping | Negative coping | SRMH |
|---|---|---|---|---|---|---|
| STAI | Pearson coefficient | 1 | 0.557 | −0.073 | 0.414 | −0.352 |
| | p | | <0.001* | <0.001* | <0.001* | <0.001* |
| | N | 12,124 | 12,124 | 12,124 | 12,124 | 12,124 |
| CES-D | Pearson coefficient | 0.557 | 1 | −0.191 | 350 | −0.395 |
| | p | <0.001* | | <0.001* | <0.001* | <0.001* |
| | N | 12,124 | 12,124 | 12,124 | 12,124 | 12,124 |
| Positive coping | Pearson coefficient | −0.073 | −0.191 | 1 | 0.258 | 0.237 |
| | p | <0.001* | <0.001* | | <0.001* | <0.001* |
| | N | 12,124 | 12,124 | 12,124 | 12,124 | 12,124 |
| Negative coping | Pearson coefficient | 0.414 | 0.350 | 258 | 1 | −0.180 |
| | p | <0.001* | <0.001* | <0.001* | | <0.001* |
| | N | 12,124 | 12,124 | 12,124 | 12,124 | 12,124 |
| SRMH | Pearson coefficient | −0.352 | −0.395 | 0.237 | −0.187 | 1 |
| | p | <0.001* | <0.001* | <0.001* | <0.001* | |
| | N | 12,124 | 12,124 | 12,124 | 12,124 | 12,124 |

CES-D means the Center for Epidemiologic Studies Depression Scale; STAI means the Spielberger State-Trait Anxiety Inventory; SRMH means the Self-Rated Mental Health; *means p < 0.05.



NOTE: CES-D means the Center for Epidemiologic Studies Depression Scale; SRMH means the Self-Rated Mental Health; * means p<0.05

NOTE: STAI means The Spielberger State-Trait Anxiety Inventory (STAI); SRMH means the Self-Rated Mental Health; * means p<0.05

FIGURE 3
The relationship between SRMH total score, study, CES-D and STAI total score.

suggested that anxiety and depression symptoms were negatively correlated with the health self-rating scale, and a positive coping style would help to prevent anxiety and depression, while negative coping style might aggravate anxiety and depression. Table 2 presents the results. Moreover, linear regression model was used to investigate the relationship between SRMH total score, study, CES-D and STAI total score, and we found that study affected SRMH total score by influencing CES-D ($B = -4.535, p < 0.001$) and STAI total score ($B = -5.727, p < 0.001$), and played a partial mediation effect (the SRMH was taken as the dependent variable, study as the independent variable, the result of linear regression analysis showed that $B = -7.635$, $p < 0.001$; the CES-D was taken as the dependent variable, study as the independent variable, the result of linear regression analysis showed that $B = -2.548$, $p < 0.001$; then the SRMH was taken as the dependent variable, CES-D and study were treated as independent variables, respectively, the result of linear regression analysis showed that $B = -4.535$, $p < 0.001$; The relationship between SRMH and STAI and study was consistent with the previous analysis process). Figure 3 presents the results.

## Discussions

In this large, cross-sectional study, we explored the effects of the omicron outbreak on the psychological status of college students and drew several interesting conclusions: (1) the prevalence of depressive symptoms and anxiety symptoms among the Chinese college students was 14.1 and 9.8%, respectively; (2) being male is a risk factor for both depressive symptoms and anxiety symptoms; (3) depression and anxiety symptoms were negatively correlated with the health self-rating scale, and positive coping style (such as study) would help to prevent anxiety and depression, while negative coping style might aggravate anxiety and depression.

Previous studies have shown that isolation due to COVID-19 could take a toll on the psychological state of college students. For example, Yu et al., found that the prevalence of depressive symptoms was 15.8% (1,486/9,383) among Chinese college students (18). Ma et al. (7) found that the prevalence rates of depressive and anxiety symptoms among Chinese college students were 21.1 and 11.0%, respectively. In Guan et al.'s (19) study, they found that the overall prevalence of anxiety among Chinese college students was 7.3%, while in Fu et al.'s study, they found that 41.1% of Chinese college students experienced anxiety symptoms during the COVID-19 epidemic (6). By using CES-D and STAI, we found the prevalence of depressive symptoms and anxiety symptoms among Chinese college students was 14.1 and 9.8%, respectively. Therefore, the conclusions of different studies often vary greatly, which may be due to the use of different emotional symptom assessment scales with inconsistent sensitivity and specificity. In addition, the timing of the investigation might also affect the results, as those previous studies were carried out in the early stages of the Novel Coronavirus outbreak, when there was a great deal of fear and uncertainty about the disease. At the time of this study, many college students were already well aware of the disease, and the incidence of anxiety and depression may have decreased accordingly.

In our current study, we found that being male was a major risk factor for both anxiety symptoms and depressive symptoms, seemingly contrary to previous research. According to the world health organization (WHO), women are more likely to suffer from depression (5.1% compared to 3.6% worldwide) and anxiety (4.6% compared to 2.6% worldwide) than men (20). Previous studies have also shown that adolescent and young adult females are more prone to depression than males (21, 22). For example, Fawzy and Hamed (23) found that female sex was significantly associated with stress, depression and anxiety scores. And Qi et al. (24) found that the prevalence of psychotic depression (PD) in female patients (10.97%) was higher than that in male patients (7.99%). Therefore, our findings were contrary to those of others, and we hypothesized that male students were more active and socially inclined (in the face of bad emotions, male college students tend to face alone, or it was not easy to talk to friends like female college students), which might have a greater impact on their psychological state once they were confined to school. Moreover, compared with female college students, male college students were more likely to use negative and bad ways to deal with negative emotions (25). However, further exploration and verification were needed for the above research conclusions.

Moreover, we found that different ways of coping with emotions may have different outcomes. By using the simplified coping style questionnaire (SCSQ), we found that positive coping with emotional symptoms, such as learning or study, could effectively prevent anxiety and depression (learning or study could affect the overall mental health of individuals by improving anxiety or depression, and played a part of the mediating effect), while negative coping might increase the risk of anxiety or depressive symptoms. Zhang et al. found that positive coping was a protective factor for trauma-related distress in junior high school students, while negative coping was a risk factor (26). Si et al., found that passive coping strategies were positively correlated to Posttraumatic stress and depression, Anxiety and Stress Scale (DASS) scores (27). In Sun et al.'s study, they found that active guidance of psychological growth could promote physical and mental recovery in COVID-19 patients (28). In Zhao et al.'s (29) study, they found that aerobic exercise, resistance exercise, and mind-body exercise could improve depressive symptoms and levels. Moreover, Xiong et al. also found that higher negative coping style scores would increase the prevalence of anxiety symptoms (30). Therefore, our research conclusions were consistent. Students who adopt positive coping styles tend to have better psychological resilience, better coping measures and more psychological support, while students who adopt negative coping styles are more likely to develop negative attitudes and even suicidal behaviors (31, 32).

This study experienced certain limitations: (1) as this study is just a cross-sectional study, longitudinal studies with large samples are needed to verify the above conclusions; (2) it was unclear whether the psychiatric or psychological conditions of the college students might influence their work and study; (3) the diagnosis of depression and anxiety is based on scales instead of clinical criteria. As there is an overlap of symptoms of anxiety or depression, it may result in overestimation and inaccuracy.

## Conclusions

During the epidemic of Omicron, a significant number of college students, especially boys, will suffer from anxiety or depression due to the closure of the school. Therefore, we should pay attention to the psychological state of this group of people, and we recommend the use of positive coping methods such as learning or study to prevent bad emotions during the isolation period.

## Data availability statement

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

## Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of Shanghai Jiao Tong University. The patients/participants provided their written informed consent to participate in this study. Ethical review and approval was not required for the animal study because the Ethics Committee of Shanghai Jiao Tong University.

## Author contributions

WL contributed to the study concept and design, analyzed the data, and drafted the manuscript.

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## Conflict of interest

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

## Publisher's note

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# The determinants of the quality of clinical management among diabetic and hypertensive patients in a context of fragility: A cross-sectional survey from Lebanon

Shadi Saleh[1,2], Dina Muhieddine[1], Randa Hamadeh[3], Hani Dimassi[4], Karin Diaconu[5], Stella Arakelyan[5], Alastair Ager[5] and Mohamad Alameddine[6]*

[1]Global Health Institute, American University of Beirut, Beirut, Lebanon, [2]Department of Health Management and Policy, Faculty of Health Sciences, American University of Beirut, Beirut, Lebanon, [3]Ministry of Public Health, Beirut, Lebanon, [4]Department of Pharmaceutical Sciences, School of Pharmacy, Lebanese American University, Byblos, Lebanon, [5]Institute for Global Health and Development, Queen Margaret University, Edinburgh, United Kingdom, [6]College of Health Sciences, University of Sharjah, Sharjah, United Arab Emirates

**Introduction:** The management of NCDs is a growing challenge in low- and middle-income settings with the increasing prevalence and the associated demands that such conditions make on health systems. Fragile settings both exacerbate the risk of NCDs and undermine systems capacity. Lebanon is a setting where strategies to address rising NCDs burden have faced particularly acute contextual challenges.

**Methods:** We conducted a cross-sectional survey with patients accessing non-communicable disease across 11 primary care centers within the Greater Beirut and Beqaa areas. Response were received from 1,700 patients. We generated a Clinical Management Index Score as a measure of quality of care, and scores related to a range of socio-demographic characteristics and other context specific variables.

**Results:** Significantly higher clinical management index scores (better quality of care) were associated with patients living in the semi-urban/rural context of Beqaa (compared to Greater Beirut), having health insurance coverage, aged above 60, having high levels of educational attainment, and making partial or full payment for their treatment. Relatively lower index scores (poorer quality of care) were associated with Syrian nationality (compared to Lebanese) and with patients suffering from diabetes or hypertension (compared to comorbid patients).

**Conclusion:** The study identified a wide margin for improving quality of NCDs care in fragile contexts with particular gaps identified in referral to ophthalmology, accessing all prescribed medication and receiving counseling for smoking cessation. Additionally, findings indicate a number of predictors of comparatively poor quality of care that warrant attention, notably with regard

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EDITED BY
Jerome T. Galea,
University of South Florida,
United States

REVIEWED BY
Amer Kaissi,
Trinity University, United States
Nazar Abdelrahim Mohamed,
Ministry of Health, Kuwait
Ali Mokdad,
University of Washington,
United States

*CORRESPONDENCE
Mohamad Alameddine
malameddine@sharjah.ac.ae

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to Syrian nationality/legal status, lack of health coverage, seeking free health provision and lower educational attachment. Although these are all relevant risk factors, the findings call on donor agencies, NGOs and provider institutions to design targeted programs and activities that especially ensure equitable delivery of services to diabetic and hypertensive patients with compounded vulnerability as a result of a number of these factors.

KEYWORDS

**non-communicable diseases, diabetes, hypertension, fragility, refugees, equity, Lebanon**

## Introduction

Non-communicable diseases (NCDs) including cardiovascular diseases, diabetes, chronic respiratory diseases and cancer are the leading causes of mortality worldwide (1). In Lebanon, NCDs contribute to 91% of all deaths and cardiovascular diseases alone account for almost half of NCDs mortality (2). The majority of premature deaths due to NCDs occur in low and middle-income countries (LMICs) (3). LMICs disproportionately suffer from NCDs, especially that those countries are hosting the greatest proportion of conflicts in the world (4). Patients in conflict and post-conflict settings are often more vulnerable to NCDs due to the increase in negative coping mechanisms, which often constitute NCDs risk factors, such as smoking and alcohol consumption. The growing burden of NCDs in LMICs aggravates existing health threats and worsens poverty and presents substantive challenges to the equitable delivery of affordable care (4, 5).

Fragility is commonly defined as "the combination of exposure to risk and insufficient coping capacity of the state, system and/or communities to manage, absorb or mitigate those risks" (2). Hence, fragility exposes populations to a range of threats including poverty, insecurity, as well as social and economic inequality (6). There is a huge gap in access to health services in countries experiencing fragility (7). Around 1.3 billion people globally have no access to effective and affordable health care, and among the latter, about 170 million spend more than 40% of their income on health expenditure (8).

The management of chronic diseases represents a major challenge for healthcare systems globally, given that they often require a long period of supervision and observation or care (9). Inadequate management of chronic diseases represents an important factor in the development of adverse outcomes, including hospitalizations (10). Factors that contribute to the poor management of chronic diseases include low educational and income levels among patients, strained patient-provider relationships, limited or non-existent health insurance or health coverage. Patients suffering from chronic diseases face increased healthcare utilization costs, decreased self-reported health status, and reduced functional capacity (11).

There is a dearth of data on care quality in LMICs, particularly in areas such as system competence, confidence in the system, and user experience and wellbeing, including patient-reported health outcomes (12). Health systems often produce inadequate insight on what matters most to people, such as competent care, user experience, health outcomes, and confidence in the system (12). Furthermore, few studies have investigated the associations between self-reported patient satisfaction scores and health outcomes (e.g., physical health, hospital utilization, and expenditures) while accounting for baseline patient-level characteristics (e.g., gender, education level, SES) (13).

## The local context

Lebanon is an upper middle-income country in the Eastern Mediterranean Region with an estimated population of over 6 million (14) of which more than one million are Syrian refugees (15). The Lebanese healthcare system is highly privatized, with healthcare delivery primarily provided by the private sector (16). Six social insurance funds cover health needs under the tutelage of different government bodies (17), they include: The National Social Security Fund (NSSF), The Civil Servants Cooperative (CSC), and the four military schemes (18). Despite of these funds, almost half of the population remains without any formal health coverage (19). The Lebanese civil war had an enormous negative impact on the public health care system, which was further exacerbated following the massive influx of Syrian refugees following the Syrian crisis (20).

The burden of NCDs remains the largest in Lebanon (5). Considering the local unrest, economic crisis, COVID-19 pandemic, Beirut Port explosion and other substantial challenges the country is facing, Lebanon has become more vulnerable to fragility, especially in rural and semi-urban areas where the health system and support services are relatively weak (21, 22). The aforementioned challenges made providing comprehensive NCDs care for the entire patient population a significant challenge especially that patients are of various nationalities and fall under diverse health coverage schemes. For instance, 58% of the Syrian refugees not receiving financial support from Non-Governmental Organizations (NGOs) access Primary Health Care Centers (PHCCS) for NCDs care compared to 17% of the host community (23).

Lebanon has been left stumbling following a financial crisis that hit the country since 2019 and worsened as the Lebanese pound lost 81% of its value (52). In the middle of this economic and political instability, the health care system continued to struggle with a shortage of supplies and medication and an exponential increase in the number of patients (53), the government was not able to set aside a stimulus package for hospitals to aid in supplies and resources as the pandemic surged and as a result some hospitals sustained depending on international and local non-governmental aid such as the WHO and NGOs to import essential supplies and equipment (53). In addition, as a consequence of the tremendous devaluation in the country's currency, the pay for a physician in Lebanon has dwindled to an estimated total loss in physicians' income by more than 80% (54) which lead to an enormous exodus of health care professionals, with almost 40% of skilled medical doctors and almost 30% of registered nurses leaving the country (55). All that combined negatively impacted the quality of care, and if no proper action is to be taken, the Lebanese healthcare system is expected to collapse.

This study assessed the differences in the quality of clinical management among diabetic and hypertensive patients accessing PHCCs in two different fragile settings in Lebanon. Differences in clinical management were related to sociodemographic factors such as age, gender, nationality, setting, and health status.

# Methods

The current study received ethical approval from the Institutional Review Board (IRB) for Social and Behavioral studies at the American University of Beirut—Protocol number SBS-2018-0514. It also received ethical approval from the IRB committee at the Queen Margaret University (Protocol number REP 0201).

## Study design and setting

This was a cross-sectional study using a quantitative survey design, conducted in two contrasting regions of Lebanon between January and July 2020. The two regions were the urbanized area of Greater Beirut (fragility setting 1) and the Beqaa Valley (fragility setting 2), see Box 1. Data collection occurred in two phases. The first phase extended from February to March 2020 during which the research team collected data from 708 patients. The mounting insecurity and restrictions imposed due to COVID-19 forced a temporarily suspension of data collection with the remaining 992 patients recruited between June and July of 2020.

A total of eight data collectors were recruited. Data collectors attended a 2-day training which included an overview of the study and its objectives, the recruitment process, and research ethics and proper surveying practices. Data collection was performed using KoBo, a toolkit for collecting and managing data in challenging environments (28).

## Participants

Targeted health facilities were PHCCs, highly accessed by Lebanese and Syrian populations, that offered diabetes and hypertension services. Overall, 14 PHCCs were approached, of which 11 agreed to participate in the study. At these facilities, targeted participants were Syrian or Lebanese individuals who were: (1) older than 40 years, and (2) diagnosed with diabetes or hypertension (based on personal self-reporting of a confirmed physician diagnosis). Patients not meeting the above-mentioned criteria or not consenting to participate were excluded.

## Data collection

Eligible patients receiving NCDs services were approached before attending their appointment. The survey required ∼40 min to be completed. Items on clinical management were self-reported; sections related to laboratory testing were completed with reference to documentation regarding the laboratory results that patients are required to bring with them to every appointment.

The study questionnaire was reviewed by an expert panel including health services/system researchers and clinicians from Lebanon and the United Kingdom. The local context was taken into consideration and necessary amendments were introduced through a group consensus process. The final draft of the questionnaire was translated to the Arabic language by an expert translator and back-translated to English by another translator. The original and back-translated English versions were compared, and some minor edits were introduced to the translated version to account for any differences and ensure the accuracy of translation. The final Arabic version of the questionnaire was pilot tested on 40 patients. Their feedback on the clarity, readability, comprehensiveness, and completion time required was solicited. Patients' feedback included the need for explaining some medical terms used in the questionnaire and the merging of some redundant questions for diabetic and hypertensive patients to make the survey shorter. The Arabic version of the questionnaire was modified in light of the feedback received during pilot testing.

BOX 1 | Setting information.

| **Fragility context one: the greater beirut area** | **Fragility context two: the beqaa valley area** |
|---|---|
| The main urban commercial center of the country, accommodating a population of 2,434,609, including 206,628 Syrian and 17,486 Palestinian and other nationalities (24).<br>Has the highest concentration of health services available in the country, including access to specialized secondary and tertiary care services.<br>Has high levels of socio-economic inequality, which has worsened since the damage experienced by the Beirut Port explosion in August 2020, which left 300,000 people homeless (25). | Predominantly a rural environment, where the main economic activity is focused on agricultural industry. Accommodates the highest number of Syrian refugees settled in Lebanon (339,473, 38.6% % of whole refugee population) (24). In contrast to Beirut, the health system in the Beqaa has been historically under-developed and under-resourced: only 22 public primary healthcare centers (26) and 21 hospitals are available in the region (27), with limited access to secondary and tertiary care and referrals forwarded to Beirut. |

TABLE 1 Description of questionnaire sections and sources.

| Section | # of questions | Description | Source |
|---|---|---|---|
| 1 | 12 | Socio-demographics characteristics | World Health Organization (WHO) individual questionnaire (30) |
| 2 | 11 | disease risk factors | WHO individual questionnaire (30) |
| 3 | 6 | history of disease | WHO individual questionnaire (30) |
| 4 | 26 | itemized accounts of services received at (PHCC) or *via* referral | World Bank package (30) |
| 6 | 1 | General access to services | Drafted by the research team |
| 7 | 1 | Affordability of NCDs services and care coverage | Drafted by the research team |

## Sample size

Sample size was determined based on the primary research aim of determining differences in the quality clinical management score between groups. The sample size was based on a planned Analysis of Variance (ANOVA) with 5 groups. The minimum required sample was calculated as 1,550, based on a desired power set at 90%, a type I error set at 5%, and an effect size Cohen's F of 0.1 (29). The determined sample size was deemed appropriate for analysis of other dependent variables: hospitalization, visits to physicians, and lab tests. A total of 1,700 participants were recruited.

## Data sources

The survey questionnaire comprised 76 questions distributed across 7 sections as per Table 1.

## Clinical management index scoring

We generated the quality of care (QoC) 10-item index to assess the quality of health services offered to diabetic and hypertensive patients at primary care clinics in Lebanon. The selection of 10 items was informed by the World Health Organization (WHO) Package of Essential NCDs interventions for primary care in low-resource settings (31), literature on the recommended management of diabetes (32), and the World Bank Basic Package of Health Services (33) adopted by the Lebanese Ministry of Public Health (MoPH) at the primary care level. Further consultations were held with local experts to check the appropriateness of the QoC measure to the Lebanese context. The index was constructed by summing the points from binary items (yes = 1, no = 0) asking about a minimum of 2 annual consultations with a General Practitioner (GP), referrals and attendance to appointments with an ophthalmologist, administration of laboratory tests (lipid profile test, Hba1c test, spot urine micro-albumin), lifestyle counseling, medication prescription and collection. The QoC index ranges from 0 to 10, where higher values indicate better alliance with the recommended national guidelines on diabetes and hypertension management and control.

## Statistical methods and main variables

Data was analyzed using Statistical Package for the Social Sciences (SPSS) v27 (34). The main dependent variable was clinical management which was assessed as a score ranging from 1 to 10 using a set of clinical items ranging from visits to a general practitioner to prescribed and received medication (see following sections). The items are in line with WHO Package of Essential Non-communicable disease (PEN) recommendations and have been reviewed by local MoH experts. The score was deemed to have a normal distribution after checking its histogram, Quantile-Quantile (QQ) plot, and skewness and kurtosis scores. Differences in clinical score were tested using either the independent *t*-test (for two groups) or the ANOVA F test. Variables that showed statistical significance at the bivariate level in the previous step were included in a multivariable linear regression with clinical management as the outcome.

# Results

## Characteristics of the study population and performance

The majority of participants were females (67.3%), Syrian (58.1%), married (81.6%). 39.8% were aged over 60. The majority of participants were drawn from setting 2 (84.1%). Just over half of the participants reported having no health coverage (51.8%). The majority of participants were hypertensive (53.4%), 26.9% were diabetic and 19.6% were comorbid. 43.6% of the respondents had no formal schooling and another 37% had only completed primary education. Only 14.5% of respondents reported being employed and the rest were either unemployed (79.3%) or unable to work (6.2%) (Table 2).

TABLE 2 Characteristics of the study population.

| Characteristics | *N* (%) |
|---|---|
| **Age groups** | |
| ≤49 | 432 (25.4%) |
| 50–59 | 591 (34.8%) |
| 60 + | 676 (39.8%) |
| **Gender** | |
| Female | 1,144 (67.3%) |
| Male | 556 (32.7%) |
| **Nationality** | |
| Lebanese | 712 (41.9%) |
| Syrian | 988 (58.1%) |
| **Marital status** | |
| Single | 56 (3.3%) |
| Married | 1,387 (81.6%) |
| Divorced/widowed | 256 (15.1%) |
| **Fragility setting*** | |
| Setting 1 | 270 (15.9%) |
| Setting 2 | 1,430 (84.1%) |
| **Education** | |
| No formal schooling | 741 (43.6%) |
| Primary | 633 (37.3%) |
| Secondary | 193 (11.4%) |
| High school and above | 132 (7.7%) |
| **Employment** | |
| Working | 247 (14.5%) |
| Not working | 1,347 (79.3%) |
| Unable to work | 105 (6.2%) |
| **Health coverage** | |
| No | 874 (51.8%) |
| Yes | 812 (48.2%) |
| **Health condition** | |
| Diabetic | 458 (26.9%) |
| Hypertensive | 908 (53.4%) |
| Comorbid | 334 (19.6%) |

*The urbanized area of Greater Beirut (fragility setting 1) and the Beqaa Valley (fragility setting 2).

## Performance of the study population on the clinical management index score

Out of all patients, 61.4% reported attending two GP visits over the last 12 months, with diabetic patients reporting the highest proportion (67.2%) and hypertensive patients the lowest (57.7%). While comorbid patients were the most referred to ophthalmologists (26%), hypertensive patients were least referred (9.8%). When referred, patients were strongly adherent, with 93% of patients reporting attending their referral to ophthalmologist consultations. Comorbid patients were the most tested for lipid profile (83.4%) and diabetic patients the least tested (65.5%). Unsurprisingly, diabetic patients were most tested for Hba1c (94.8%) and hypertensive patients were least tested (40.1%). Urine tests were performed by more diabetic (66.8%) and comorbid patients (66.5%) compared to hypertensive patients (58.3%). Across conditions, hypertensive patients were the least likely to have received nutrition advice (78.9%), but the most likely to report receiving most to all prescribed medications (18.5%). Comorbid patients were the most likely to receive smoking cessation advice and prescribed medications (Table 3).

## Clinical management index score by patient characteristics

Overall, the average clinical management index score was 5.7 (out of 10) across all patient groups. Comorbid patients had the highest score compared to diabetic and hypertensive patients (6.62 ± 1.7 vs. 6.13 ± 1.78 and 5.15 ± 1.94, respectively) ($p < 0.001$). Clinical management index scores were significantly higher among the age group older than 60 (5.96 ± 1.91) ($p < 0.001$) compared to lower age groups (5.69 ± 1.88 for age groups 50–59 and 5.32 ± 2.04 for age group under 49) ($p < 0.001$). Scores for females were significantly lower than for males (5.55 ± 1.96 vs. 6.02 ± 1.89) ($p < 0.001$). Scores for Lebanese patients were significantly higher than for Syrians (6.03 ± 1.95 vs. 5.46 ± 1.92) ($p < 0.001$). Scores also differed by setting, with higher scores in Beqaa/setting 2 (5.72 ± 1.93) compared to Beirut/setting 1 (5.6 ± 2.06). Bivariate analysis revealed

TABLE 3 Description of items for clinical management score for hypertensive and diabetic patients.

| Items | All patients<br>*N* (%) | Diabetic<br>*N* (%) | Hypertensive<br>*N* (%) | Comorbid<br>*N* (%) | *P*-value |
|---|---|---|---|---|---|
| Offered/attended 2 GPs visits | 1,042 (61.4%) | 307 (67.2%) | 523 (57.7%) | 212 (63.7%) | 0.002 |
| Referred to an ophthalmologist | 288 (16.9%) | 112 (24.5%) | 89 (9.8%) | 87 (26%) | <0.001 |
| Attended ophthalmologist | 272 (94.8%) | 105 (93.8%) | 85 (96.6%) | 82 (94.3%) | 0.674 |
| **Tests requested** | | | | | |
| Lipid profile | 1,202 (70.9%) | 300 (65.5%) | 625 (69.0%) | 277 (83.4%) | <0.001 |
| Urine test | 1,057 (62.2%) | 306 (66.8%) | 529 (58.3%) | 222 (66.5%) | 0.002 |
| HbA1c | 1,099 (64.8%) | 434 (94.8%) | 363 (40.1%) | 302 (91.0%) | <0.001 |
| Smoking advice | 665 (44.2%) | 171 (40.7%) | 348 (44.2%) | 146 (48.8%) | 0.097 |
| Nutrition advice | 1,330 (85.6%) | 421 (92.9%) | 610 (78.9%) | 299 (91.2%) | <0.001 |
| Prescribed medications | 1,221 (91.9%) | 235 (86.1%) | 659 (91.3%) | 327 (98.2%) | <0.001 |
| Received most to all medications | 254 (15.7%) | 42 (9.3%) | 156 (18.5%) | 56 (17.4%) | <0.001 |

GP, General practitioner.

no significant differences by health coverage status. Patients with no formal schooling scored significantly lower (5.47 ± 1.96) compared to patients with higher education levels ($p < 0.001$). Generally, clinical management scores were significantly higher for patients who contributed partially or fully to the payment of consultation items (i.e., consultation, medications, diagnostic tests, etc.) than those who did not contribute ($p < 0.001$). Patients who paid fully or partially for their medications scored significantly higher compared to those who received their medications for free (6.13 ± 1.94 vs. 5.46 ± 1.92) ($p < 0.001$), with similar results observed for patients who paid partially or fully for consultations (5.85 ± 1.89 vs. 5.57 ± 2.0) and diagnostic tests (5.93 ± 1.81 vs. 5.55 ± 2.05) ($p < 0.001$) (Table 4).

At the multivariate level, once all variables were accounted together in a regression model, fragility setting 2, having health coverage, age above 60, primary and secondary educational levels, and partial or full payment contribution were all are associated with a higher clinical management index score. In contrast, being of Syrian nationality, and suffering from diabetes or hypertension were associated with a lower index score. On average those living in fragility setting 2 had a higher score index by 0.94 points ($p < 0.001$) compared to their counterparts in fragility setting 1. Patients 60 years old and older received an average 0.442 higher points on the quality of clinical management scale compared to patients below the age of 50 ($p < 0.001$). Patients with primary education ($b = 0.265$, $p = 0.011$) and secondary education ($b = 0.513$ $p = 0.001$) were significantly more likely to receive better clinical management score compared to those without formal schooling. Furthermore, patients who partially or fully pay for services reported significantly better clinical management scores compared to those who received services for free ($b = 0.688$, $p < 0.001$). Syrian patients received significantly lower clinical management scores ($b = -0.55$, $p < 0.001$) compared to their Lebanese counterparts. Results also show that, compared to comorbid patients, diabetic patients ($b = -0.538$, $p < 0.001$) and hypertensive patients ($b = 1–0.445$, $p < 0.001$) reported a significantly lower clinical management index score (Table 5).

## Discussion

This is the first of its kind study in Lebanon examining the quality of the clinical management of diabetic and hypertensive patients at PHCCs in the fragile context of Lebanon. The study found that a significantly higher clinical management index score was associated with patients: living in the semi-urban/rural areas (setting 2/Beqaa), with health coverage, aged above 60, having primary and secondary educational levels, and making partial or full payment for their treatment. In contrast, significantly poorer quality of clinical management index scores were associated with Syrian nationality (compared to Lebanese) and with patients suffering from diabetes or hypertension (compared to comorbid patients).

Clinical management index scores ranged from 5.15/10 ± 1.94 for hypertensive patients to 6.62/10 ± 1.7 for comorbid patients, with the average among all patients being 5.7/10. This flags a general lack of compliance with the international and national guidelines for diabetes and hypertension care and highlights a clear opportunity for improving the quality of care delivered to diabetic and hypertensive patients. This finding is particularly disconcerting in that it suggests a suboptimal control of diabetes and hypertension which increases substantively the risks of costly complications within the target population. This not only has consequences for patients and the course of their disease, but also threatens the capacities of a health system with already very scarce resources. The most critical areas of non-compliance indicated by the clinical

TABLE 4 Clinical management index score by patients' characteristics and financial arrangements.

| | Clinical management index score (0–10) | |
|---|---|---|
| | **Mean (SD)** | ***P*-value** |
| **OVERALL** | 5.70 (1.95) | |
| **PATIENTS' CHARACTERISTICS** | | |
| **Health condition** | | |
| Diabetic | 6.13 (1.78) | |
| Hypertensive | 5.15 (1.94) | |
| Comorbid | 6.62 (1.70) | <0.001 |
| **Age groups** | | |
| ≤49 | 5.32 (2.04) | |
| 50–59 | 5.69 (1.88) | |
| 60 + | 5.96 (1.91) | <.001 |
| **Gender** | | |
| Female | 5.55 (1.96) | |
| Male | 6.02 (1.89) | <0.001 |
| **Nationality** | | |
| Lebanese | 6.03 (1.95) | |
| Syrian | 5.46 (1.92) | <0.001 |
| **Fragility setting** | | |
| Setting 1 | 5.60 (2.06) | |
| Setting 2 | 5.72 (1.93) | 0.356 |
| **Health coverage** | | |
| No | 5.66 (1.94) | |
| Yes | 5.75 (1.96) | 0.337 |
| **Education level** | | |
| No formal schooling | 5.47 (1.96) | |
| Primary | 5.83 (1.95) | |
| Secondary | 6.11 (1.83) | |
| High school and above | 5.80 (1.90) | <0.001 |
| **Proportion of medicine expenses paid by patient** | | |
| Free | 5.46 (1.92) | |
| Partial/full | 6.13 (1.94) | <0.001 |
| **Proportion of consultations paid by patient** | | |
| Free | 5.57 (2.02) | |
| Partial/full | 5.85 (1.89) | 0.004 |
| **Proportion of diagnostic tests paid by patient** | | |
| Free | 5.55 (2.05) | |
| Partial/full | 5.93 (1.81) | <0.001 |
| **Patients payment contribution** | | |
| None | 5.21 (2.02) | |
| Partial to full | 5.96 (1.88) | <0.001 |

TABLE 5 Multivariable linear regression model for clinical management score index by patient characteristics.

| | ***B*** | **Std. Error** | ***P*-value** |
|---|---|---|---|
| (Constant) | 4.48 | 0.353 | <0.001 |
| **Fragility setting** | | | |
| Setting 1 (reference) | – | – | |
| Setting 2 | 0.943 | 0.151 | <0.001 |
| **Health coverage** | | | |
| No (reference) | – | – | |
| Yes | 0.438 | 0.096 | <0.001 |
| **Gender** | | | |
| Female | – | – | |
| Male | 0.118 | 0.101 | 0.239 |
| **Age groups** | | | |
| ≤49 (reference) | – | – | |
| 50–59 | 0.252 | 0.117 | 0.032 |
| 60 + | 0.442 | 0.120 | <0.001 |
| **Nationality** | | | |
| Lebanese (reference) | – | – | |
| Syrian | −0.550 | 0.105 | <0.001 |
| **Education level** | | | |
| No formal schooling (reference) | – | – | |
| Primary | 0.265 | 0.105 | 0.011 |
| Secondary | 0.513 | 0.156 | 0.001 |
| High school and up | 0.348 | 0.195 | 0.074 |
| **Health condition** | | | |
| Comorbid (reference) | – | – | |
| Diabetic | −0.538 | 0.136 | <0.001 |
| Hypertensive | −1.445 | 0.122 | <0.001 |
| **Patients payment contribution** | | | |
| None | | | |
| Partial to full | 0.688 | 0.100 | <0.001 |

Adjusted *R*-square = 17.1%.

management index were the referral to an ophthalmologist (only 16.9% of all patients referred), receiving most to all prescribed medications (only 15.7% patients reporting), and receiving smoking cessation advice (advised to only 44.2% of patients). It is also of concern that only three out of each five patients attended two GP visits per year as per the clinical management guidelines. These findings call for a deeper analysis of the root causes for non-compliance with the established guidelines and whether they relate to patients, care providers or the delivery system at large.

Our findings also flagged the sociodemographic characteristics of those in the target population receiving significantly poorer clinical management of their conditions. Those characteristics include being a Syrian refugee, a patient under 60 years of age, those who live in the urban setting of Beirut, those who have no formal schooling and those who benefit from free care.

Patients aged above 60 reported receiving better clinical management of their conditions compared to those belonging to younger age groups. One explanation for this could be that patients older than 60 become relieved from the financial burdens of healthcare access because they either move in with, or otherwise depend on, their children with higher current income or become eligible for health coverage (35). In Lebanon, a law was approved to extend the provision of health care to the entire population above the age of 64 through the National Social Security Fund (NSSF). This covers 90 per cent of hospitalization costs and 80 per cent of medical consultations and medication excluding dental care, while for Syrian refugees, the United Nations High Commissioner for Refugees (UNHCR) covers 85% of primary healthcare costs (36, 37).

Our results also illustrated the discrepancies on health outcomes by nationality. The health systems of countries receiving refugees are placed under tremendous pressure. Such systems often struggle to meet the urgent and acute health needs of the refugees, and as a result often neglect the care for patients with NCDs (38, 39). Refugees are specifically vulnerable to NCDs owing to several factors (38). The stress which results from fleeing one's home renders refugees susceptible to many chronic diseases such as hypertension, diabetes and many types of cancer (40, 41). In addition, refugees go through lifestyle changes which influence their dietary intake and activity levels and may as a result increase the risk of NCDs (38, 42). Earlier studies reported underutilization of NCDs services among Syrian refugees compared to Lebanese community members and showed that host community members had better access to care and fewer reports of medication interruption compared to refugees (43, 44). Study findings suggest that providing Syrian refugees with access to free or highly subsidized NCDs services is a necessary but not sufficient condition for them to be able to attain proper disease control. Many other determinants of health (e.g., income, education, employment, etc.) will negatively influence their health outcomes compared to their host communities.

Our results are also in accordance with other studies in demonstrating ties between socioeconomic status and health outcomes (35). People who belong to lower economic classes and who have less education are more likely to suffer from diseases, experience loss of functioning and experience higher mortality rates (35, 45). Education is a key determinant of health given that it influences both access to a range of resources such as income, safe neighborhoods, or healthier lifestyles (46). It also influences the attitudes and behaviors that lead to better health (35). People belonging to different socioeconomic groups lead different lifestyles in many aspects of life (e.g., childhood, educational experiences, work careers, marriage and family experiences, and health care) (47, 48).

Patients with health coverage received significantly better clinical management of their conditions compared to those with no health coverage. Given that health insurance is mostly provided by employers, people who lack health coverage are typically unemployed or have lower incomes (48, 49). Such socially disadvantaged patients have multiple risk factors (50). It is important to note that despite the presence of health coverage, patients would still be expected to make full or partial payment for some aspects of their care (e.g., drugs, lab tests). For example, patients covered by the NSSF still need to cover 20% of the cost of drugs and ambulatory care services. Our results demonstrated that patients that make partial or full payment for their medical expenses receive better quality of clinical care compared to patients who receive free healthcare. Patients benefiting from free care are usually the poorest and the most disadvantaged and, in the settings considered here, were primarily Syrian refugees and their families. In Lebanon, Syrian refugees benefit from free care through the 25 mobile medical units established by the Lebanese Ministry of Public Health in collaboration with UNHCR, NGOs and humanitarian agencies, which provide free consultations and medication to Syrian refugees. If access to a primary healthcare facility is unavailable, UNHCR covers 85% of primary healthcare (37). Disadvantaged Lebanese citizens with no health insurance resort to public hospitals or contracted private hospitals, where the Ministry of Public Health covers 95% and 85% of hospital care costs and 100% of medication costs for chronic and high-risk diseases (18, 51). While the provision of free healthcare is welcome and would improve accessibility to health service to NCDs patients, our findings suggest that a poorer quality of clinical management is reported by NCDs patients who are receiving free services. The results call on agencies providing free services to systematically monitor and evaluate the quality of such services since the subsidization of cost is a necessary but not sufficient condition for the equitable access to quality services by the vulnerable NCDs patients.

While each of the above-mentioned categories require targeted programming and attention, we argue that highest priority needs to be given to individuals with compounded vulnerability. For example, while being a Syrian refugee appears to negatively and significantly affect the quality of chronic care received, being an illiterate refugee seeking free care in Beirut will entail multiple layers of vulnerability and will require additional attention to ensure proper and equitable care for all patients. The findings thus call on donor agencies, NGOs and provider institutions to design targeted programs and activities that will ensure equitable delivery of services to diabetic and hypertensive patients with particular attention to patients with compounded vulnerability. While the context of Lebanon may be unique in some aspects, many of the recommendations in this paper would likely apply to other countries hosting a large number of refugees. The authors argue that the significant elements of vulnerability for NCD patients, including refugee status, literacy rate, and having health coverage, would apply to other contexts and recommend the carrying of studies similar to this one to validate the elements of vulnerability specific to each context.

The study has a number of shortcomings that are important to report. First, the QoC index, despite being grounded on the guidelines of multiple agencies (WHO, World Bank), best practice guidelines and the guidelines of the Ministry of

Public Health, was never validated before and may need to be modified based on expert validation in the future. Despite strong assurances to the participating patients that their responses would not affect the care and/or aid they are receiving, it cannot be ascertained whether the study is free of bias toward poorer care and outcomes in anticipation of higher subsidies and continued support. The research team was not able to recruit equally from the two fragility contexts. The presence of a large number of refugees in fragility setting 2 have resulted in a larger number of responses from that setting. The fact that the study was planned and ethically approved prior to the COVID-19 pandemic, while data collection took place at the peak of the pandemic in Lebanon, did not allow the research team to systematically capture the effect of the pandemic on the quality of provided NCDs services to the target population. The pandemic also introduced a bias since people were reluctant to visit primary healthcare centers out of fear of contracting the virus. This may have caused a delay in seeking care and generally resulted in poor compliance to NCD protocols.

## Conclusion

The study identified a wide margin for improving quality of NCDs care in fragile contexts with particular gaps identified in referral to ophthalmology, accessing all prescribed medication and receiving counseling for smoking cessation. Additionally, findings indicate a number of predictors of comparatively poor quality of care that warrant attention, notably with regard to Syrian nationality/legal status, lack of health coverage, seeking free health provision and lower educational attachment. Although these are all relevant risk factors, the findings call on donor agencies, NGOs and provider institutions to design targeted programs and activities that especially ensure equitable delivery of services to diabetic and hypertensive patients with compounded vulnerability as a result of a number of these factors.

## 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 study protocol was reviewed and approved by the Ethics Research Panel of Queen Margaret University, Edinburgh (Protocol number QMU: REP 0201) and the Ethics Review Committee of the American University Beirut (protocol number AUB: SBS-2018-0514). The patients/participants provided their written informed consent to participate in this study.

## Author contributions

SS has made substantial contributions to the analysis, interpretation of the data, write up, and revising the manuscript. DM has made substantial contributions to the acquisition, analysis, interpretation of the data, drafting the original manuscript, and revising it. RH and AA have made substantial contributions to the interpretation of the data and the revision of the manuscript. HD has made substantial contributions to the analysis, interpretation of the data, and revising the manuscript. KD has made substantial contributions to the conception and design of the work, analysis, interpretation of the data, and revising the manuscript. SA has made substantial contributions to the analysis, interpretation of the data, and the revision of the manuscript. MA has made substantial contributions to the conception and design, supervision of the work, write up, and revision of the manuscript. All authors have read and approved the submitted version of the 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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# Psychosocial response to the COVID-19 pandemic in Panama

Diana C. Oviedo[1,2,3*†], María Sofía Pinzón[2†], Sofía Rodríguez-Araña[1], Adam E. Tratner[4], Elianne Pauli-Quirós[2], Carlos Chavarría[2], Camilo Posada Rodríguez[1] and Gabrielle B. Britton[1,3]

[1]Centro de Neurociencias y Unidad de Investigación Clínica, Instituto de Investigaciones Científicas y Servicios de Alta Tecnología (INDICASAT-AIP), Panama City, Panama, [2]Escuela de Psicología, Universidad Santa María la Antigua (USMA), Panama City, Panama, [3]Sistema Nacional de Investigación (SNI) SENACYT, Panama City, Panama, [4]SENACYT, Florida State University, Panama City, Panama

EDITED BY
Jerome T. Galea,
University of South Florida,
United States

REVIEWED BY
Muhammad Syawal Amran,
National University of
Malaysia, Malaysia
Antonio G. Lentoor,
Sefako Makgatho Health Sciences
University, South Africa
Simon George Taukeni,
University of Namibia, Namibia
Daniela Chieffo,
Catholic University of the Sacred
Heart, Italy

*CORRESPONDENCE
Diana C. Oviedo
d.ovi@hotmail.com

†These authors have contributed
equally to this work

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**Background:** The impact of the COVID-19 pandemic and the associated restrictions on mental health is being studied.

**Objective:** To analyze the psychosocial response to the COVID-19 pandemic in adults residing in Panama.

**Methods:** A community sample of 480 adult residents of Panama completed a survey that included sociodemographic questions, COVID-19 related questions (e.g., health concerns regarding the virus, knowledge and behaviors in biosafety) and scales of stress, anxiety, depression, prosocial behavior, resilience, perceived social support, and insomnia.

**Results:** Most of the participants (>60%) reported being negatively affected by the pandemic. Women experienced greater depression, anxiety, and stress symptoms than men, and age was negatively associated with depression, anxiety, and stress symptoms. Self-perceived health status and self-perceived social support were negatively associated with depression, anxiety, and stress symptoms. Self-perceived social isolation was positively associated with depression, anxiety, and stress symptoms. Psychiatric illness and insomnia were positively associated with depression, anxiety, and stress symptoms, whereas psychological resilience was negatively associated with depression, anxiety, and stress symptoms.

**Discussion:** These results corroborate other studies regarding COVID-19 and mental health. This study highlights the need for specific prevention and intervention mechanisms related to the COVID-19 pandemic in different population groups. This is the first report of the psychological impact of COVID-19 in the general Panamanian population and one of the only studies in the Latin American region and, therefore, contributes to research in the Latino population and lower-middle income countries.

KEYWORDS

**COVID—19, psychological distress, mental health, restrictions, depression, anxiety, stress**

# Introduction

By early 2020, the SARS-CoV-2 coronavirus disease 2019 (COVID-19) had spread rapidly throughout the world and was officially declared a pandemic in March 2020. To prevent the propagation of the virus, many countries adopted different mitigation strategies such as quarantines, rigorous lockdowns, mobility restrictions, closure of schools and the isolation of vulnerable populations (1). Research on previous epidemics, such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS), documented that these measures are associated with an increase in mental health-related distress (2, 3). Studies have reported high-stress levels, sleep disturbances such as insomnia and nightmares, an increase in depressive and anxiety symptoms, and poor concentration, among others (4).

Moreover, research on the effects of COVID-19 lockdowns has documented high anxiety, depression, and stress levels, as well as post-traumatic stress disorder symptoms, irritability, isolation, fear, uncertainty, anger, loneliness, and guilt in people who experienced ongoing restrictions (5–7). These psychological manifestations are associated with personal, social, behavioral and cognitive variables that, taken together, encompass psychosocial determinants of how people respond to menacing situations (8). These social determinants of the pandemic have impacted individual emotional distress (9). Research has shown that the social determinants related to worse psychological responses to the pandemic include being female, age, previous mental health diagnosis, lower income, racial and ethnic disparities, poor subjective and objective health status, and being a healthcare worker (10–13). Furthermore, the rise in psychological and psychiatric symptoms is also a result of COVID-19 related deaths and illnesses as well as social unrest and economic crises (14, 15).

Most research investigating mental health during the pandemic has focused on high-income countries, and there is limited empirical research on COVID-19's psychosocial effects on low and middle-income countries (LMIC), specifically in Latin America (16). For instance, in Panama, the only reported study regarding mental health in healthcare workers, has evidenced a high prevalence of mental health disorders in this population group (17). Panama had one of the strictest lockdown measures in the world (18), which lasted until late 2021 (19). The country implemented various restrictive mechanisms to mitigate and control the spread of the pandemic: mobility and travel restrictions according to ID number and sex, suspension of in-person educational activities and social activities, border closures, sanitary and epidemiological control, staff rotation and teleworking modality (20).

Furthermore, in Panama as well as in other LMIC, the COVID-19 pandemic exposed economic, social, health and educational inequalities that affected the most disadvantaged and vulnerable individuals (21). While many affluent countries have experienced severe health crises, low and middle-income countries have undergone more pronounced economic crises that are projected to continue (22). In developing countries, it is estimated that 255 million full-time jobs have been lost (23). Additionally, the informal sector has been severely impacted by the pandemic. Around 67% of people with informal jobs live in developing countries, and most have been affected by lockdown measures, affecting economic stability (22). Moreover, in developing countries there is a high prevalence of comorbidities, coupled with limited access to health services, particularly mental health resources (24, 25). All these factors increase the toll on the mental health of residents in developing countries. Therefore, this study aims to explore the psychosocial determinants associated with the pandemic in the Panamanian population. The objective of this study was to analyze the psychosocial response to the COVID-19 pandemic in adults residing in Panama.

# Methods

## Participants and procedure

This was a descriptive, quantitative, cross-sectional study. Participants were 480 adult residents of Panama (80.8% women), aged 18 years or older ($M = 32.7$; SD = 14.6, Range = 18–66). Participants were recruited using convenience sampling. Sample size was calculated using Raosoft Sample Size Calculator. Considering 2,958,577 as the population of people 18 years and older in Panama (26), prevalence of psychosocial effects of the pandemic at 30% (average reported psychosocial effects of pandemic in previous studies), at 95% confidence levels and 5% error margin, the estimated minimum sample size was 323. The research team used advertisements on social media platforms (e.g., Instagram, Facebook, Twitter), which included a description of the study and the principal investigator's contact information. Those who voluntarily contacted the principal investigator were provided access to an online survey *via* a Google Forms link if they met the inclusion criteria of being an adult over 18 years old resident of Panama, having access to a technological device such as a laptop, cellphone or tablet, and not having a physical condition that would make it difficult or preclude accessing the link or answering questions (e.g., visual impairment, cognitive impairment, illiteracy). Recruitment and data collection took place from March 26, 2021 to May 11, 2021. This study was approved by the National Research Bioethics Committee of Panama (CNBI). Participants provided informed consent in compliance with the Declaration of Helsinki principles (1964). The online survey consisted of sociodemographic questions regarding sex, age, marital status, the number of cohabitants living in the same household, employment status, and monthly income. Participants also indicated how many chronic illnesses (e.g., diabetes, hypertension) and psychiatric disorders (e.g., depression, anxiety) they had been diagnosed with, as well as their self-perceived health status (0 = Very bad, 2 = Average, 4 = Very good). In addition, questions assessed biosafety knowledge and behaviors, as well as attitudes and health concerns pertaining to COVID-19. Lastly, several scales that measure psychological symptoms and manifestations linked to COVID-19 pandemic outcomes were included.

### Measures

The Depression, Anxiety and Stress Scale-21 (DASS-21) (27) was used to report symptoms of depression, anxiety, and stress. The Athens Scale of Insomnia (ASI) (28, 29) was included to indicate if participants experienced sleep difficulties at least 3 times in the past month and the severity of their symptoms. Participants also completed a self-report measure of prosocial behavior (Prosociality Scale) (30). Additionally, participants reported perceived psychological resilience during the past month using the Connor-Davidson Resilience Scale (CD-RISC) (31). Finally, the Multidimensional Scale of Perceived Social Support (MSPSS) (32) was included to assess the perceived quality of social support from family, friends, and relationship partners.

## Results

### Statistical analyses

Statistical analyses were conducted using IBM SPSS Statistics version 27.0. Descriptive statistics were used to summarize the demographic characteristics of the sample. Means and standard deviations were calculated for quantitative variables, and categorical variables were presented as frequencies and percentages. Univariate analyses were used to compare groups and examine relationships between variables of interest. Specifically, we used analysis of variance to investigate sex and age cohort differences, and hierarchical linear regression to examine the unique contribution of demographic, economic, health, social psychological, and psychiatric factors on psychological distress symptoms. Results for which $p < 0.05$ were accepted as significant.

### Results

Table 1 summarizes the sample's sociodemographic characteristics. The majority of participants were Panamanian nationals (88.5%), single (79.4%), educated (76.1% completed a bachelor's degree or higher), female (80.8%), and cohabitated with one or more people (94.4%). More than one-third (37.3%) of participants were unemployed at the time of the survey, and less than half of the sample (46.3%) earned a monthly income higher than $2,000.

Table 2 shows the perception of risk and health factors. Most participants (79.2%) reported their overall health as "Good" or "Very good," whereas 26.9% reported having one or more chronic illnesses (e.g., diabetes, hypertension, obesity). Additionally, 21% of participants reported having a psychiatric diagnosis (e.g., depression, anxiety, agoraphobia), and nearly one-third of the sample (32.1%) reported taking at least one prescribed medication. In addition, most participants did not report an increase in cigarette (14.6%) or alcohol (22.1%) consumption. However, most participants (78.3%) reported changes in their amount of physical activity.

Many participants reported disturbances to their psychosocial well-being during the pandemic. For instance, 35% of participants reported mild to moderate levels of depression, 25% reported mild to moderate anxiety symptoms, and 51% reported mild to moderate levels of stress. Table 3 summarizes the aspects of participants' lives that were most affected by the pandemic, as well as perceived risk of contagion, social isolation, and the ability to overcome the pandemic. For example, 44.1% of participants reported that they had felt socially isolated from others during confinement. Most participants reported that the areas that were most negatively impacted were recreational activities and hobbies (74.6%), social relationships (67.7%), mental health (62.9%), and the economy (50.4%). Regarding risk of contagion, 12% of participants believed that they are at risk of COVID-19 infection due to having a chronic disease, 9% due to being an older adult, and 7% due to high exposure to the virus at work. Nine percent of participants reported that they are at risk due to being pregnant, immunosuppressed, a smoker, and not following biosecurity measures.

Additionally, approximately one in 10 of those surveyed (11%) were placed under mandatory quarantine (imposed by the government) because they had either tested positive for COVID-19 or were in close contact with someone who had tested positive for the virus. Half of the sample indicated that they frequently received information about the virus, and most of the participants (93%) reported that they knew, complied with, and agreed with the biosafety measures recommended by the Ministry of Health (MINSA). Most participants (93.8%) stated that they complied with biosafety measures because they wanted to take care of their health and that of others, while the rest complied with these measures because they were forced to do so, they were afraid of receiving a fine, or they were afraid of being detained by authorities.

TABLE 1 Sociodemographic characteristics.

| | Total ($N = 480$) $n$ (%)/M (SD) | Female ($N = 388$) $n$ (%)/M (SD) | Male ($N = 92$) $n$ (%)/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/Partnered | 99 (20.6%) | 77 (19.8%) | 22 (23.9%) |
| Single/Divorced/ Widowed | 381 (79.4%) | 311 (80.2%) | 70 (76.1%) |
| **Education level** | | | |
| 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%) |
| > \$2,000 | 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%) |

## Analysis of variance

Analysis of variance was used to examine sex differences. There was a significant difference between men and women in depression scores, such that women ($M = 13.8$) had a higher mean score of depression than men ($M = 10.6$), $F_{(1,479)} = 4.76$, $p = 0.03$. Women ($M = 10.0$) also had higher anxiety scores than men ($M = 6.8$), $F_{(1, 479)} = 9.48$, $p = 0.002$, and higher ($M = 17.0$) stress scores than men ($M = 13.0$), $F_{(1, 479)} = 12.44$, $p < 0.001$. However, there were no sex differences in resilience scores, $F_{(1, 479)} = 3.73$, $p = 0.054$, insomnia scores, $F_{(1,479)} = 1.92$, $p = 0.167$, perceived social support, $F_{(1, 479)} = 0.64$, $p = 0.423$, or prosociality, $F_{(1, 479)} = 2.50$, $p = 0.114$. In sum, women reported higher depression, anxiety, and stress scores compared to men, but there were no significant differences in resilience, insomnia, prosociality, or perceived social support.

Similarly, analysis of variance was used to examine differences between age groups. Participants were divided into two groups: young adults (18–29 years of age) and adults (aged 30 and older). There was a statistically significant difference between those younger than 29 and those older than 30 years of age in depression scores, such that those younger adults ($M = 14.5$) had significantly higher scores than older adults ($M = 9.0$), [$F_{(1, 478)} = 44.00$, $p < 0.001$. Younger adults ($M = 11.0$) also reported higher anxiety scores than older adults ($M = 7.1$), $F_{(1, 478)} = 21.49$, $p < 0.001$, and higher stress scores ($M = 18.4$) than older adults ($M = 13.1$), $F_{(1, 478)} = 36.14$, $p < 0.001$. Conversely, older adults ($M = 76.12$) reported significantly higher resilience scores than younger adults ($M = 68.6$), $F_{(1, 478)}$

TABLE 2 Subjective health and risk factors.

| | Total ($N = 480$)<br>$n$ (%)/M (SD) | Female ($N = 388$)<br>$n$ (%)/M (SD) | Male ($N = 92$)<br>$n$ (%)/M (SD) |
|---|---|---|---|
| **Subjective health** | | | |
| Very good | 120 (25.0%) | 92 (23.7%) | 28 (30.4%) |
| Good | 260 (54.2%) | 211 (54.4%) | 49 (53.3%) |
| Regular | 94 (19.6%) | 81 (20.9%) | 13 (14.1%) |
| Poor | 5 (1.0%) | 4 (1.0%) | 1 (1.1%) |
| Very poor | 1 (0.2%) | - | 1 (1.1%) |
| **Participants with Chronic illnesses** | | | |
| Yes | 129 (26.9%) | 99 (25.5%) | 30 (32.6%) |
| Diabetes | 14 (2.91%) | 44 (11.3%) | 11 (12.0%) |
| Hypertension | 45 (9.38%) | 77 (19.8%) | 22 (23.9%) |
| Obesity | 30 (6.25%) | 24 (6.2%) | 6 (6.5%) |
| Arthritis | 4 (0.83%) | 3 (0.8%) | 1 (1.1%) |
| Cancer | 4 (0.83%) | 1 (0.3%) | 3 (3.3%) |
| Renal Illness | 1 (0.2%) | 1 (0.3%) | 0 (0%) |
| Pulmonary Illness | 12 (2.5%) | 9 (2.3%) | 3 (3.3%) |
| Cardiac Illness | 6 (1.3%) | 2 (0.5%) | 4 (4.3%) |
| Vascular Illness | 2 (0.4%) | 2 (0.5%) | 0 (0%) |
| Other Chronic Illness | 54 (11.3%) | 49 (12.6%) | 5 (5.4%) |
| **Participants with Psychiatric Illnesses** | | | |
| Yes | 101 (21.0%) | 88 (22.7%) | 13 (14.1%) |
| Depression | 63 (13.1%) | 56 (14.4%) | 7 (7.6%) |
| Anxiety | 74 (15.4%) | 64 (16.5%) | 10 (10.9%) |
| Schizophrenia | 0 (0%) | 0 (0%) | 0 (0%) |
| Agoraphobia | 1 (0.2%) | 1 (0.3%) | 0 (0%) |
| Social Phobia | 3 (0.6%) | 3 (0.8%) | 0 (0%) |
| Other Psychiatric Illness | 22 (4.6%) | 18 (4.6%) | 4 (4.3%) |
| **Participant takes at least one medication** | | | |
| Yes | 154 (32.1%) | 121 (31.2%) | 33 (35.9%) |
| **Participant has forgotten or increased his/her dose** | | | |
| Frequently | 21 (13.9%) | 19 (15.7%) | 2 (6.6%) |
| Occasionally | 45 (29.8%) | 37 (30.6%) | 8 (26.7%) |
| Rarely | 85 (56.3%) | 65 (53.7%) | 20 (66.7%) |
| **Cigarette consumption** | | | |
| Frequently | 12 (2.5%) | 7 (1.8%) | 5 (5.4%) |
| Occasionally | 19 (4.0%) | 14 (3.6%) | 5 (5.4%) |
| Never | 449 (93.5%) | 367 (94.6%) | 82 (89.1%) |
| **Increase in cigarette consumption** | | | |
| Yes | 14 (14.6%) | 9 (12.7%) | 5 (20.0%) |
| **Alcoholic beverage consumption** | | | |
| Frequently | 49 (10.2%) | 35 (9.0%) | 14 (15.2%) |
| Occasionally | 210 (43.8%) | 168 (43.3%) | 42 (45.7%) |
| Never | 221 (46.0%) | 185 (47.7%) | 36 (39.1%) |
| **Increase in alcoholic beverage consumption** | | | |
| Yes | 85 (22.1%) | 67 (21.6%) | 18 (24.0%) |
| **Physical activity before the pandemic** | | | |
| Frequently | 160 (33.3%) | 115 (29.6%) | 45 (48.9%) |
| Occasionally | 120 (25.0%) | 99 (25.5%) | 21 (22.8%) |

*(Continued)*

TABLE 2 Continued

| | Total ($N = 480$)<br>$n$ (%)/M (SD) | Female ($N = 388$)<br>$n$ (%)/M (SD) | Male ($N = 92$)<br>$n$ (%)/M (SD) |
|---|---|---|---|
| Rarely | 200 (41.7%) | 174 (44.8%) | 26 (28.3%) |
| **Change in physical activity during the pandemic** | | | |
| Yes | 376 (78.3%) | 306 (78.9%) | 70 (76.1%) |
| **Change in level of physical activity** | | | |
| No longer engaged in physical activity | 103 (27.9%) | 78 (25.9%) | 25 (36.7%) |
| Rarely engaged in physical activity | 57 (15.4%) | 45 (14.9%) | 12 (17.6%) |
| Engaged in physical activity at least once a week | 76 (20.6%) | 67 (22.2%) | 9 (13.2%) |

= 34.60, $p < 0.001$. Further, older adults ($M = 47.4$) reported higher prosociality scores than younger adults ($M = 45.7$), $F_{(1, 478)} = 4.01$, $p = 0.046$. There was not a significant difference between groups in insomnia scores, $F_{(1, 478)} = 1.23$, $p = 0.268$, or perceived social support scores, $F_{(1, 478)} = 1.47$, $p = 0.227$. In sum, younger adults reported worse depression, anxiety, and stress scores than older adults, while older adults reported higher resilience and prosociality scores than younger adults.

## Hierarchical multiple linear regression

A hierarchical multiple regression analysis was performed to investigate whether sociodemographic characteristics, economic factors, physical health, social factors, and mental health are uniquely related to depression, anxiety, and stress symptoms (Table 4). The composite sum score of all DASS-21 subscales was used as the criterion variable. Predictor variables were entered stepwise: education level, marital status, sex, and age were added as predictor variables in Step 1, monthly income and employment status were added as predictor variables in Step 2, self-perceived health status and the number of diagnosed chronic illnesses were added as predictor variables in Step 3, the composite sum score of all MSPSS subscales, self-perceived loneliness, number of cohabitants, and self-perceived isolation were added as predictors in Step 4, and the total number of diagnosed psychiatric disorders, the composite sum score of all CD-RISC subscales, and the composite sum score of all AIS subscales were added as predictors in Step 5.

Step 1 explained a significant portion of the variance [$F_{(4, 473)} = 17.391$, $MSE = 12.850$, $R^2 = 0.128$, $p < 0.001$] in DASS-21, and indicated significant effects for sex and age but not civil status and education level. Step 2 explained additional variance but did not indicate significant model fit [$F\Delta_{(2, 471)} = 1.257$ $MSE = 12.84$, $R^2\Delta = 0.005$, $R^2 = 0.133$, $p = 0.285$]. Monthly income and employment status were not significantly associated with depression, anxiety, and stress symptoms. Step 3 explained additional variance [$F\Delta_{(2, 469)} = 25.649$, $MSE = 12.219$, $R^2\Delta = 0.085$, $R^2 = 0.218$, $p < 0.001$] and indicated significant effects for self-perceived health status, but not the number of diagnosed chronic illnesses. Step 4 explained additional variance [$F\Delta_{(4, 465)} = 77.885$, MSE $= 9.496$, $R^2\Delta = 0.314$, $R^2 = 0.532$, $p < 0.001$] and indicated significant effects for self-perceived isolation, perceived social support but not self-perceived loneliness and the number of cohabitants. Step 5 explained additional variance [$F\Delta_{(3, 462)} = 48.842$, $MSE = 8.301$, $R^2\Delta = 0.113$, $R^2 = 0.645$, $p < 0.001$] and indicated significant effects for the number of diagnosed psychiatric disorders, insomnia, and resilience.

# Discussion

The main objective of this study was to analyze the psychosocial response to the COVID-19 pandemic in adults residing in Panama. Overall findings indicate several protective and risk factors associated with mental health outcomes for this sample of Panamanian adults during the COVID-19 pandemic. Social psychological factors, such as perceived social isolation (33, 34) and social support (35) accounted for the greatest proportion of the variance in depression, anxiety, and stress symptoms (36).

Our findings suggest that quarantine, isolation, and social distancing had a significant impact on the participants; more than half reported feeling affected by the COVID-19 pandemic, specifically regarding recreational activities and hobbies, social relations, mental health, and their income. These findings are in line with other recent studies showing that the biosafety measures implemented to stop the spread of the virus have significant implications for the psychosocial well-being of humans (37–39). Nevertheless, some people reported that during confinement they did not feel alone and that they were satisfied with the support of their loved ones. In this study, we reported negative relationships between the perception of social support and resilience on depression, anxiety, and stress symptoms. Similarly, several other studies have shown that social support, social well-being, prosocial behaviors, and resilience are factors that can enhance an adaptive response

TABLE 3 Contagion risk, affected areas and psychological attention.

| | Total ($N = 480$)<br>*n* (%)/M (SD) | Female ($N = 388$)<br>*n* (%)/M (SD) | Male ($N = 92$)<br>*n*(%) / M (SD) |
|---|---|---|---|
| **Risk of COVID-19 contagion** | | | |
| Agree | 193 (40.2%) | 158 (40.7%) | 35 (38.0%) |
| Unsure | 71 (14.8%) | 60 (15.5%) | 11 (12.0%) |
| Disagree | 216 (45.0%) | 170 (43.8%) | 46 (50.0%) |
| **Testing positive for COVID-19** | | | |
| I had symptoms and was tested | 63 (13.1%) | 46 (11.9%) | 17 (18.5%) |
| No, but the people I live with had symptoms or tested positive | 62 (12.9%) | 49 (12.6%) | 13 (14.1%) |
| No and none of the people I live with presented symptoms | 355 (74.0%) | 293 (75.5%) | 62 (67.4%) |
| **Close relatives testing positive for COVID-19** | | | |
| Relatives and friends | 199 (41.5%) | 161 (41.5%) | 38 (41.3%) |
| **Close relatives and friends that passed away from COVID-19** | | | |
| Family | 66 (13.8%) | 51 (13.1%) | 15 (16.3%) |
| Friends | 73 (15.2%) | 60 (15.5%) | 13 (14.1%) |
| **Currently quarantined** | | | |
| No | 427 (89.0%) | 341 (87.9%) | 86 (93.5%) |
| Other | 53 (11.0%) | 47 (12.1%) | 6 (6.5%) |
| **Lack of companionship** | | | |
| Frequently | 172 (35.8%) | 136 (35.1%) | 36 (39.1%) |
| Occasionally | 133 (27.7%) | 111 (28.6%) | 22 (23.9%) |
| Rarely | 175 (36.5%) | 141 (36.3%) | 34 (37.0%) |
| **Emotional isolation** | | | |
| Frequently | 212 (44.1%) | 174 (44.9%) | 38 (41.3%) |
| Occasionally | 141 (29.4%) | 118 (30.4%) | 23 (25.0%) |
| Rarely | 127 (26.5%) | 96 (24.7%) | 31 (33.7%) |
| **Able to cope with the pandemic** | | | |
| Agree | 401 (83.5%) | 317 (81.7%) | 84 (91.3%) |
| Unsure | 37 (7.7%) | 33 (8.5%) | 4 (4.3%) |
| Disagree | 42 (8.8%) | 38 (9.8%) | 4 (4.3%) |
| **Affected by the COVID-19 pandemic** | | | |
| Affected | 313 (65.2%) | 255 (65.7%) | 58 (63.0%) |
| Slightly affected | 167 (34.8%) | 133 (34.3%) | 34 (37.0%) |
| **Affected areas** | | | |
| Mental health | 302 (62.9%) | 254 (65.5%) | 48 (52.2%) |
| Economy | 242 (50.4%) | 195 (50.3%) | 47 (51.1%) |
| Social relations | 325 (67.7%) | 261 (67.3%) | 64 (69.6%) |
| Recreational activities and hobbies | 358 (74.6%) | 292 (75.3%) | 66 (71.7%) |
| **Receiving psychological attention currently** | | | |
| Yes | 96 (20.0%) | 82 (21.1%) | 14 (15.2%) |
| **Received psychological attention in the past** | | | |
| Yes | 249 (51.9%) | 214 (55.2%) | 35 (38.0%) |
| **Satisfied with the support of family and friends** | | | |
| Agree | 390 (81.2%) | 313 (80.7%) | 77 (83.7%) |
| Disagree | 68 (14.2%) | 59 (15.2%) | 9 (9.8%) |
| Unsure | 22 (4.8%) | 16 (4.1%) | 6 (6.5%) |

TABLE 4 Hierarchical multiple linear regression.

| | *b* | SE *B* | β | *t* | *p* |
|---|---|---|---|---|---|
| **Step 1** | | | | | |
| Sex | −4.956 | 1.508 | −0.142 | −3.287*** | 0.001 |
| Age | −0.290 | 0.043 | −0.308 | −6.708*** | 0.000 |
| Marital status | −0.400 | 0.480 | −0.036 | −0.833 | 0.405 |
| Education level | −0.422 | 0.555 | −0.035 | −0.762 | 0.447 |
| **Step 2** | | | | | |
| Sex | −4.673 | 1.518 | −0.134 | −3.079** | 0.002 |
| Age | −0.294 | 0.048 | −0.313 | −6.130*** | 0.000 |
| Marital status | −0.457 | 0.482 | −0.041 | −0.948 | 0.344 |
| Education level | −0.177 | 0.576 | −0.015 | −0.307 | 0.759 |
| Monthly income | −2.440 | 1.561 | −0.088 | −1.563 | 0.119 |
| Employment status | 0.462 | 0.675 | 0.041 | 0.684 | 0.494 |
| **Step 3** | | | | | |
| Sex | −3.935 | 1.453 | −0.113 | −2.708** | 0.007 |
| Age | −0.334 | 0.050 | −0.354 | −6.723*** | 0.000 |
| Marital status | −0.587 | 0.460 | −0.053 | −1.277 | 0.202 |
| Education level | 0.215 | 0.551 | 0.018 | 0.390 | 0.697 |
| Monthly income | −1.693 | 1.490 | −0.061 | −1.136 | 0.257 |
| Employment status | 0.324 | 0.643 | 0.029 | 0.504 | 0.615 |
| Perceived health | −5.738 | 0.849 | −0.293 | −6.760*** | 0.000 |
| Chronic illness | 0.341 | 0.964 | 0.017 | 0.354 | 0.724 |
| **Step 4** | | | | | |
| Sex | −3.332 | 1.137 | −0.096 | −2.929** | 0.004 |
| Age | −0.141 | 0.041 | −0.150 | −3.488*** | 0.001 |
| Marital status | −0.407 | 0.366 | −0.037 | −1.112 | 0.267 |
| Education level | 0.320 | 0.430 | 0.026 | 0.745 | 0.457 |
| Monthly income | −0.069 | 1.171 | −0.003 | −0.059 | 0.953 |
| Employment status | −0.460 | 0.503 | −0.041 | −0.914 | 0.361 |
| Perceived health | −4.296 | 0.672 | −0.219 | −6.397*** | 0.000 |
| Chronic illness | 0.200 | 0.751 | 0.010 | 0.266 | 0.790 |
| Cohabitation | 0.322 | 0.311 | 0.036 | 1.035 | 0.301 |
| Perceived loneliness | 0.853 | 0.479 | 0.081 | 1.783 | 0.075 |
| Perceived isolation | 5.364 | 0.504 | 0.497 | 10.642*** | 0.000 |
| Perceived social support | −0.108 | 0.029 | −0.121 | −3.666*** | 0.000 |
| **Step 5** | | | | | |
| Sex | −2.505 | 0.997 | −0.072 | −2.513* | 0.012 |
| Age | −0.076 | 0.037 | −0.081 | −2.079* | 0.038 |
| Marital status | −0.158 | 0.321 | −0.014 | −0.493 | 0.622 |
| Education level | 0.049 | 0.378 | 0.004 | 0.129 | 0.897 |
| Monthly income | 0.353 | 1.028 | 0.013 | 0.343 | 0.731 |
| Employment status | −0.340 | 0.441 | −0.030 | −0.771 | 0.441 |
| Perceived health | −1.497 | 0.634 | −0.076 | −2.360* | 0.019 |
| Chronic illness | 0.270 | 0.659 | −0.013 | −0.410 | 0.682 |
| Cohabitation | 0.291 | 0.272 | 0.032 | 1.066 | 0.287 |
| Perceived loneliness | 0.617 | 0.421 | 0.059 | 1.466 | 0.143 |
| Perceived isolation | 3.716 | 0.462 | 0.344 | 8.047*** | 0.000 |
| Perceived social support | −0.042 | 0.027 | −0.047 | −1.559 | 0.120 |

*(Continued)*

TABLE 4 Continued

| | *b* | SE *B* | β | *t* | *p* |
|---|---|---|---|---|---|
| Psychiatric illness | 3.196 | 0.556 | 0.173 | 5.752*** | 0.000 |
| Insomnia | 0.703 | 0.104 | 0.223 | 6.737*** | 0.000 |
| Resilience | −0.200 | 0.034 | −0.207 | 5.842*** | 0.000 |

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

to stressful situations (40, 41). Thus, these findings point toward potential protective factors for individuals undergoing quarantine and lockdowns (42).

Regarding the risk factors for exposure to the virus, the current study documented a higher risk of infection among younger adults. Although older adults are a vulnerable group due to higher rates of chronic illnesses and increased mortality rates, emerging adults are more prone to contagion and spread of the virus due to social exposure and the belief that they are less at risk for severe symptoms (43–45). Moreover, other factors linked to the risk of contagion include having high exposure to the virus due to one's profession (e.g., healthcare worker), pregnancy, being immunosuppressed, smoking, and not following biosafety measures. Studies also indicate that vulnerable groups are affected by deficiencies, risks, or limitations related to health services, economic conditions, overcrowding, family dysfunction, unhealthy housing and environment, social insecurity, and discrimination. These risk factors increase the probability of comorbidities such as diabetes, obesity, hypertension, immunosuppression, or smoking (24, 25).

Furthermore, results indicated that male participants reported an increase in the consumption of cigarettes and alcoholic beverages. Some studies show that the stress derived from isolation can be a potential trigger for cigarette and alcohol consumption, which may indicate a maladaptive response to the pandemic (46, 47). In contrast, other studies documented that the pandemic encouraged some people to quit smoking, as smoking has been identified as a risk factor for more severe COVID-19 symptoms (48–51).

In line with other recent studies, results indicated that women experienced greater depression, anxiety, and stress symptoms than men (8–11). Sex differences in mental health symptoms are widely documented (52, 53) and recent research suggests that the COVID-19 pandemic uniquely affected the mental health of men and women. For example, many adult women experienced greater stress during confinement due to increased childcare demands and economic concerns (e.g., loss of employment, work from home mandates (54).

Our analyses also indicated that marital status, education, and economic factors (i.e., monthly income and employment status) were unrelated to depression, anxiety, and stress symptoms. Age and self-perceived health status—but not chronic illness—were negatively associated with depression, anxiety, and stress symptoms. Self-perceived social isolation was positively associated with depression, anxiety, and stress symptoms, whereas self-perceived social support was negatively associated with depression, anxiety, and stress symptoms. However, perceived loneliness and the number of cohabitants were unrelated to depression, anxiety, and stress symptoms. Psychiatric illness and insomnia were positively associated with depression, anxiety, and stress symptoms, whereas psychological resilience was negatively associated with depression, anxiety, and stress symptoms.

The results of this study corroborate previous research documenting an association between self-perceived health status and symptoms of depression, anxiety, and stress (55). Moreover, these results showed that chronic illnesses were not associated with symptoms of depression, anxiety, and stress (56, 57). One possibility for this finding is that most participants were young adults (aged 18–29) who had relatively few chronic illnesses. In addition, depression, anxiety, and stress was unrelated to the marital status, level of education, monthly income, and current employment status of participants. This further contradicts recent research documenting that lower education, low socioeconomic status, and unemployment is associated with greater symptoms of depression, anxiety, and stress (10, 58, 59). However, psychiatric illnesses were associated with symptoms of depression, anxiety, and stress. Feelings of loneliness and isolation are detrimental to mental health as they can be considered risk factors for the development of mental disorders such as depression, anxiety, adjustment disorder, chronic stress, insomnia, or dementia in old age (60, 61). Hence, preexisting mental health problems may be a notable risk factor for psychological distress during lockdowns (62).

In this study, young adults reported higher levels of depression, anxiety, and stress compared to adults. One study indicated that there were higher levels of stress, anxiety, and depression in adults aged 18 to 25 years compared to adults aged 26 to 60 years, and that people over 61 years old scored the lowest in stress, anxiety, and depression (56). Another study documented that people between 18-and 30 years old and over 60 years old presented higher levels of stress compared to middle aged adults (63). In contrast, other research documented that emerging adults experienced higher stress levels, whereas older adults experienced greater anxiety and depression (64). Additionally, women presented higher levels of depression, anxiety, and stress, similarly to other recent studies (65). Results also indicated a negative association between psychological resilience and symptoms of depression, anxiety, and stress. This corroborates previous research documenting that depression, anxiety, stress, insomnia, social disturbance, and somatic symptoms are associated with lower resilience (66). This finding may highlight the importance of resilience as a protective factor in the development of mental health problems in the context of pandemic lockdowns. Likewise, other factors, such as low income, familial problems, and less educational attainment may reduce individuals' resilience (67). In this sample, emerging adults scored lower in resilience compared to older adults. Previous research has indicated that emerging adults are affected more acutely by experiencing a loss or a traumatic situation, therefore, they may have difficulty understanding and controlling negative thoughts and unpleasant emotions such as fear, anger, irritability, and aggressiveness that arise due to social isolation and health-related stress (66, 68, 69).

## Limitations

This research employed a correlational and cross-sectional design, which prevents from drawing causal conclusions about the psychosocial effects of lockdowns. Participants were recruited *via* online convenience sampling, which constrained the pool of potential participants, thereby rendering the study's results as less generalizable. For instance, this study was limited to people with access to social media, computers, or smartphones, which may have resulted in the recruitment of participants who were younger, more educated, and more affluent than the general population. This sampling method may have also yielded a greater number of female participants because women are more interested and willing to participate in online psychological research than men (70). Indeed, several recent COVID-19 online survey studies that used similar recruitment methods obtained samples comprised of a disproportionate number of female participants (54, 71, 72). Nevertheless, at the time of the study, lockdown restrictions affected participants' and researchers' mobility, therefore online surveys were the only feasible option to collect data.

Despite the study's limitations, these data provide useful information about the mental health of Panamanian residents during the pandemic. The strengths of this study include the recruitment of a large sample and the utilization of valid instruments previously used and reported in similar studies. This study is the first report on the psychological impact of COVID-19 in the Panamanian general population and one of the only studies on the psychological impact of COVID-19 in the Latin American region, thus contributing to research on the Latin American population and low-middle income countries.

## Data availability statement

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

## Ethics statement

The studies involving human participants were reviewed and approved by National Research Bioethics Committee of Panama (Comité Nacional de Bioética de la Investigación, CNBI). The patients/participants provided their written informed consent to participate in this study.

## Author contributions

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

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EDITED BY
Joao Mauricio Castaldelli-Maia,
Faculdade de Medicina do ABC, Brazil

REVIEWED BY
Anderson Sousa Martins-da-Silva,
University of São Paulo, Brazil
Ligia Florio,
Universidade de São Paulo, Brazil

*CORRESPONDENCE
Paulino Feliciano
paulinofeliciano32@gmail.com

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# The impact of COVID-19 on self-reported burnout and health and mental health services in Nampula, Mozambique

Paulino Feliciano[1]*, Jennifer J. Mootz[2], Antonio Suleman[1], Austin Y. Su[3], Saida Khan[4], Lidia Gouveia[4], Palmira Santos[4], Milton L. Wainberg[2] and Annika C. Sweetland[2]

[1]Department of Psychiatry and Mental Health, Psychiatric Hospital of Nampula, Nampula, Mozambique, [2]Department of Psychiatry, New York State Psychiatric Institute, Columbia University, New York, NY, United States, [3]Columbia Vagelos College of Physicians and Surgeons, New York, NY, United States, [4]Department of Mental Health, Ministry of Health, Maputo, Mozambique

**Background:** The purpose of this study was to examine the impact of the COVID-19 pandemic on self-reported burnout of health workers, quality of care, and perceptions of COVID-19-related stigma in Mozambique.

**Method:** We conducted a cross-sectional quantitative assessment of 170 frontline health workers in Nampula District, Mozambique, including 149 (87.6%) primary care providers and 21 (12.4%) mental health specialists.

**Results:** Of the 170 frontline workers, only 10.1% of frontline workers were experiencing more professional burnout, whereas 33.3% felt it had lessened. The perceived impact on quality of care also varied, without any significant differences by sex, education level, or mental health training background. Compared to the beginning of the COVID-19 pandemic in March 2020, 42.3 and 38.1% providers felt that their ability to provide mental health and general health care, respectively, had worsened, compared to 57.7 and 61.9% who believed that either there was no change, or that the work had become easier. Likewise, 26.8% of providers felt that their ability to meet patients' needs had gotten more difficult, whereas 43.4% reported no change and 29.8% reported that it was easier. Twenty-two percent of providers reported an overall increase in caseloads since before the pandemic whereas the majority (67.9%) reported a decrease. Providers believed that 57.1% of people in general were afraid of people with COVID-19, 27.5% were afraid of a person recovered from COVID-19, and 39.9% were afraid of a person with family members with COVID-19. The perceived stigma about healthcare professionals was also low; only 27.4% believed that people in general were afraid of healthcare providers who deliver care to people with COVID-19.

**Conclusion:** In contrast with other global studies, many healthcare workers in our sample reported a reduction in burnout, which may be associated with the lower overall caseloads seen during this period. Similarly, the quality of care was minimally impacted. More research is needed to determine whether the experience in Mozambique is unique, or similarly observed in other low-resource settings.

KEYWORDS

**Mozambique, COVID-19, mental health, healthcare workers, stigma, burnout, mental health services**

## Introduction

The COVID-19 pandemic has had a profound impact on the mental health of directly and indirectly affected individuals. A recent meta-analysis of five countries found the prevalence of symptoms of anxiety, depression, and Post-Traumatic Stress Disorder (PTSD) to be 32.6, 27.6, and 16.7%, respectively (1). In subgroup analyses between confirmed and suspected COVID-19 cases, rates were even higher, at 63.9% for anxiety symptoms and 55.4% for depressive symptoms (1). Frontline healthcare workers are highly vulnerable to the mental health impacts of the pandemic. Widespread pandemic-related burnout has been reported in countries such as the United States (2), Spain (3), Italy (4), China (5), and many others, in both inpatient and outpatient settings (3). In another systematic review and meta-analysis of 38 studies from 19 countries, one-third to one-half of all healthcare professionals had evidence of mental health problems. The combined prevalence of PTSD, anxiety, depression, and distress was 49, 40, 37, and 37%, respectively (6). PTSD may be more prevalent among health workers due to increased stress (7). Factors that mediate pandemic-related burnout in healthcare workers include resilience (8), workplace social support (9), and negative financial and economic impacts (10).

In Mozambique, the first case of COVID-19 was detected in March 2020. The first wave of the pandemic occurred between September and November 2020 with 7,983 confirmed cases and a fatality rate of 1% (11). The second wave was from January to March 2021, during which time an additional 67,197 cases were detected and the fatality rate was 1.1% (11). The timing of waves in Mozambique coincides with the timing of waves in other African countries: 73% of African nations similarly experienced a second, more severe COVID wave in late 2020 through early 2021, with a peak mean daily caseload of 23,790 compared to 18,273 in the first wave (12). It is likely, but not known, that there was an overrepresentation of infected healthcare workers in both waves.

This study had three objectives, which were to assess: (1) the impact of COVID-19 on health and mental health care delivery, (2) levels of burnout among frontline health workers, and (3) the stigma related to COVID-19. The study was carried out in February 2021, at the peak of the second wave before vaccines were available in Mozambique.

## Methods

We received ethical approval for this study from Institutional Review Boards at New York State Psychiatric Institute in the US and Mozambique Institute for Health Education and Research in Mozambique.

### Sample

This study was carried out in Nampula Province, in northern Mozambique in the context of an initiative in which all healthcare workers from a random selection of 8 districts had recently been trained to screen for and deliver several evidence-based mental health interventions (13). One hundred and seventy frontline health professionals were invited to participate in this study and all (100%) agreed to participate; professional background and type of recent mental health training is available for 167 (98.2%). This includes 152 (91.0%) primary care providers (physicians and nurse technicians) and 15 (8.9%) psychiatric technicians, a mid-level mental health specialist professional category that is unique to Mozambique, which involves 30 months of technical academic training to provide mental health services, including prescribing psychotropic medications (14). 4 months prior to the survey, all 152 primary care providers in this sample had received several mental health trainings as part of a research study (13); 77 (45.3%) had received partial mental health training (screening for mental disorders and prescription of psychotropic medications) and 75 (44.1%) were additionally trained to deliver three evidence-based counseling interventions for common disorders, substance use disorders, and suicide risk (comprehensive mental health training). Of the 170 providers, 83 were female (48.5%), 86 were male (50.6%), and one declined to respond. The mean age was 31 years (range 21–65, s.d. 8).

### Data collection

A 6-h training was first provided to the seven research assistants to facilitate data collection via REDCap. The research assistants called providers across eight districts

(Erati, Nacaroa, Lipo, Rapale, Mecount, Ribaue, Angoche, Larde) of Nampula Province and inquired about their interest in completing the survey. All primary care providers and psychiatric technicians had received tablets when they completed training for delivery of mental health interventions. For those interested, the research assistants explained the process of completing the survey using their tablet. The research assistants were available to answer any technical questions that arose regarding accessing the survey via the tablet.

### Survey

The survey consisted of 12 items measuring three constructs: (1) the impact of COVID on health and the provision of mental health care; (2) professional burnout; and (3) stigma related to COVID. The first five items asked providers to rate on a 3-point Likert scale the degree of change since the beginning of the pandemic (March 2020) in terms of their ability to provide health and mental health services, quality of care provided, perceived ability to meet the needs of patients and the mental health status of patients. Response options included 1 (worst), 2 (no change), or 3 (best). A sixth item asked them to describe any changes in their patient caseload since March 2020 on a 5 point scale (significantly decreased to significantly increased). Two questions assessed professional burnout: the first asked professionals to rate their level of burnout in general, and the second asked the degree to which their level of burnout had changed over time. Finally, four stigma-related items assessed providers' opinions about the degree to which they thought people in general were afraid of people with COVID-19, people who had previously had COVID-19, family members of people with COVID-19, and/or health workers who see COVID-19 patients based on a 3-point scale (false, a little true, very true).

### Data analysis

We used SPSS 26.0 to summarize and report on demographic characteristics and frequencies in item results. We analyzed the relationship between demographic data (sex, education level, and mental health training) and dependent variable results using the chi-square test for independence. Mental health training was divided into three groups for analysis: partial mental health training, comprehensive mental health training, and psychiatric technicians (mental health specialist). Chi-square values at $p < 0.05$ indicate statistical significance. There were no missing observations for the survey responses about COVID-19.

## Results

### Impact of COVID-19 on healthcare delivery

Most providers indicated that their number of cases had declined since before the pandemic, with just 22% reporting an overall increase. The perceived impact on the quality of mental healthcare delivered varied across the sample, with no significant differences by sex x2 (6, $N = 170$) = 5.480, $p = 0.484$, education level x2 (9, $N = 170$) = 6.817, $p = 0.656$, or mental health training background x3 (6, $N = 167$) = 7.850, $p$ =. 0249. When compared to the quality of care provided before March 2020, 42.3 and 38.1% of providers felt that their ability to provide mental health and general health care, respectively, had worsened. Many providers expressed that there was no change in mental health care provision (29.8%) and health care (37.5%) or noticed that their work was becoming easier (28.0 and 24.4%, respectively). Assessments of the patients' mental health status were evenly distributed among the response options: 35.7% thought the patients' mental health had worsened, 28.6% thought there was no change, and 32.1% thought that patients' mental health had improved. Most providers felt that there were no changes in their ability to meet patients' needs (43.4%) or that meeting patients' needs had become easier since March 2020 (29.8%). Fewer providers (26.8%) found that meeting patients' needs had become more difficult.

### Impact of COVID-19 on professional burnout

Of the 170 frontline workers, only 10.1% felt that their burnout at work had worsened. A little more than half (53%) felt that there was no change and a third (33.3%) felt that burnout had improved. There were no significant differences in feelings of burnout according to sex x2 (8, $N = 170$) = 5.032, $p = 0.754$, education level x2 (9, $N = 170$) = 9.479, $p = 0.394$, or mental health training background x3 (8, $N = 167$) = 13.140, $p = 0.107$.

### Stigma related to COVID-19

Regarding the stigma related to COVID-19, providers believed that people were more likely to be afraid of a person who had COVID-19 (57.1%) or has a family member with COVID-19 (39.9 %). Providers indicated that fewer people were afraid of someone who had recovered from COVID-19 (27.5%) or healthcare professionals caring for patients with COVID-19 (27.4%). Providers noted that people may have some stigma toward individuals with family members that have COVID (40.1%).

## Discussion

In this study, we found that, among primary care providers and psychiatric technicians in Nampula, Mozambique, most did not perceive any decrease in their ability to provide mental or primary healthcare or their ability to fill their patients' needs due to the pandemic. That said, they also noted a decrease in the overall number individuals seeking primary healthcare services. In addition, most providers reported unchanged or decreased levels of burnout as compared to before the pandemic.

These findings stand in stark contrast to the negative mental health impact of the pandemic on health-care workers seen elsewhere in the world, including other African nations. A meta-analysis of 27 studies analyzing mental health symptoms in African healthcare providers during the pandemic found an overall prevalence of 45% for depression 37% for anxiety, and 28% for insomnia (15), which are comparable to the rates of pandemic burnout symptoms found in multi-continental studies (6). Factors that mediated burnout in these settings have included poor work environments, interpersonal and professional conflicts, emotional distress, and low social support (16). However, authors have noted a high degree of variability between individual studies, as well as a significantly lower rate of burnout symptoms in Sub-Saharan Africa when compared to North Africa (16), suggesting heterogeneity of burnout symptoms across the continent. Even with these differences and within this context, our findings are unusual in that most of our surveyed providers reported no change or even improvement in burnout symptoms.

In addition, COVID-19 incidence and mortality rates are generally lower in African countries, including Mozambique, which has been theorized to be due to lower mean age and lower average life expectancy paradoxically leading to a younger, more COVID-resilient population (17). However, these rates may also be underreported. A recent study by the COVID-19 Excess Mortality Collaborators estimated the true death toll of the pandemic as up to three times higher than the official toll, and noted that most African countries, including Mozambique, had a high degree of discordance between reported COVID-19 mortality and excess mortality compared to pre-pandemic levels (18). Combined with the limited COVID-19 testing capacity of many resource-poor African nations (19), these data suggests that the true impact of COVID-19 in Africa remains to be seen.

The decrease in patient volume may also be explained by increased barriers to healthcare. Even before the pandemic, healthcare in Nampula was relatively difficult to access due to distance to clinics and poor road networks (20). In addition, many studies reported that the COVID-19 pandemic caused a reduction in health service use, including hospitalizations and clinic visits, across the African continent. Likely mediators have been quarantine and movement restriction policies widely implemented to prevent spread of infection (19). In Mozambique, all but urgent care healthcare services were temporarily suspended across the country to minimize the spread of COVID-19. Moreover, all patients were required to wear masks to receive any healthcare and, although masks were widely available and mandated throughout the country, any individuals who were not able to purchase a mask may not have been able to seek and receive healthcare services.

Another potential factor affecting our findings is COVID-19 stigma, which our providers noted was prevalent within their patient population and in the community in general. COVID-19 stigma is very common in rural areas of Africa due to limited access to mainstream media and widespread health illiteracy resulting in the spread of COVID-19 misinformation (21). As such, it is highly likely that, across Nampula Province, fear of contracting COVID-19 may have made people less likely to seek care. Paradoxically, these factors could have led to increased time and resources per patient, more favorable working conditions, and less pandemic burnout among providers as a result.

There may be alternative explanations of our findings unrelated to decreases in patient volume. First, malaria, tuberculosis, and HIV are endemic to the area, and regions of Mozambique including Nampula had recently seen polio, cholera, and measles outbreaks in the year prior to the pandemic (22). Medical personnel in Mozambique have more familiarity with infectious disease outbreaks and could therefore be less concerned with COVID-19 given the relatively low mortality rate of COVID-19 compared to other conditions such as tuberculosis and HIV.

Another potential protective factor was a recent policy change that reduced the number of hours providers worked; healthcare providers in Nampula were beneficiaries of this policy without a concomitant decrease in pay. This policy could have reduced financial or work-related stressors associated with burnout (16). Finally, it is important to note that our sample consisted of primary care providers who had recently received several trainings in mental health as part of an ongoing study. Positive outcomes of this training, including normalization of mental health issues and/or direct emotional benefit for healthcare workers, may have also had some protective effect against burnout.

This study had several limitations. First, despite reassurances that all responses were confidential, it is possible that some providers modified their responses due to social desirability. Second, there is some uncertainty as to whether providers in Nampula conceptualized "burnout" in the same way that providers in Western nations or higher-income nations might. The idea of burnout was developed in the United States and Europe and has been criticized as ethnocentric due to its framing around job and profession, concepts that may have different cultural contexts in non-Western communities (23). Despite these criticisms, cross-cultural studies of burnout are minimal. Indeed, the Maslach Burnout Inventory, the leading metric for measuring burnout symptoms, has not yet been validated in African populations (16), although it is used widely there. More research focused on cross-cultural interpretations of burnout is needed to maximize the efficacy of mental health research in non-Western nations. Finally, there was a problem in the translation of one question which led to ambiguity in interpreting results. Instead of saying "are people afraid of a person that *has* COVID-19?" the question was worded in the past tense: "are people afraid of a person that *had* COVID-19?" This was nearly identical in meaning to the subsequent question which was "are people afraid of a person that recovered from COVID-19?" Despite the similarities, the proportion of respondents that said yes to the former question (57.1%) was higher than the responses to the latter question (27.5%), suggesting that they interpreted the question in the intended way (current vs. past infection).

In sum, in this typically overburdened and under-resourced setting, COVID-19 cases did not overwhelm the health system, but rather led to a reduction in the number of people seeking medical care, contributing to more favorable working conditions. The improved working conditions may have mitigated the impact of the burnout pandemic among frontline workers, as well as their ability to deliver quality care. More research is needed to determine whether the experience in Mozambique is unique, or similarly observed in other low-resource settings.

## 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 viewed and approved by the IRBs of New York State Psychiatric Institute and Mozambique Institute for Health Education and Research. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

PF, JM, AS, ACS, and MW: conceptualization, data collection, data analysis, and writing. AS, SK, LG, and PS: data analysis and writing. All authors contributed to the article and approved the final version.

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## Conflict of interest

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

## Publisher's note

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# Perceived access to general and mental healthcare in primary care in Colombia during COVID-19: A cross-sectional study

Carlos Gómez-Restrepo[1,2†], Magda Cepeda[1*†], William C. Torrey[3], Fernando Suarez-Obando[4], José Miguel Uribe-Restrepo[5], Sena Park[6], María Paula Jassir Acosta[1], Pablo Martínez Camblor[6], Sergio M. Castro[1], Jeny Aguilera-Cruz[1], Lilian González[1], Natalia Chaparro[1], Ana María Gómez-Gamez[1], Kathleen Bell[6] and Lisa A. Marsch[6]

[1]Departamento de Epidemiología Clínica y Bioestadística, Pontificia Universidad Javeriana, Bogotá, Colombia, [2]Hospital Universitario San Ignacio, Bogotá, Colombia, [3]Department of Psychiatry, Geisel School of Medicine, Dartmouth College, Hanover, NH, United States, [4]Insituto de Genética, Pontificia Universidad Javeriana, Bogotá, Colombia, [5]Departamento de Psiquiatría y Salud Pública, Pontificia Universidad Javeriana, Bogotá, Colombia, [6]Center for Technology and Behavioral Health, Dartmouth College, Lebanon, NH, United States

EDITED BY
Rahul Shidhaye,
Pravara Institute of Medical Sciences, India

REVIEWED BY
Maria Stefanova Kamusheva,
Medical University of Sofia, Bulgaria
Ruchir Rustagi,
Delhi Health Services, India

*CORRESPONDENCE
Magda Cepeda
macepeda@javeriana.edu.co

†These authors share first authorship

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**Introduction:** The COVID-19 pandemic has had an impact both in general and mental healthcare, challenged the health systems worldwide, and affected their capacity to deliver essential health services. We aimed to describe perceived changes in ease of access to general and mental healthcare among patients with a diagnosis of depression and/or unhealthy alcohol use in Colombia.

**Methods:** This study is embedded in the DIADA project, a multicenter implementation research study aimed at evaluating the integration of mental healthcare in primary care in Colombia. Between November 2020 and August 2021, we conducted a COVID-19 pandemic impact assessment in a cohort of participants with newly diagnosed depression and/or unhealthy alcohol use part of DIADA project. We assessed the ease of access and factors related to perceived ease of access to general or mental healthcare, during the COVID-19 pandemic.

**Results:** 836 participants completed the COVID-19 pandemic impact assessment. About 30% of participants considered their mental health to be worse during the pandemic and 84.3% perceived access to general healthcare to be worse during the pandemic. Most of participants (85.8%) were unable to assess access to mental health services, but a significant proportion considered it to be worse. Experiencing worse ease of access to general healthcare was more frequent among women, patients with diagnosis of depression, and patients with comorbidities. Experiencing worse ease of access to mental healthcare was more frequent among patients aged between 30 and 49.9 years, from socioeconomic status between 4 and 6, affiliated to the contributive social security regime, attending urban study sites, and those who perceived their mental health was worse during the pandemic.

**Discussion:** Despite the overall perception of worse mental health during the pandemic, the use of mental healthcare was low compared to general healthcare. Ease of access was perceived to be worse compared to pre-pandemic. Ease of access and access were affected by geographical study site, socioeconomic status, age and gender. Our findings highlight the need for improved communication between patients and institutions, tailored strategies to adapt the healthcare provision to patients' characteristics, and continued efforts to strengthen the role of mental healthcare provision in primary care.

KEYWORDS

**mental health, primary health care, COVID-19, healthcare access, depression, unhealthy alcohol use, mental healthcare**

## Introduction

The COVID-19 pandemic challenged the provision of healthcare worldwide. Healthcare institutions re-organized and adapted to continue providing both COVID and non-COVID related care. They did so within government-imposed constraints to contain the pandemic spread, which included social distancing, lockdowns, and mobility restrictions. Some strategies used by healthcare institutions included implementing remote healthcare and the prioritization of services deemed as essential (1–4). The implementation of these strategies required adaptation and an accelerated learning curve for all the actors within the systems, but especially for health providers and patients, who had to take part in navigating new processes for healthcare provision and access.

The adjustments that institutions went through to continue providing healthcare within the constraints of the pandemic tested their preparedness for the use of technology in healthcare provision and the fluidity of their communication with their patients. It was not easy and several reports show that health institutions struggled to meet the healthcare and information needs of the patients (2, 5–8). For example, while the institutions required people to self-isolate and to practice social distancing, they provided limited and fragmented information about where and how patients could continue receiving non-COVID healthcare. Along with the fear of contagion, these factors compounded the burden among patients with making the decision whether their symptoms or health conditions were worthy of seeking any healthcare or postponing until unavoidable (5, 7–9). Mental healthcare is one service severely affected by this situation. Indeed, mental healthcare was often deemed as non-essential, resulting in numerous understaffed mental health units and care prioritized only for emergencies and critical cases (6, 8). This magnified already existing barriers in access to mental healthcare, where not only already diagnosed patients struggled to maintain their ongoing care but non-diagnosed patients were undetected, undiagnosed, and untreated. Along with the unprecedented societal, familial and economic burden of the pandemic, the lack of mental healthcare may have contributed to the large toll that mental health difficulties took on the population public health (10, 11).

The DIADA project is a multicenter implementation research project aimed at assessing the integration of a technology-based mental healthcare in six primary care sites in Colombia (12, 13). The model leverages technology and collaborative learning to improve detection, diagnosis and treatment of depression and unhealthy alcohol use. The model implementation was suspended at the time of the arrival of the pandemic in Colombia, in March 2020. At the time, the model had been in preparation and implementation for between 2 years and 6 months across the study sites. In this paper, we assess the perceived ease of access to general and mental healthcare during the pandemic among patients diagnosed with depression and/or unhealthy alcohol use during the model implementation at the study sites.

## Materials and methods

### Methods and design

This study is embedded in the DIADA project. Briefly, the DIADA project implementation was based on a modified stepped-wedge design, where the model was implemented at a new site approximately every 6 months starting on February 2018 through February 2020. The model design has been described elsewhere (12, 13). The project leverages technology and collaborative learning to integrate the model in healthcare provision by general practitioners through universal screening, diagnostic support, and healthcare providers' training in identifying and treating depression and/or unhealthy alcohol use. During the model implementation, we invited patients with newly diagnosed depression and unhealthy alcohol use to participate in a cohort for symptom follow-up during the year after diagnosis, with visits at the third, sixth, ninth, and 12 months. The in-person and by-phone follow-ups were conducted by trained research assistants. We suspended the model implementation on March 16th, 2020, due to the country-wide restrictions imposed to mitigate the COVID-19 pandemic spread. We continued the cohort follow-up remotely by phone. On November 2020, a COVID-19 impact survey was included in the scheduled follow-up questionnaire, provided that the patient agreed to answer it. Given the timing of the survey inclusion, it was applied at the 9 and 12 month follow-up call among the majority of the participants who were being followed. For patients that had already completed their year of follow-ups at the time of the survey inclusion, we requested IRB authorization and the patients' consent to contact them to complete the survey.

## Setting

The technology-based mental healthcare model was first implemented in February 2018 in a primary care center in Bogotá DC. Afterwards, it was implemented in rural Santa Rosa de Viterbo (August 2018), semi-rural Duitama (February 2019), rural Guasca (August 2019), and rural Soacha and Armero-Guayabal (February 2020).

## Participants

Participating patients were newly diagnosed adults (aged 18 years or older) with depression and/or unhealthy alcohol use, detected during consultation with a general practitioner in primary care. We excluded patients with a diagnosis of severe concomitant mental illness such as schizophrenia, bipolar disorder, depression with psychotic characteristics or who expressed suicidal intent. Patients intoxicated or with alcohol withdrawal symptoms who required a higher level of care (emergencies or hospital treatment) or who were unable to provide their informed consent, were not part of the study.

## Variables and measurements tools

The COVID-19 impact survey was developed by researchers of the NIMH U19 Scale-up Hubs (14). The instrument measures the local response to COVID-19 (1 item), exposure to COVID-19 (5 items), impact of COVID-19 (19 items) and access to mental and general health services (10 items). The impact of COVID-19 includes issues such as stigmatization, food insecurity, economic impact, mental health, and alcohol and drug use during the pandemic. We made minor modifications to the survey to add site-specific language and follow-up items to clarify responses. The questionnaire was implemented using REDCap electronic data capture hosted at Pontificia Universidad Javeriana (15, 16) and the research assistants registered the patients' responses through a tablet or computer interface.

## Bias

We attempted to minimize selection bias by building a standard follow-up procedure for contacting patients, including phone calls and standard SMS throughout the follow-up window.

## Outcome measurement

We assessed the perceived ease of access to general and mental healthcare with two questions, where responses options were: easier than before, same as before, more difficult than before, and non-applicable. The questions were prompted with "compared to before the quarantine in March 2020, getting mental (or general) healthcare within the COVID-19 context has been:". We introduced the questions asking the patients to reflect on their experiences in obtaining general or mental healthcare, including access in any healthcare-related context, such as in-person appointments, emergency visits, phone calls and online services with a psychologist, psychiatrist, and/or a primary healthcare provider. The patients assessed the ease of access as non-applicable when they reported not having used or sought to use either service during the pandemic. For analysis purposes, we re-categorized the response alternatives as "same as" or "better than before", "worse than before", and "non-applicable". The questions used in this module are shown in the Appendix 1.

## Sociodemographic and clinical factors

The study asked participants to report on sociodemographic and clinical factors during the recruitment and/or follow-up visits. Gender was registered as male or female. Age was calculated as the years between the date of birth and the date of answering the survey and categorized as 29.9 years or younger, between 30 and 49.9 years, between 50 and 69.9 years, and 70 years or older. Socioeconomic status (SES) (17) was re-categorized as rural SES 1–3, SES 4-6, no response. Social security affiliation was re-categorized as subsidized, contributive, no insurance, prepaid, complementary, or no response. Confirmed COVID-diagnosis was defined as a positive result of PCR as reported by the patient. Comorbidities were defined as having reported any diagnosed condition at recruitment (yes, no, no response). We asked the patients to assess their mental health during the pandemic compared to before, including whether it was worse, about the same, better than before, or no response. Baseline diagnosis corresponded to the diagnosis of depression or unhealthy alcohol use (alone or comorbid with depression) that brought the participant into the study. Symptom severity at baseline corresponded to the score obtained during the screening. For depression, we used the PHQ-9 questionnaire (18) and categorized scores as 0–9 (none to mild), 10–14 (moderate), 15–19 (moderate to severe), and 20–27 (severe). For unhealthy alcohol use, we used the AUDIT questionnaire (19) and categorized to 0–7 (none), 8–15 (mild), and 16–35 (moderate to severe).

## Statistical analysis

The dataset was downloaded and analyzed using the statistical software Stata 14.0 (20). Through data recruitment, a predefined process was implemented to assess and resolve missing information and variable outliers, by either recontacting the participant or verifying information with the corresponding research assistant. We conducted a descriptive analysis of sociodemographic and clinical factors and of the outcome variables (perception of ease of access). Qualitative variables were described as absolute and relative frequencies. Quantitative variables were described as medians and percentiles 25 and 75th. We compared the distribution of sociodemographic and clinical factors of the patients according to their perceived ease of access to either general or mental healthcare. We tested the statistical significance using the Fisher exact test and considered *p* values below 0.05 to be significant.

Our study was approved by the ethics committees of the Pontificia Universidad Javeriana in Colombia and Dartmouth College in the US, as well as by a Data and Safety Monitoring Board appointed by NIMH. All participants provided their written informed consent to participate in the study and gave their verbal informed consent prior to completing the COVID impact questionnaire.

This paper was written following the strengthening the reporting of observational studies in epidemiology (STROBE) recommendations for cross-sectional studies (21).

# Results

Out of 1,258 cohort participants, 836 participants were reachable and agreed to participate in the COVID-19 impact survey. Of these, 760 had a diagnosis of depression, and 76 had a diagnosis of unhealthy alcohol use with or without co-diagnosis of depression. Participants with a depression diagnosis were more likely to participate in the survey than participants with unhealthy alcohol use (68 vs. 56%). Table 1 shows the demographic characteristics of the population. Overall, 77% of the survey respondents were female, about half were aged between 50 and 69.9 years, and about 53% identified their ethnicity as "mestizo". About half of the population belonged to socioeconomic status between 1 and 3 and were married or co-habitating. More than two thirds of the population had any comorbidity (77.8%). There were significant differences in sex, age and marital status distribution of the participants according to baseline diagnoses. Patients with depression diagnosis were mostly women (82.4%), aged between 50 and 69.9 years (50.7%) and married or cohabitating (46.7%), whereas patients with unhealthy alcohol use were primarily men (75%), aged between 18 and 29.9 years (51.3%), and single (47.4%).

In Table 2, we show the differences in the perception of ease of access to general and mental healthcare, according to sociodemographic and clinical factors. Regarding general healthcare, 84.3% of the patients assessed the ease of access to be worse and 7.36% considered it was the same or better than before the pandemic. Women were more likely to assess it as worse (86.7 vs. 76.3%, $p < 0.001$), as well as patients with a baseline diagnosis of depression compared to unhealthy alcohol use (85.7% vs. 70.7%, $p < 0.001$), and patients with comorbidities compared to patients without comorbidities (85.7% vs. 80%, $p = 0.008$).

Regarding mental healthcare, 12.8% of the patients assessed the ease of access as worse and 1.4% assessed it as "same as or better than before". The remaining 85.8% of the patients answered the question as "non-applicable". Patients aged between 30 and 49.9 years were more likely to assess the ease of access to mental healthcare as worse (16.8%), along with patients from SES between 4 and 6 (21.6%), patients affiliated to the contributive social security regime (23.6%), attending urban study sites (24.3%), and patients who perceived their mental health was worse during the pandemic (27%). It is worth noting that, in most comparisons, patients were more likely to answer this question as "non-applicable" than "better as or same than before" or "worse than before" (Table 2).

In Figure 1, we show the differences in the perception of ease of access to general and mental health according to (a) perceived mental health during the pandemic, (b) severity of depression symptoms at baseline, and (c) severity of unhealthy alcohol use at baseline. All differences were statistically significant ($p < 0.001$), except for the perceived ease of access to general healthcare according to severity of depression symptoms at baseline ($p = 0.132$).

# Discussion

Among 836 participants from a primary-care based cohort of patients with a diagnosis of depression and/or unhealthy alcohol use, the ease of access to general and mental healthcare was perceived as worse during the pandemic, compared to

TABLE 1 Characteristics of the study population, according to baseline diagnosis.

| Factors | Depression ($n =$ 760/1,121) | Unhealthy alcohol use[b] ($n = 76/137$) | Total ($n =$ 836/1,258) | $p$-value |
|---|---|---|---|---|
| **Sex** | | | | |
| Men | 134 (17.6%) | 57 (75%) | 191 (22.8%) | <0.001 |
| Women | 626 (82.4%) | 19 (25%) | 645 (77.2%) | |
| **Age (years)** | | | | |
| 18-29.9 | 99 (13%) | 39 (51.3%) | 138 (16.5%) | <0.001 |
| 30-49.9 | 190 (25%) | 18 (23.7%) | 208 (24.9%) | |
| 50-69.9 | 385 (50.7%) | 15 (19.7%) | 400 (47.8%) | |
| 70-89.9 | 86 (11.3%) | 4 (5.3%) | 90 (10.8%) | |
| **Socioeconomic status** | | | | |
| Rural | 110 (14.5%) | 10 (13.2%) | 120 (14.4%) | 0.542 |
| SES 1–3 | 403 (53%) | 36 (47.4%) | 439 (52.5%) | |
| SES 4–6 | 239 (31.4%) | 30 (39.5%) | 269 (32.2%) | |
| NA/NR | 8 (1.1%) | 0 (0%) | 8 (1%) | |
| **Social security affiliation** | | | | |
| Subsidized | 537 (70.7%) | 49 (64.5%) | 586 (70.1%) | 0.479 |
| Contributive | 219 (28.8%) | 27 (35.5%) | 246 (29.4%) | |
| Other[a] | 3 (0.4%) | 0 (0%) | 3 (0.4%) | |
| NA/NR | 1 (0.1%) | 0 (0%) | 1 (0.1%) | |
| **Severity of depression symptoms, according to PHQ-9** | | | | |
| None to mild | 287 (37.8%) | 46 (60.5%) | 333 (39.8%) | <0.001 |
| Moderate | 290 (38.2%) | 19 (25%) | 309 (37%) | |
| Moderate to severe | 139 (18.3%) | 6 (7.9%) | 145 (17.3%) | |
| Severe | 44 (5.8%) | 5 (6.6%) | 49 (5.9%) | |
| **Severity of unhealthy alcohol use symptoms, according to AUDIT** | | | | |
| None | 737 (97%) | 1 (1.3%) | 738 (88.3%) | <0.001 |
| Mild | 14 (1.8%) | 45 (59.2%) | 59 (7.1%) | |
| Moderate to severe | 9 (1.2%) | 30 (39.5%) | 39 (4.7%) | |
| **Setting of study site** | | | | |
| Rural | 167 (22%) | 21 (27.6%) | 188 (22.5%) | 0.151 |
| Urban | 247 (32.5%) | 29 (38.2%) | 276 (33%) | |
| Semi-rural | 346 (45.5%) | 26 (34.2%) | 372 (44.5%) | |
| **Confirmed COVID-diagnosis** | | | | |
| No | 680 (89.5%) | 67 (88.2%) | 747 (89.4%) | 0.697 |
| Yes | 80 (10.5%) | 9 (11.8%) | 89 (10.6%) | |
| **Comorbidities** | | | | |
| Yes | 604 (79.5%) | 46 (60.5%) | 650 (77.8%) | <0.001 |
| No | 150 (19.7%) | 30 (39.5%) | 180 (21.5%) | |
| NA/NR | 6 (0.8%) | 0 (0%) | 6 (0.7%) | |
| **Mental health during pandemic** | | | | |
| Worse than before | 236 (31.1%) | 20 (26.3%) | 256 (30.6%) | 0.159 |
| About the same | 459 (60.4%) | 51 (67.1%) | 510 (61%) | |
| Better than before | 64 (8.4%) | 4 (5.3%) | 68 (8.1%) | |
| NA/NR | 1 (0.1%) | 1 (1.3%) | 2 (0.2%) | |

NA/NR Not applicable/No response. SES Socioeconomic status.
[a] No insurance/Prepaid/Complementary. [b] With or without depression.

TABLE 2 Distribution of sociodemographic and clinical factors related to perceived ease of access to general or mental healthcare.

| Factors | General healthcare | | | | Mental healthcare | | | |
|---|---|---|---|---|---|---|---|---|
| | Same or better $n = 61$ (7.3%) | Worse $n = 704$ (84.3%) | Not applicable $n = 70$ (8.4%) | $p$-value | Same or better $n = 12$ (1.4%) | Worse $n = 107$ (12.8%) | Not applicable $n =$ 717 (85.8%) | $P$-value |
| **Sex** | | | | | | | | |
| Men | 14 (7.4%) | 145 (76.3%) | 31 (16.3%) | <0.001 | 3 (1.6%) | 22 (11.5%) | 166 (86.9%) | 0.806 |
| Women | 47 (7.3%) | 559 (86.7%) | 39 (6%) | | 9 (1.4%) | 85 (13.2%) | 551 (85.4%) | |
| **Age (years)** | | | | | | | | |
| 18–29.9 | 11 (8%) | 102 (73.9%) | 25 (18.1%) | 0.003 | 4 (2.9%) | 20 (14.5%) | 114 (82.6%) | 0.059 |
| 30–49.9 | 15 (7.2%) | 178 (86%) | 14 (6.8%) | | 4 (1.9%) | 35 (16.8%) | 169 (81.3%) | |
| 50–69.9 | 31 (7.8%) | 346 (86.5%) | 23 (5.8%) | | 3 (0.8%) | 46 (11.5%) | 351 (87.8%) | |
| 70–89.9 | 4 (4.4%) | 78 (86.7%) | 8 (8.9%) | | 1 (1.1%) | 6 (6.7%) | 83 (92.2%) | |
| **Socioeconomic status** | | | | | | | | |
| Rural | 9 (7.5%) | 97 (80.8%) | 14 (11.7%) | 0.018 | 0 (0%) | 7 (5.8%) | 113 (94.2%) | <0.001 |
| SES 1-3 | 22 (5%) | 375 (85.4%) | 42 (9.6%) | | 3 (0.7%) | 41 (9.3%) | 395 (90%) | |
| SES 4-6 | 30 (11.2%) | 224 (83.6%) | 14 (5.2%) | | 9 (3.3%) | 58 (21.6%) | 202 (75.1%) | |
| NA/NR | 0 (0%) | 8 (100%) | 0 (0%) | | 0 (0%) | 1 (12.5%) | 7 (87.5%) | |
| **Social security regime** | | | | | | | | |
| Subsidized | 30 (5.1%) | 498 (85%) | 58 (9.9%) | 0.002 | 3 (0.5%) | 49 (8.4%) | 534 (91.1%) | <0.001 |
| Contributive | 31 (12.7%) | 202 (82.4%) | 12 (4.9%) | | 9 (3.7%) | 58 (23.6%) | 179 (72.8%) | |
| Other[a] | 0 (0%) | 3 (100%) | 0 (0%) | | 0 (0%) | 0 (0%) | 3 (100%) | |
| NA/NR | 0 (0%) | 1 (100%) | 0 (0%) | | 0 (0%) | 0 (0%) | 1 (100%) | |
| **Diagnosis** | | | | | | | | |
| Depression | 56 (7.4%) | 651 (85.7%) | 53 (7%) | <0.001 | 12 (1.6%) | 99 (13%) | 649 (85.4%) | 0.667 |
| Unhealthy alcohol use[b] | 5 (6.7%) | 53 (70.7%) | 17 (22.7%) | | 0 (0%) | 8 (10.5%) | 68 (89.5%) | |
| **Setting of study site** | | | | | | | | |
| Rural | 8 (4.3%) | 163 (86.7%) | 17 (9%) | <0.001 | 1 (0.5%) | 17 (9%) | 170 (90.4%) | <0.001 |
| Urban | 35 (12.7%) | 228 (82.9%) | 12 (4.4%) | | 10 (3.6%) | 67 (24.3%) | 199 (72.1%) | |
| Semi-urban | 18 (4.8%) | 313 (84.1%) | 41 (11%) | | 1 (0.3%) | 23 (6.2%) | 348 (93.5%) | |
| **Confirmed COVID-19 diagnosis** | | | | | | | | |
| No | 56 (7.5%) | 622 (83.4%) | 68 (9.1%) | 0.05 | 11 (1.5%) | 92 (12.3%) | 644 (86.2%) | 0.394 |
| Yes | 5 (5.6%) | 82 (92.1%) | 2 (2.2%) | | 1 (1.1%) | 15 (16.9%) | 73 (82%) | |
| **Comorbidities** | | | | | | | | |
| Yes | 50 (7.7%) | 556 (85.7%) | 43 (6.6%) | 0.008 | 11 (1.7%) | 85 (13.1%) | 554 (85.2%) | 0.741 |
| No | 11 (6.1%) | 144 (80%) | 25 (13.9%) | | 1 (0.6%) | 22 (12.2%) | 157 (87.2%) | |
| NA/NR | 0 (0%) | 4 (66.7%) | 2 (33.3%) | | 0 (0%) | 0 (0%) | 6 (100%) | |

NA/NR Not applicable/No response; SES Socioeconomic status.

[a] Other: No insurance/Prepaid/Complementary. [b] With or without depression.

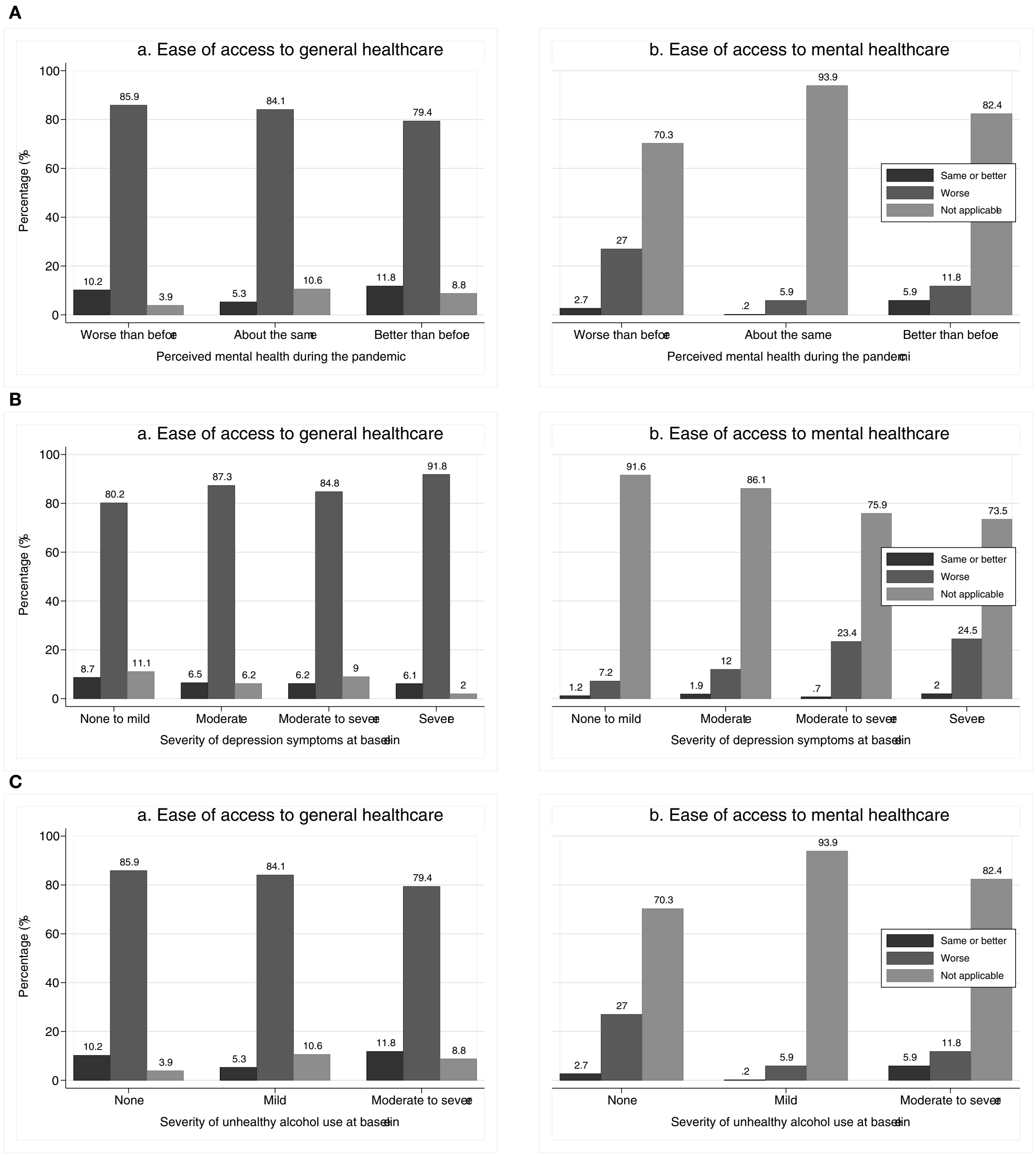

FIGURE 1
**(A)** Perceived ease of access (a) general and (b) mental healthcare during COVID-19, compared to before, according to perceived mental health during the pandemic[a]. **(B)** Perceived ease of access (a) general and (b) mental healthcare during COVID-19, compared to before, according to severity of depression symptoms at baseline[b]. **(C)** Perceived ease of access (a) general and (b) mental healthcare during COVID-19, compared to before, according to severity of unhealthy alcohol use at baseline[c]. [a]Two participants who did not assess their perceived mental health during the pandemic assess ease of access to general healthcare as same as before and not applicable to mental healthcare. [b]Severity of depression symptoms according to PHQ-9. [c]Severity of unhealthy alcohol use according to AUDIT.

before the pandemic. Regarding access to mental healthcare, patients were more likely unable to access it and, among those who were able, they were more likely to perceive access as worse than before. For both general and mental healthcare, there were differences in the factors related to the perceived ease of access. For general healthcare, women, patients with baseline diagnosis of depression, and patients with any comorbidity were more likely to assess the ease of access as worse than before. In contrast, the ease of access for mental healthcare was more likely to be assessed as worse than before by patients aged between 30 and 49.9 years old, belonging to SES between 4 and 6, being affiliated to the contributive social security regime, and those who perceived that their mental health had worsened during the pandemic.

The challenges with access to general healthcare services, especially for non-COVID health conditions, have been described in multiple settings worldwide (3, 7, 22). Several factors have contributed to the quality and the quantity in healthcare access, including the diversion of resources toward the care of COVID patients, the prioritization of the health conditions deemed essential for healthcare provision, and the barriers to implementation of remote healthcare (such as by phone or online) (1, 3–5). Healthcare provision changes required health providers and patients to adapt to quickly changing steps in the process of healthcare and a fast-learning curve in healthcare systems' use of communication technology such as smartphones, computer programs, remote calls, email, and others (5). Therefore, in spite of the huge potential of technology use to improve the efficiency in healthcare processes such as education and information, triage, prescription refill, and consultation and therapy, the changes were a new barrier for patients with poor technology and internet literacy or poor access to technology, especially among patients from rural and semi-urban settings (23). Indeed, in a cross-sectional study with patients from primary care sites in Colombia, we showed that although nearly all the population had a cell phone, only 19.7% of them reported using the internet, 65% of them used the internet to look for health information, and only a third of participants used the phone to arrange a clinical appointment (24). Moreover, technology and internet literacy were lower in rural than in urban settings (24).

Health institutions struggled to adapt healthcare provision within the constraints of the pandemic, leaving patients needing care with multiple sources of uncertainty. For example, during the first days of the pandemic in Colombia, some study sites closed, appointments were canceled, and patients were referred to phone lines for information. However, some patients reported that when they called the lines were rarely answered. Although the emergencies rooms were available, patients dealt with the fear of COVID contagion in those sites. The intense public campaign for self-isolation and social distancing and the lack of clarity regarding the process changes implemented for healthcare provision left patients in the position of needing to decide whether they were candidates for healthcare (i.e., worthy of going to a hospital) and encumbering already crowded hospitals (1, 2, 6, 7, 9). This led to a number of patients refraining or postponing seeking any healthcare which, in some settings, has been correlated to avoidable mortality and poor outcomes for easily manageable health conditions (1, 6, 9). Therefore, the high prevalence of perceived worsening in ease of access to healthcare during the pandemic reflects the struggle of both institutions and patients to maintain fluid communication regarding the steps to both mitigate the pandemic spread and address ongoing healthcare needs.

We observed that women, patients with depression diagnosis, and those with any comorbidity were more likely to assess the ease of access to general healthcare as worse. First, this distribution reflects the actual demographic characteristics of the study sites population (12, 25), suggesting that they remained as the more likely to use the services during the pandemic, even if access was difficult. Nevertheless, the poor perception of ease of access suggests an unmet healthcare need. A large study conducted among European people aged older than 50 years-old reported that women were less likely than men to have their healthcare access postponed or denied (26). It has been reported that, during 2020, the worldwide prevalence of major depressive disorder was 3,152.9 per 100,000 population (95%CI 2, 722.5–3,654.5), which corresponds to an increase of 27.6% compared to before the COVID-19 pandemic (95%CI 25.1–30.3). Such increase was larger among women than among men [women: 29.8% (95%CI 27.3–32.5; men: 24.0% (95%CI 21.5–26.7))] (27). However, it has also been reported that women had large unmet healthcare needs during the pandemic, due to suppression of programs such as reproductive health and mental health, but also due to a larger risk of underemployment and caregiving roles (28, 29). Second, the fact that patients with any comorbidity were more likely to use available healthcare services, even if difficult, is explained by the presence of "chronic programs" or dedicated consultation for chronic health conditions at the study sites (such as hypertension and diabetes), where patients receive regular check-ups and prescription refill. This implied that patients with high baseline levels of healthcare utilization were seeking to get access. This finding was also observed among elderly European patients, where patients with poor overall health and high healthcare utilization had more unmet needs (26). In our context, at the beginning of the pandemic, some patients reported having bought their medication, as they were unable to get appointments in either chronic programs or regular consultation, although the situation eventually resolved. Finally, the finding that patients with more severe depression symptoms at baseline were more likely to use services, whereas patients with more severe symptoms of unhealthy alcohol use were less likely to use them, also reflects differences in the sex and age distribution between these diagnoses. Indeed, patients with depression were more likely to be middle to older aged (between 40 and 65 years-old) women, whereas patients with unhealthy alcohol use were more likely to be young-adult men. It also reflects the phenomenon that while severity of depression correlates to seeking help, patients with unhealthy alcohol use tend to seek less help.

A striking finding of our study is the low number of patients who were able to assess the ease of access for mental healthcare, in spite of being patients with diagnosis of either depression and/or unhealthy alcohol use. Less than 15% of patients assessed the ease of access to mental healthcare, and about 90% of those who did, assessed it as worse. These findings reflect the various barriers identified in access to mental healthcare in our settings (30), which became more evident in the context of the pandemic. First, the low availability of mental health trained healthcare providers, either specialized or not, worsened during the pandemic. For example, due to infection or because mental healthcare was often deemed non-essential, mental health units were understaffed and/or access was restricted to urgent or critical cases (6, 8, 31, 32). In our context, mostly psychologists and psychiatrists at secondary care services offer mental healthcare. However, whereas this option remained unchanged during the pandemic, patients with less severe symptoms at baseline were less likely to use the mental healthcare services, compared to those with more severe symptoms (Table 2). This suggests that either the patients, the institutions (including health insurers), or both, prioritized mental healthcare access for patients with greater symptom severity. Second, the lack of an established relationship between the patient and the healthcare institution led to less use of the services. The "Aging in the Time of COVID-19" study, a web-based survey conducted in 2020 among English speaking people from the US, showed that patients were more likely to access a healthcare provider and to receive medication during the pandemic if they had an established primary care provider relationship (29). These findings were similar to ours, where patients with more severe mental health symptoms were more likely to use mental healthcare services, probably for prescription refill. Third, the fragmentation, poor integration and unclear role of mental healthcare were reflected in the lack of specific strategies to maintain access during the pandemic. In our population, by the arrival of the pandemic in March 2020, we had been preparing and implementing the DIADA model of care between 2 years and 6 months at the study sites. Within a collaborative learning and technology-based model, we worked with the primary care study sites to integrate mental healthcare into their healthcare provision processes. However, most of the patients were unable to assess the access to mental healthcare, implying that either they do not yet consider general healthcare a source of mental healthcare or that they got a referral from their general practitioners, but were not able to navigate the system toward specialized mental healthcare or the mental healthcare received was not satisfactory. For example, some patients complained because the appointment was focused only on prescription refill. Indeed, among the patients who perceived their mental health worsened during the pandemic (255/836, 30%), only about 30% of them accessed mental healthcare but 96.1% reported having used general healthcare. In sum, these findings highlight the need for a continued effort to address the existing barriers to reduce the gaps in mental healthcare access: in the patients' expectations regarding the role of primary care in their mental healthcare, in the perceived role of primary care institutions and general practitioners for mental healthcare provision, and in the efforts by insurers and institutions to enhance the integration across healthcare levels for continued mental healthcare access.

Older adults (aged older than 50 years), patients belonging to SES between 1 and 3, affiliated with the subsidized social security regime, and from rural sites, were less likely to assess access to mental healthcare services. Similar findings have been reported in other settings. For example, in a study among pregnant participants in Massachusetts, those of color (Black, Asian, Multiracial, and/or Hispanic/Latino/a) were more likely to report experienced barriers in their mental healthcare during the pandemic (33). Structural barriers and healthcare access restrictions and policies in relation to immigrants affected their mental and physical health and their probability of seeking and/or actually receiving healthcare during the pandemic (34, 35). In contrast, patients with higher income tend to be more likely to seek and navigate services to gain access to a service. The "Aging in the Time of COVID-19" study showed that the access to medication was higher among older patients with a higher income, but lower among patients with caregiving responsibilities and social isolation (29). Besides structural barriers for access among underserved and poor population (7, 29, 34), lack of education and low technology and internet literacy in this population may also explain access differences. Low education is associated with lower recognition of mental health symptoms (30, 33) and lower technology and internet literacy (24), factors that negatively impact awareness and access to remote healthcare. Finally, large differences in technology and internet access and in the geographical distribution of healthcare professionals explain the differences found in the use and the perceived ease of access to mental healthcare between rural and urban patients. Living in urban settings was considered a potential barrier for healthcare access due to the stricter enforcement of isolation and lockdowns, but access challenges were mitigated by broadband access allowing remote healthcare. COVID-19 restrictions are less strictly enforced in rural areas, but the remote healthcare solutions are less useful (22, 23). In Colombian rural settings, technology and internet access is still difficult with insufficient broadband and low use of smartphones (24). In addition, the rural sites in our study do not have local psychologists and psychiatrists, so the patients must travel to cities nearby for their regular appointments, which increases out of pocket costs and requires the investment of time. These obstacles already discouraged patients to seek mental healthcare with specialized professionals in pre-pandemic time and, during the pandemic, it may have worsened, due to the mobility restrictions, the economic uncertainty, and communication issues between institutions and patients (8).

In Colombia, the affiliation to the healthcare system is mandatory through three regimes: contributive, subsidized, and special regimes (e.g., Military, Professors, and Indigenous). The affiliation occurs through health promoting institutions (EPS, in Spanish), which are mainly private. Additionally, a complementary prepaid regime is accessible through a premium. Healthcare is provided through health provider institutions (IPS, in Spanish), which can also be private or public. IPS are categorized according to the healthcare complexity level they are authorized to provide. The primary care level is the entry point to the health system. Although there are not restrictions to provide non-specialized mental healthcare in primary care, except for specific programs for health promotion and disease prevention (e.g., for physical activity promotion), mental healthcare is provided only by psychologists and psychiatrists at secondary and tertiary level of care. This implies that either a general practitioner or other specialist must refer the patient for specialized mental healthcare. Both psychiatrists and psychologists can implement a treatment plan based on therapy. Virtually, any medical doctor can prescribe psychiatric medications. Nevertheless, in practice, only psychiatrists do so and, for chronic use, patients must regularly attend an appointment for prescription renewal.

The pandemic proved a time for testing the adaptation preparedness of the health systems and institutions and the strength of the relation between patients and healthcare institutions. General healthcare and mental healthcare were both affected by unclear and inequitable adaptations and communication strategies. Although technology is a useful tool for adaptation and continued care, the evidence suggests it is not a one-size-fits-all tool and it requires both communication with, and adaptation to, the population resources and needs. We reflected on what the COVID impact survey tells us about the DIADA model of technology-enhanced depression and unhealthy alcohol use care in primary care. The DIADA model improves patients' access to mental healthcare (12, 25), but with COVID-19 the institutions struggled to maintain the integration of mental healthcare, due to several factors. First, although our model includes a universal screening strategy for depression and unhealthy alcohol use in the waiting rooms in primary care, this step was not feasible with site closures. Consequently, the diagnosis relied on the ability of the providers to identify the patients with mental health conditions and on the patients explicitly seeking mental healthcare. Second, the fact that the first step of our model required that the patient was physically at the primary care site will continue to be a barrier to patient identification to the extent that remote healthcare remains the standard of care for a number of health conditions (22, 23). This implies that the model must adapt to make it sustainable and acceptable through remote care. Third, our model leveraged technology and a collaborative learning strategy to train and support general practitioners to provide mental healthcare in primary care. For this to be effective, Colombian healthcare must strengthen the perception by health insurers, institutions and general practitioners of their key role in mental healthcare provision. Within the Colombian healthcare system, primary care providers continued care for multiple conditions, through programs and plans, encompassing processes ranging from education and treatment to health promotion (e.g., prenatal care) to primary and secondary prevention (e.g., vaccination and chronic programs). For example, even though the follow-up calls we implemented for symptoms assessment were not aimed as therapeutic interventions, our participants often expressed these were a space for relief and wellbeing, as they felt heard and cared for. Not only patients with diagnosed mental health conditions but also the entire base of clients from primary care will benefit from leveraging this regulatory framework and the benefits of technology to promote health and prevent disease through improved mental health (1). Fourth, we trained general practitioners based on a collaborative learning approach to provide mental health interventions depending on the severity of patients' symptoms. Yet, patients who required specialized care often mentioned barriers for access, including lack of psychologists and psychiatrists, a complicated process to access prescribed medications, and transportation to nearby towns to attend appointments. In the Colombian healthcare system, these issues arose partially due to financial and logistical priorities determined by health insurers. Therefore, health insurers should be key stakeholders for the adoption and implementation of our model in order to meet increased demand of mental healthcare in primary care centers. Finally, although our model helped to identify and increase the number of patients requiring mental healthcare in primary care, patients who accessed it during COVID-19 were those with more severe symptoms. These findings were also observed in a systematic review that reported that healthcare utilization decreased by about one third during the pandemic, especially for people at the milder spectrum of an illness (36). Although the authors consider these findings partly reflecting a reduction in over-diagnoses and over-treatment, these findings may also indicate the amount of unmet needs in healthcare and, consequently, relate to the increase of preventable non-COVID morbidity and mortality (9, 36) and the large toll mental health difficulties have had on public health worldwide. Therefore, health systems and institutions could strengthen their efforts to help patients develop awareness about their mental health, design and implement innovative community-tailored strategies to maintain the healthcare provision (including education and information), and find efficient and fast communication ways to help patients navigate the healthcare process.

Our study has some limitations. First, given its cross-sectional nature, it is unclear whether the ease of access to care actually changed during the pandemic. If the patients did not often use the services prior to the pandemic, they may have an unclear idea of how it actually changed. Second, we applied the COVID impact questionnaire between November 2020 and August 2021, spanning the second and third waves of the pandemic in Colombia. Therefore, the collected information reflects the experience of the patients up to the time of the survey, which may have been different in between the evaluation period, given all the adaptations that the healthcare institutions went through. Third, the participation rate in the survey was higher among patients with depression than among patients with unhealthy alcohol use. Therefore, the perceived worsening in ease of access to general and mental healthcare access reflect mostly the experience of the patients with depression, who were mainly women and patients with comorbidities. Nevertheless, the differences in participation according to diagnosis also reflect the differences in the demographic characteristics between these groups, where patients with unhealthy alcohol use were mostly young adult men. Overall, we found these patients were challenging to reach in spite our efforts to locate them. Frequently, their phone numbers had been canceled, which was likely a consequence of economic uncertainty. Given their demographic characteristics, we expect their experience would likely have been that of patients without comorbidities and who, compared to patients with depression, were less likely to use both general and mental healthcare services.

Finally, we did not explore reasons underlying the perception of worse access. Thus, we can only speculate based on the experience of other settings regarding access barriers throughout the pandemic, the information informally provided by the participants during the survey, and the dialogue with the hospitals' leaders. Nevertheless, our findings align with findings of other studies, adding valuable evidence regarding how patients experience healthcare access during the pandemic. To our knowledge, this is the first study that assesses this phenomenon in Colombia, a middle-income country located in Latin America, a region that experiences a large inequity in general and mental healthcare access and a large public health burden both by the pandemic and by mental health deterioration.

In conclusion, Colombian primary care patients diagnosed with depression and/or unhealthy alcohol use experienced worsened general and mental healthcare ease of access during the pandemic, compared to before the pandemic. Patients were unlikely to use mental healthcare services, which correlated to being low SES, affiliated with a subsidized social security regime, and attending a rural study site. The low use and the predominant perception of worsening access to general and mental healthcare reflect issues in the ability of the healthcare systems to adapt the care provision to their clients' resources, abilities and needs and the lack of working and standardized communication strategies between institutions and patients. These findings are not unique to our population, as the pandemic took a large toll in public health worldwide not only due to COVID-19 cases, but also due to unattended needs in non-COVID-19 health conditions. Our findings provide valuable evidence about factors that can be addressed in order to reduce the barriers and inequity in general and mental healthcare access in primary care among population from Colombia and Latin America.

## Data availability statement

Raw anonymized data will be made available upon request. Requests to access the datasets should be directed to MC, macepeda@javeriana.edu.co.

## Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committees of the Pontificia Universidad Javeriana in Colombia and Dartmouth College in the US, as well as by a Data and Safety Monitoring Board appointed by NIMH. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

CG-R, MC, WT, FS-O, JU-R, SC, LM contributed to conception and design of the study. MC, SP, MJ, JA-C, LG, NC, AG-G, LM contributed to data collection and review. MC and JA-C organized the database. MC wrote the first draft of the manuscript. CG-R, WT, FS-O, JU-R, SP, MJ, PM, KB, LM wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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## Conflict of interest

Author LM is affiliated with the business that developed the mobile intervention platform used in this research. This relationship is extensively managed by author LM and her academic institution.

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

## Author disclaimer

The contents are solely the opinion of the authors and do not necessarily represent the views of the NIH or the U.S. government.

## Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.896318/full#supplementary-material

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EDITED BY
Ravi Philip Rajkumar,
Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), India

REVIEWED BY
Samson Femi Agberotimi,
North-West University, South Africa
Gigi Lam,
Hong Kong Shue Yan University, Hong Kong SAR, China

*CORRESPONDENCE
Dan Zhao
zhaodan@cicams.ac.cn
Shuai Liu
liushuai863@foxmail.com

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# Mental distress, quality of life and physical symptoms in Chinese women with ovarian cancer receiving olaparib treatment during the COVID-19 pandemic

Wei Mao[1], Fujuan Li[2], Bin Li[1], Yunxia Li[3], Xiaolan Zhang[4], Zhengjie Ou[1], Shuai Liu[5,6,7]* and Dan Zhao[1]*

[1]Department of Gynecology Oncology, National Cancer Center/National Clinical Research Center for Cancer/Cancer Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China, [2]Department of Gynecology Oncology, The Fifth People's Hospital of Qinghai Province, Xining, China, [3]Department of Medical Oncology, General Hospital of Ningxia Medical University, Yinchuan, China, [4]Department of Gynecology Oncology, Qinghai University Affiliated Hospital, Xining, China, [5]Department of Psychiatry, Nanfang Hospital, Southern Medical University, Guangzhou, China, [6]Guangdong-Hong Kong-Macao Greater Bay Area Center for Brain Science and Brain-Inspired Intelligence, Guangzhou, China, [7]The Third People's Hospital of Qinghai Province, Xining, China

**Objectives:** Women with ovarian cancer (OC) have experienced unprecedented challenges since the novel coronavirus disease-2019 (COVID-19) outbreak in China. We aim to evaluate the experience of psychological status, physical symptoms and quality of life (QoL) and investigate the impact of COVID-19 pandemic on OC patients receiving olaparib.

**Methods:** The survey was conducted online from April 22 to May 12 in 2020. Demographic and clinical questions were listed to collect general information. The degree of insomnia, depression, anxiety, stress symptoms and QoL were assessed by the Chinese versions of the Insomnia Severity Index, the Patient Health Questionnaire-9, the Generalized Anxiety Disorder-7, the Impact of Event Scale-Revised, and the General Functional Assessment of Cancer Therapy, respectively. Multivariate logistic regression analysis was conducted to analyze the risk factors for mental distress and QoL.

**Results:** A total of 56 respondents coming from 15 various provinces in China participated in the survey. The prevalence of insomnia, depressive, anxiety, stress symptoms and reduced QoL were 37.5, 51.8, 37.5, 30.4, and 51.8%, respectively. Unfavorable disease status, shorter period of olaparib administration, adverse events of olaparib and delay in cancer care were correlated with mental health problems. Reduced QoL was also significantly associated with psychological distress.

**Conclusions:** This study emphasized that mental health problems and reduced QoL should gain more attention in women with OC who are receiving oral olaparib at home. Appropriate psychological healthcare strategies are necessary for OC patients during the COVID-19 pandemic.

KEYWORDS

**COVID-19, olaparib, ovarian cancer, quality of life, mental health**

# Introduction

Ovarian cancer (OC) is a globally intractable disease because patients are often diagnosed at a late stage with poor chance to cure. More than 70% of patients experience a relapse within subsequent 3 years (1) and the 5-year survival rates still remain low for decades, which leaves OC survivors huge psychological burden and decreased quality of life (QoL) during their cancer journey (2).

On March 11th 2020, the World Health Organization (WHO) declared the coronavirus disease 19 (COVID-19) a pandemic (3). In China, the number of confirmed cases kept increasing for several months in 2020. This led to a sudden shortage of healthcare units, medical and nursing staff, life protective equipment and ventilators. In cancer community, evidence suggested that cancer survivors harbored a higher risk of viral infection compared with the general population, and that the hospital admission and recurrent hospital visits are potential risk factors for the viral infection (4). Given the data, it is prudent to reduce the hospital visits for cancer patients to minimize the COVID-19 exposure and the risk of transmission. One way to reduce hospital visits is to use oral therapies, especially when there are acknowledged reliable alternatives to chemotherapy in the desired setting. In the setting of ovarian cancer, one of the important oral alternatives are inhibitors of poly (ADP-ribose) polymerase (PARP), such as olaparib, which has been reported to provide a long period of remission and survival benefit for OC survivors after completing cycles of platinum-based chemotherapy (5, 6). Although patients receive PARP inhibitors at home, which help keep the survivors and her caregivers safe by minimizing the need for hospital visits, the benefit-risk profile should not be neglected about their financial situations, medication costs, individual goals to care, current disease status, the need to obtain laboratory values, etc., (7).

Cancer survivors harbor a higher risk of mental distress that is usually underestimated compared with the general population (8). Two main pathways account for the development of mental health problems in cancer patients: the processes involved in the biopsychosocial model (with interdependent contributions of biological, psychological, and social factors) and the range of specific neuropsychiatric effects of certain cancers and their treatments (8). The clinical course of ovarian cancer is often featured by an advanced stage, frequent recurrence, unstable disease status, long periods on therapy owing to the expanding use of maintenance therapies. These characteristics may add more possibility and complexity to mental distress development among OC patients.

Recent research has suggested that cancer patients suffer additional psychological burden during the COVID-19 crisis (9). Among OC survivors, the unprecedented COVID-19 crisis is impacting them for postponing scheduled oncology care, which associates with higher levels of cancer worry, anxiety and depression (10). Though clinical evidence has shown that oral olaparib treatment did not exert a significant detrimental effect on the QoL of OC patients (11), adverse effects such as fatigue, anemia could occur most. Besides, the psychological status during the COVID-19 pandemic remained unclear and no relative research is available in this particular population. To advance survivorship care under the special circumstances, it is meaningful and crucial to understand the potential risk factors of the development of psychological problems and reduced QoL.

Accordingly, in this study, we attempted to evaluate the experience and explore the potential risk factors of mental distress and reduced QoL among OC patients who were receiving oral olaparib treatment during the COVID-19 pandemic. It might be practically helpful in providing targeted psychological supportive care and conducting practical interventions for this population especially under the unique circumstances, for the purpose of achieving multidimensional patient-oriented health management of OC patients.

# Materials and methods

## Participants and procedures

Patients with OC who were receiving oral olaparib during the COVID-19 pandemic in 2020 were asked to fill out the designed questionnaire *via* WeChat-based survey instrument Questionnaire Star (Changsha Ranxing Science and Technology, Shanghai, China) in this cross-sectional study. All the respondents were recruited online and completed the questionnaires from April 22 to May 12. The questionnaires were distributed *via* WeChat group. Specifically, a link to this survey was distributed by investigators to various group chats from several hospitals through the WeChat program. Those who received the link were voluntary to participate in this study with informed consent and could withdraw from the investigation at any moment. This investigation only allowed to be answered once on the same device. The current study was approved by the Ethics Committees of the National Cancer Center/Cancer Hospital at the Chinese Academy of Medical Sciences.

## Measurements

### Social demographics, clinical characteristics and pandemic-related status

General information was collected *via* a list of questions about social demographics, current clinical characteristics and pandemic-related status. Specifically, social demographics, such as age, educational level (junior high school and below, high school/technical secondary school or undergraduate/junior college), marital status (unmarried, married or divorced), type of registered permanent residence (urban or rural), household income (<5,000 yuan/month, 5,000–10,000 yuan per month or >10,000 yuan per month) were collected. Additionally, body mass index (BMI) was calculated based on self-reported weight in kilograms divided by height in meters squared (kg/m$^2$). Clinical characteristics were obtained by self-report of the participants, including the number of chemotherapy courses (<10 or ≥10), disease status (complete control of tumor, partial control of tumor, tumor still in progression or other conditions), comorbidities (hypertension, diabetes, coronary diseases, hyperlipidemia thyroid hypofunction, asthma, abnormal liver function, abnormal renal function, others or none), recurrence (yes or no), the date when they firstly receiving olaparib, adverse events plus severity degrees occurred after administration of olaparib. Pandemic-related status included whether delay in cancer care.

### Insomnia severity index

The Insomnia Severity Index (ISI) is commonly employed for assessment of insomnia across a wide range of patients, with its reliability already validated in cancer survivors (12). And the Chinese version of ISI has been validated measurement tool with Cronbach's alpha of 0.81 (13). There are seven items associated with insomnia symptoms over the previous 2 weeks. The ISI evaluation is rated on a 5-point Likert scale with a summing total score ranging from 0 to 28. A total score of ≥ 8 was defined as experiencing insomnia problems (14).

### The patient health questionnaire-9

Depressive symptoms were assessed by the Chinese version of the Patient Health Questionnaire-9 (PHQ-9), which was an extensively applied and validated questionnaire for depression screening in Chinese population with Cronbach's alpha of 0.86 (15). It contains nine items with each item ranging from 0 to 3 and a total score ranging from 0 to 27 points. The questionnaire assesses the frequency of the depressive symptoms that bother patients during the previous 2 weeks. A total score of ≥5 was regarded as experiencing depressive symptoms (16).

### The generalized anxiety disorder scale (GAD-7)

We use the Chinese version of the Generalized Anxiety Disorder Scale (GAD-7) to evaluate the severity of anxiety in the participants. It is a self-report 7-item questionnaire that can has been reported with satisfactory reliability and validity in Chinese with Cronbach's alpha of 0.89 (17). Patients were asked how often the anxiety symptoms bothered them in the last 2 weeks in each item. The total score of GAD-7 takes values from 0 to 21. A total score of ≥ 5 indicated potential anxiety symptoms (18).

### The impact of event scale-revised

The psychological impact of COVID-19 was evaluated by the Chinese version of Impact of Event Scale-Revised (IES-R). It is widely used to assess psychological stress after a certain stressful event in the past 7 days and has been validated great psychometric properties in China with Cronbach's alpha > 0.8 (19). A total of 22 questions were included, with each question of stress event stated here in the questionnaire referred to the outbreak of COVID-19. It was also graded on a 5-point Likert scale, from not at all (0 point) to always (4 points). Patients with total score of ≥25 were considered as experiencing stress symptoms (20).

### The general functional assessment of cancer therapy (FACT-G)

We use the general Functional Assessment of Cancer Therapy (FACT-G; Chinese version 4.0) to assess quality of life (QoL). The FACT-G questionnaire was first published in 1993 after 5 years of development and testing, meeting all requirements for use in oncology clinical research (21). The Chinese version has showed good psychometric properties with Cronbach's alpha of 0.85 (22). It consists of 27 questions regarding four dimensions of physical well-being (PWB), social/family well-being (SWB), emotional well-being (EWB), and functional well-being (FWB), which is widely used and a well-validated instrument to assess QoL in a range of cancer settings (22). The FACT-G measures are rated on a 5-point Likert scale from 0 (not at all) to 4 (very much), depending on the QoL patients have experienced within the past 7 days. The total score ranges from 0 to 108 and a higher score indicated a better QoL. The cutoff score of low QoL in this investigation was ≤ 70 score of FACT-G (23).

## Statistical analysis

IBM SPSS 25.0 was applied to analyze statistical data. Descriptive statistics were used for demographic, clinical characteristics and pandemic-related status of patients. Shapiro-Wilk normality test was used for normality test in the distribution of continuous variables. For the comparison between groups, the student's *t*-test or the Mann-Whitney *U*-test were conducted for analyzing normally-distributed or non-normal-distributed continuous variables, respectively. And the Chi-Square or Fisher's exact test were conducted for categorical variables. Those factors significantly associated with a certain kind of mental distress would be further incorporated into multivariate logistic regression models. Multivariate logistic regression analysis was performed to detect potential risk factors for symptoms of insomnia, depression, anxiety and stress, as well as low QoL. Bivariate correlation analysis was conducted using Spearman's rank correlation analysis for scores of ISI, GAD-7,

TABLE 1 Comparisons of social demographics, clinical factors and pandemic-related status among participants between with and without mental health problems.

| | **Total samples** $n = 56$ | **Without insomnia symptoms n=35** | **With insomnia symptoms** $n = 21$ | ***P*-value**[a] | **Without depressive symptoms** $n = 27$ | **With depressive symptoms** $n = 29$ | ***P*-value**[a] | **Without anxiety symptoms** $n = 35$ | **With anxiety symptoms** $n = 21$ | ***P*-value**[a] | **Without stress symptoms** $n = 39$ | **With stress symptoms** $n = 17$ | ***P*-value**[a] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Social-demographics** | | | | | | | | | | | | | |
| **Age, mean ± SD** | 56.52 ± 10.85 | 54.86 ± 10.69 | 59.29 ± 10.81 | 0.141 | 55.59 ± 10.88 | 57.38 ± 10.95 | 0.543 | 54.54 ± 11.69 | 59.81 ± 8.57 | 0.079 | 55.59 ± 11.71 | 58.65 ± 8.51 | 0.337 |
| **BMI, mean ± SD** | 23.76 ± 3.38 | 23.59 ± 3.13 | 24.04 ± 3.82 | 0.627 | 24.06 ± 3.06 | 23.47 ± 3.68 | 0.517 | 23.76 ± 2.98 | 23.76 ± 4.04 | 0.996 | 23.43 ± 2.72 | 24.52 ± 4.56 | 0.367 |
| **Educational level** | | | | 0.943 | | | 0.469 | | | **0.004** | | | 0.207 |
| Junior high school and below | 12 (21.4) | 8 (22.9) | 4 (19.0) | | 6 (22.2) | 6 (20.7) | | 7 (20.0) | 5 (23.8) | | 7 (17.9) | 5 (29.4) | |
| High school/technical secondary school | 21 (37.5) | 13(37.1) | 8 (38.1) | | 8 (29.6) | 13 (44.8) | | 8 (22.9) | 13 (61.9) | | 13 (33.3) | 8 (47.1) | |
| Undergraduate/junior College | 23 (41.1) | 14 (40.0) | 9 (42.9) | | 13 (48.1) | 10 (34.5) | | 20 (57.1) | 3 (14.3) | | 19 (48.7) | 4 (23.5) | |
| **Urban area (Yes)** | 49 (87.5) | 30 (85.7) | 19 (90.5) | 0.700 | 23 (85.2) | 26 (89.7) | 0.700 | 31 (88.6) | 18 (85.7) | 1.000 | 35 (89.7) | 14 (82.4) | 0.662 |
| **Marital status (Married)** | 51 (91.1) | 31 (88.6) | 20 (95.2) | 0.640 | 24 (88.9) | 27 (93.1) | 0.664 | 30 (85.7) | 21 (100.0) | 0.145 | 4 (10.3) | 1 (5.9) | 1.000 |
| **Monthly household income (Yuan)** | | | | 0.602 | | | 0.810 | | | 0.167 | | | 0.192 |
| <5,000 | 17 (30.4) | 9 (25.7) | 8 (38.1) | | 9 (33.3) | 8 (27.6) | | 13 (37.1) | 4 (19.0) | | 11 (28.2) | 6 (35.3) | |
| 5,000–10,000 | 29 (51.8) | 19 (54.3) | 10 (47.6) | | 14 (51.9) | 15 (51.7) | | 18 (51.4) | 11 (52.4) | | 23 (59.0) | 6 (35.3) | |
| >10,000 | 10 (17.8) | 7 (20.0) | 3 (14.3) | | 4 (14.8) | 6 (20.7) | | 4 (11.4) | 6 (28.6) | | 5 (12.8) | 5 (29.4) | |
| **Clinical factors** | 35 (62.5) | 23 (65.7) | 12 (57.1) | 0.521 | 20 (74.1) | 15 (51.7) | 0.084 | 23 (65.7) | 12 (57.1) | 0.521 | 25 (64.1) | 10 (58.8) | 0.708 |
| **Chemotherapy courses (<10)** | | | | | | | | | | | | | |
| **Disease status** | | | | 0.174 | | | **0.047** | | | **0.015** | | | 0.286 |
| Complete control of tumor | 30 (53.6) | 22 (62.9) | 8 (38.1) | | 19 (70.4) | 11 (37.9) | | 24 (68.6) | 6 (28.6) | | 23 (59.0) | 7 (41.2) | |
| Partial control of tumor | 21 (37.5) | 10 (28.6) | 11 (52.4) | | 6 (22.2) | 15 (51.7) | | 9 (25.7) | 12 (57.1) | | 12 (30.8) | 9 (52.9) | |
| Tumor still in progression | 5 (8.9) | 3 (8.5) | 2 (9.5) | | 2 (7.4) | 3 (10.3) | | 2 (5.7) | 3 (14.3) | | 4 (10.3) | 1 (5.9) | |
| **Comorbidities (Yes)** | 25 (44.6) | 15 (42.9) | 10 (47.6) | 0.729 | 12 (44.4) | 13 (44.8) | 0.977 | 14 (40.0) | 11 (52.4) | 0.367 | 17 (43.6) | 8 (47.1) | 0.810 |
| **Recurrence (Yes)** | 36 (64.3) | 22 (62.9) | 14 (66.7) | 0.773 | 15 (55.6) | 21 (72.4) | 0.188 | 21 (60.0) | 15 (71.4) | 0.388 | 25 (64.1) | 11 (64.7) | 0.965 |
| **Time since firstly receiving olaparib** | | | | 0.082 | | | **0.044** | | | 0.247 | | | 0.857 |
| <3 months | 17 (30.4) | 7 (20.0) | 10 (47.6) | | 5 (18.5) | 12 (41.4) | | 9 (25.7) | 8 (38.1) | | 11 (28.2) | 6 (35.3) | |
| 3–6 months | 24 (42.9) | 18 (51.4) | 6 (28.6) | | 11 (40.7) | 13 (44.8) | | 14 (40.0) | 10 (47.6) | | 17 (43.6) | 7 (41.2) | |
| >6months | 15 (26.7) | 10 (28.6) | 5 (23.8) | | 11 (40.7) | 4 (13.8) | | 12 (34.4) | 3 (14.3) | | 11 (28.2) | 4 (23.5) | |
| **Adverse events** | | | | | | | | | | | | | |

*(Continued)*

TABLE 1 (Continued)

| | **Total samples $n = 56$** | **Without insomnia symptoms n=35** | **With insomnia symptoms $n = 21$** | ***P*-value**[a] | **Without depressive symptoms $n = 27$** | **With depressive symptoms $n = 29$** | ***P*-value**[a] | **Without anxiety symptoms $n = 35$** | **With anxiety symptoms $n = 21$** | ***P*-value**[a] | **Without stress symptoms $n = 39$** | **With stress symptoms $n = 17$** | ***P*-value**[a] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fatigue (Yes)** | 49 (87.5) | 29 (82.9) | 20 (95.2) | 0.237 | 21 (77.8) | 28 (96.6) | **0.048** | 29(82.9) | 20 (95.2) | 0.237 | 36 (92.3) | 13 (76.5) | 0.182 |
| **Anemia (Yes)** | 20 (35.7) | 13 (37.1) | 7 (33.3) | 0.773 | 5 (18.5) | 15 (51.7) | **0.010** | 8 (22.9) | 12 (57.1) | **0.010** | 12 (30.8) | 8 (47.1) | 0.242 |
| **Leukopenia (Yes)** | 19 (33.9) | 14 (40.0) | 5 (23.8) | 0.215 | 6 (22.2) | 13 (44.8) | 0.074 | 8 (22.9) | 11 (52.4) | **0.024** | 13 (33.3) | 6 (35.3) | 0.887 |
| **Neutropenia (Yes)** | 10 (17.9) | 8 (22.9) | 2 (9.5) | 0.290 | 3 (11.1) | 7 (24.1) | 0.299 | 3 (8.6) | 7 (33.3) | **0.030** | 8 (20.5) | 2 (11.8) | 0.706 |
| **Thrombocytopenia (Yes)** | 6 (10.7) | 3 (8.6) | 3 (14.3) | 0.661 | 2 (7.4) | 4 (13.8) | 0.671 | 2 (5.7) | 4 (19.0) | 0.183 | 3 (7.7) | 3 (17.6) | 0.354 |
| **Stomatitis (Yes)** | 12 (21.4) | 6 (17.1) | 6 (28.6) | 0.334 | 7 (25.9) | 5 (17.2) | 0.429 | 8 (22.9) | 4 (19.0) | 1.000 | 8 (20.5) | 4 (23.5) | 1.000 |
| **Nausea and vomiting (Yes)** | 29 (51.8) | 18 (51.4) | 11 (52.4) | 0.945 | 9 (33.3) | 20 (69.0) | **0.008** | 12 (34.4) | 17 (81.0) | **0.001** | 18 (46.2) | 11 (64.7) | 0.201 |
| **Diarrhea (Yes)** | 6 (10.7) | 4 (11.4) | 2 (9.5) | 1.000 | 2 (7.4) | 4 (13.8) | 0.671 | 2 (5.7) | 4 (19.0) | 0.183 | 4 (10.3) | 2 (11.8) | 1.000 |
| **ALT/AST Elevation (Yes)** | 4 (7.1) | 1 (2.9) | 3 (14.3) | 0.143 | 3 (11.1) | 1 (3.4) | 0.343 | 3 (8.6) | 1 (4.8) | 1.000 | 3 (7.7) | 1 (5.9) | 1.000 |
| **Myalgia and Arthralgia (Yes)** | 14 (25.0) | 5 (14.3) | 9 (42.9) | **0.017** | 7 (25.9) | 7 (24.1) | 0.877 | 9 (25.7) | 5 (23.8) | 0.873 | 9 (23.1) | 5 (29.4) | 0.739 |
| **Pandemic-related Status** | | | | | | | | | | | | | |
| **Delay in cancer care (Yes)** | 35 (62.5) | 17 (48.6) | 18 (85.7) | **0.005** | 14 (51.9) | 21 (72.4) | 0.112 | 20 (57.1) | 15 (71.4) | 0.285 | 23 (59.0) | 12 (70.6) | 0.409 |

P-values in bold indicate statistical significance. Insomnia symptoms: Insomnia Severity Index $\geq 8$; Depressive symptoms: Patient Health Questionnaire-9 $\geq 5$; Anxiety symptoms: Generalized Anxiety Disorder-7 $\geq 5$; Stress symptoms: Impact of Event Scale-Revised $\geq 25$. ALT: alanine aminotransferase; AST: aspartate aminotransferase; BMI: body mass index; CI: confidence interval; OR: odds ratio; SD: standard deviation.

[a] Independent sample t-test for continuous variables and $\chi 2$ test for categorical variables.

PHQ-9, IES-R and FACT-G. All statistical tests were two-sided and a $p$-value $< 0.05$ was considered significant.

## Results

A total of 57 patients aged 37–80 coming from 15 various provinces answered the questionnaires with valid data. One participant was excluded in the data analysis due to one missing value about disease status so the effective rate was 98.2%. The socio-demographics, clinical characteristics and pandemic-related status of the participants are presented in Table 1. The mean age of the participants was 56.5 years (range, 37–80 years). The mean age at their diagnosis of OC was 52.9 years (range, 21–78 years). The most common tumor histology was serous epithelial ovarian carcinoma, accounting for 80.4% of the patients. Forty-two participants had previously undertaken genetic testing, in which 33 (58.9%) patients carried a *BRCA1/2* mutation, 1 with *FANCI* mutation, 1 with *PIK3CA* variants, 1 with Lynch symptom, 1 with homologous recombination deficiency (HRD) and the rest were negative. Thirty (53.6%) patients had the tumor completely controlled and 21 (37.5%) had partial control of the tumor. There were 25 (44.6%) patients with various comorbidities, in which hypertension ($n$ = 15, 26.8%) was most common. Thirty-six (64.3%) patients undergone relapses after initial treatment. The earliest time for patients who received oral olaparib as treatment was in August, 2018, and the latest was in April, 2020. Forty-six (82.1%) respondents reported receiving olaparib as maintenance therapy, and the rest were taking olaparib as direct therapy to cancer. Most patients ($n$ = 24, 42.9%) have taken olaparib for 3–6 months.

There were 35 (62.5%) participants reporting their experience of delay in cancer care due to various reasons during the COVID-19 pandemic; 4 (7.1%) reporting a severe delay in cancer care and 31 (55.3%) experienced a slight or moderate delay. With respect to current worrying during the pandemic, 13 (23.2%) patients did not get worried about treatment postponement but 22 (39.3%) patients were concerned about interruption of regular reexamination or timely treatment. In the last of the questionnaire, we asked participants whether in need of psychological support, 27 (48.2%) required some kind of psychological support.

As Figure 1 exhibited, the most common self-reported adverse event was fatigue ($n$ = 49, 87.5%), followed by nausea or vomiting ($n$ = 29, 51.8%), anemia ($n$ = 20, 35.7%), leukopenia ($n$ = 19, 33.9%), myalgia and arthralgia ($n$ = 14, 25%), and stomatitis ($n$ = 12, 21.4%). Anemia was most common in hematological adverse events. Almost all hematological adverse events were $\leq$ grade 3 except that only one patient reported neutropenia was once grade 4. Grade 2 was the most common severity of anemia (45%) and thrombocytopenia (83.3%), respectively. Only 2 (3.6%) patients reported no experience of significant adverse events. With regard to non-hematological adverse events, grade 2 was the most common severity degree in stomatitis and transaminase elevation, and the others were mostly grade 1.

The median scores of ISI, PHQ-9, GAD-7, IES-R among participants were 5.50 (1–11), 5.00 (2–11), 3.00 (0–7), 18.50 (4–28.25), and the mean score of FACT-G was 65.96 (50–80.5). The prevalence of insomnia, depressive, anxiety, stress symptoms and low QoL were 37.5, 51.8, 37.5, 30.4, and 51.8%, respectively.

In univariate analyses, Table 1 shows that insomnia symptoms were significantly associated with delay in cancer care and myalgia or arthralgia ($p < 0.05$). Depressive symptoms were significantly related to worse disease status and shorter time since firstly receiving olaparib, as well as fatigue, anemia and nausea or vomiting ($p < 0.05$). Anxiety was significantly correlated with educational level, disease status, anemia, leukopenia, neutropenia, nausea or vomiting ($p < 0.05$). Stress symptoms were not statistically significantly associated with any factors. In multivariate analyses adjusting for age, as exhibited in Table 2, a delay in cancer care ($p = 0.010$, adjusted OR: 7.794) and myalgia or arthralgia ($p = 0.023$, adjusted OR: 5.453) were independent risk factors for insomnia symptoms. Patients who had received olaparib treatment for <3 months ($p = 0.018$, adjusted OR: 7.897), and suffered nausea or vomiting ($p = 0.007$, adjusted OR: 5.703) were more prone to be at higher risk for depressive symptoms. As for anxiety symptoms, tumor under partial control ($p = 0.008$, adjusted OR: 17.387), neutropenia ($p = 0.038$, adjusted OR: 12.686), and nausea or vomiting ($p = 0.006$, adjusted OR: 18.738) were independent risk factors for developing anxiety symptoms. With regard to stress symptom, monthly household income and fatigue symptom ($p < 0.2$) were incorporated into the final multivariate analysis due to lack of variables with $p$-values $< 0.05$.

As Table 3 displays, the scores of ISI, PHQ-9, GAD-7 and IES-R showed significant pairwise positive correlation ($r = 0.414 \sim 0.881$, $p < 0.01$). Thereinto, PHQ-9 and GAD-7 scores were strongly correlated with each other most ($r = 0.881$, $p < 0.01$). As shown in Table 4, in the univariate analyses, educational level, disease status, time since firstly receiving olaparib, fatigue, anemia, depressive and anxiety symptoms were all statistically significantly associated with QoL ($p < 0.05$). Considering multicollinearity between depressive and anxiety symptoms, we chose anxiety only into subsequent multivariate analyses. In multivariate analyses adjusting for age, time since firstly receiving olaparib and anxiety symptom were independently associated with QoL. Those who had taken olaparib for 3–6 months ($p = 0.030$, adjusted OR: 15.115) and suffered anxiety symptom ($p = 0.001$, adjusted OR: 80.393) were at higher risks for reduced QoL.

## Discussion

In this study, it was suggested that the prevalence of mental health problems seemed to be higher than expected in OC

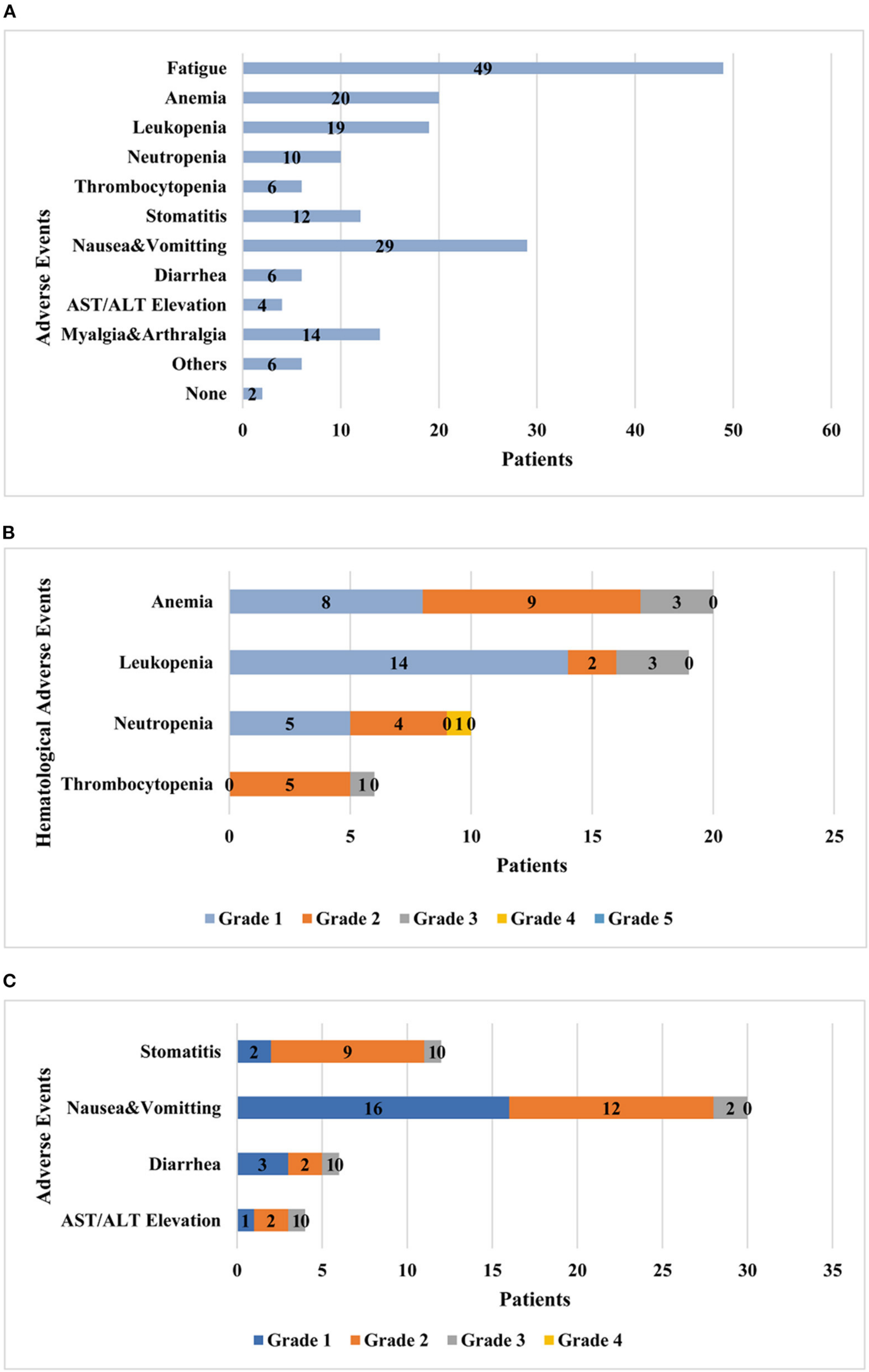

FIGURE 1
Adverse events occurred and graded during administration of oral olaparib. **(A)** Adverse events that patients reported in the course of olaparib treatment. **(B)** Patients with hematological adverse events graded in CTCAE. **(C)** Patients with other adverse events graded in WHO Toxicity Grading. CTCAE, Common Terminology Criteria for Adverse Effects; WHO, World Health Organization.

TABLE 2 Risk factors related to mental health problems.

| | Insomnia symptoms | | Depressive symptoms | | Anxiety symptoms | | Stress Symptoms | |
|---|---|---|---|---|---|---|---|---|
| | Adjusted OR (95%CI) | *P*-value[a] | Adjusted OR (95%CI) | *P*-value[a] | Adjusted OR (95%CI) | *P*-value[a] | Adjusted OR (95%CI) | *P*-value[a] |
| **Social-demographics** | | | | | | | | |
| **Age, mean ± SD** | 1.058 (0.995–1.124) | 0.071 | 1.016 (0.959–1.075) | 0.596 | 1.083 (0.987–1.190) | 0.093 | 1.027 (0.973–1.083) | 0.332 |
| **Educational level** | | | | | | | | |
| Junior high school and below | | | | | Reference | 0.067 | | |
| High school/technical secondary school | | | | | 4.057 (0.522–31.502) | 0.181 | | |
| Undergraduate/junior college | | | | | 0.114 (0.005–2.582) | 0.172 | | |
| **Monthly household income (Yuan)** | | | | | | | | |
| <5,000 | | | | | | | | 0.190 |
| 5,000–10,000 | | | | | | | | 0.121 |
| >10,000 | | | | | | | | 0.111 |
| **Clinical factors** | | | | | | | | |
| **Disease status** | | | | | | | | |
| Complete control of tumor | | | | 0.158 | Reference | **0.030** | | |
| Partial control of tumor | | | | 0.058 | 17.387 (2.093–144.427) | **0.008** | | |
| Tumor still in progression | | | | 0.847 | 5.245 (0.266–103.375) | 0.276 | | |
| **Time since firstly receiving olaparib** | | | | | | | | |
| <3 months | | | 7.897 (1.419–43.943) | **0.018** | | | | |
| 3–6 months | | | 4.318 (0.900–20.705) | 0.067 | | | | |
| >6 months | | | Reference | 0.056 | | | | |
| **Adverse events** | | | | | | | | |
| **Fatigue (Yes)** | | | | 0.114 | | | | |
| **Anemia (Yes)** | | | | 0.075 | | 0.139 | | |
| **Leukopenia (Yes)** | | | | | | 0.568 | | |
| **Neutropenia (Yes)** | | | | | 12.686 (1.149–140.108) | **0.038** | | |
| **Thrombocytopenia (Yes)** | | | | | | | | |
| **Nausea and vomiting (Yes)** | | | 5.703 (1.599–20.339) | **0.007** | 18.738 (2.342–149.919) | **0.006** | | |
| **Diarrhea (Yes)** | | | | | | | | |
| **Myalgia and arthralgia (Yes)** | 5.453 (1.267–23.474) | **0.023** | | | | | | |
| **Pandemic-related status** | | | | | | | | |
| **Delay in cancer care (Yes)** | 7.794 (1.645–36.919) | **0.010** | | | | | | 0.398 |

P-values in bold indicate statistical significance. Insomnia symptoms: Insomnia Severity Index ≥ 8; Depressive symptoms: Patient Health Questionnaire-9 ≥ 5; Anxiety symptoms: Generalized Anxiety Disorder-7 ≥ 5; Stress symptoms: Impact of Event Scale-Revised ≥ 25. CI: confidence interval; OR: odds ratio; SD: standard deviation.

[a] Multivariate binary logistic regression adjusted for age (enter method) in block 1, other social demographics, clinical factors and pandemic-related status significantly associated with a certain kind of mental health problems were incorporated in block 2 (forward likelihood ratio method).

patients. Disease status of tumor under partial control, shorter time since firstly taking olaparib, adverse events such as nausea or vomiting, and delay in cancer care due to the pandemic were associated with their adverse psychological well-being. Additionally, participants who had received olaparib treatment for less than 6 months and suffered anxiety symptoms were susceptible to decreased QoL.

A total of 37.5% of OC patients reported a symptom of anxiety during the COVID-19 pandemic in our survey, slightly higher than a recent meta-analysis reporting an anxiety prevalence rate of 31.3% (24). This was a greater proportion than we had expected compared with an anxiety prevalence rate of 26.23% (which spanned 22.30–33.56%) among on-treatment OC patients reported in a previous systematic review outside of the COVID-19 time frame (25). In the setting of the COVID-19 pandemic, one study showed 35.5% of women had an abnormal HADS Anxiety score in gynecologic cancer population, which was close to our data despite the scales we used differed. This may suggest the COVID-19 pandemic seems to adversely affect anxiety. We found that patients with moderate educational level were more susceptible to suffering anxiety symptom. It may be attributed to the lack of relevant knowledge of COVID-19

TABLE 3 Bivariate correlations among mental health scores and QoL.

| | ISI | PHQ-9 | GAD-7 | IES-R | PWB | SWB | EWB | FWB | FACT-G |
|---|---|---|---|---|---|---|---|---|---|
| ISI | 1 | 0.592** | 0.414** | 0.474** | −0.485** | −0.056 | −0.360** | −0.336* | −0.355** |
| PHQ-9 | | 1 | 0.881** | 0.535** | −0.798** | −0.119 | −0.754** | −0.348** | −0.590** |
| GAD-7 | | | 1 | 0.503** | −0.776** | −0.182 | −0.856** | −0.340* | −0.626** |
| IES-R | | | | 1 | −0.471** | 0.103 | −0.446** | −0.113 | −0.198 |
| PWB | | | | | 1 | 0.136 | 0.691** | 0.362** | 0.612** |
| SWB | | | | | | 1 | 0.270 | 0.523** | 0.714** |
| EWB | | | | | | | 1 | 0.384** | 0.689** |
| FWB | | | | | | | | 1 | 0.831** |
| FACT-G | | | | | | | | | 1 |

Spearman's rank correlation analysis was conducted for all above variables. **$p < 0.01$; *$p < 0.05$.

QoL, quality of life; ISI, Insomnia Severity Index; PHQ-9, The Patient Health Questionnaire-9; GAD-7, The Generalized Anxiety Disorder-7 Scale; IES-R, The Impact of Event Scale-Revised; PWB, physical well-being; SWB, social/family well-being; EWB, emotional well-being; FWB, functional well-being; FACT-G, The General Functional Assessment of Cancer Therapy.

and preventive practices in patients with a lower educational degree compared with those with an undergraduate or a junior college degree (26), which is consistent with the trends of the results of another study (27). Conversely, previous evidence also indicated a trend that respondents with higher levels of education showed a higher prevalence of anxiety, which was owing to their high self-awareness about their own health (28). Not surprisingly, disease status at the survey time point was associated with patients' psychologic well-being. Patients who self-identified as gaining partial control of tumor were most likely to suffer anxiety compared with those who had a complete tumor control. It is understandable that partial remission status leads to fear of quick cancer recurrence and insecurity of the current oral treatment efficacy which contribute to cancer worry and mental health problems. And deprivation of access to timely clinic in-person visits for healthcare counseling due to the COVID-19 pandemic may add fuel (10). In contrast, women who self-reported their tumor still in progression were not anxious the most as we had anticipated. Despite this, we did not find an association between disease recurrence and positive mental distress, similar to findings in other studies (29, 30). This may be attributable to a selection bias or reflect a higher level of endurance and resilience among patients in worse disease status who are capable of adequately coping through combating OC and are more willing to complete a survey (31). It is possible that the life-threatening nature, frequent disease relapses and the limited remaining life expectancy of OC remind patients to focus more on the current efficacy they are receiving rather than expect too much. Previous studies demonstrated that cancer/treatment-related physical symptoms issues (fatigue, nausea, etc.) led to higher prevalence of mental distress (30, 32). In this study, we observed that neutropenia and nausea or vomiting owing to the olaparib therapy were associated with a higher risk for anxiety. Severe neutropenia can cause fever thus add more complexity and make it more difficult for OC patients to gain timely medical interventions during this pandemic. The unfavorable physical symptoms linked to cancer treatment should be emphasized in the management of psychological healthcare during the COVID-19 pandemic.

In the present survey, the prevalence of depressive symptom in OC patients receiving olaparib was 51.8%, ranking first among the four psychological distress. Depression is quite a common complication among cancer survivors after diagnosis, with the prevalence rates up to four-times higher than the general population (33). A Chinese study (27) reported a 47.0% prevalence rate of perceived depression in patients with OC. A meta-analysis showed that among Chinese cancer patients, the prevalence rate of depression was up to 54.9% (34). The present data reported a depression prevalence rate similar to previous researches. In this study, we found that OC patients receiving shorter time period of olaparib (<3 months) were more likely to suffer depression symptom. Actually, the potential impact of the duration of olaparib treatment on the respondents' mental health is unknow. The speculations over this trend are various. On a psychological level, compared to traditional treatment strategies like surgery and chemotherapy, the converted novel oral alternative therapy may render patients uncertain for the efficacy and they might harbor misgivings on their disease controlling under oral olaparib, causing a cancer-related worry. From neuropsychiatric perspectives, cancer treatment can give rise to anxiety or depression (8). For instance, previous researchers observed that 14% of gynecological cancer patients had a common presented complaint about depression after pelvic irradiation (8). Less well recognized by clinicians are the adverse neuropsychiatric effects of PARP inhibitors. The administration of olaparib may affect alterations of the internal environment and trigger mental distress by possible unclear biological effects. Patients who had taken oral olaparib for more than 6 months experienced less depressive symptom. It is likely that these patients may have tolerated adverse physical

TABLE 4 Risk factors associated with low QoL.

| | **Total Samples** $n = 56$ | **Univariate analysis**[a] | | | **Multivariate analysis**[b] | |
|---|---|---|---|---|---|---|
| | | **High QoL** $n = 27$ | **Low QoL** $n = 29$ | ***P*-value** | **Adjusted OR (95%CI)** | ***P*-value** |
| **Social-demographics** | | | | | | |
| **Age, mean ± SD** | 56.52 ± 10.85 | 54.00 ± 10.81 | 58.86 ± 10.54 | 0.094 | 1.012 (0.947–1.082) | 0.720 |
| **BMI, mean ± SD** | 23.76 ± 3.38 | 23.92 ± 2.87 | 23.60 ± 3.84 | 0.726 | | |
| **Educational Level** | | | | **0.017** | | |
| Junior high school and below | 12 (21.4) | 7 (25.9) | 5 (17.2) | | | 0.492 |
| High school/technical secondary school | 21 (37.5) | 5 (18.5) | 16 (55.2) | | | 0.428 |
| Undergraduate/junior college | 23 (41.1) | 15 (55.6) | 8 (27.6) | | | 0.910 |
| **Urban area (Yes)** | 49 (87.5) | 25 (92.6) | 24 (82.8) | 0.424 | | |
| **Marital status (Married)** | 51 (91.1) | 24 (88.9) | 27 (93.1) | 0.664 | | |
| **Monthly household income (Yuan)** | | | | 0.191 | | |
| <5,000 | 17 (30.4) | 11 (40.7) | 6 (20.7) | | | |
| 5,000–10,000 | 29 (51.8) | 13 (48.1) | 16 (55.2) | | | |
| >10,000 | 10 (17.9) | 3 (11.1) | 7 (24.1) | | | |
| **Clinical factors** | | | | | | |
| **Chemotherapy courses (<10)** | 35 (62.5) | 18 (66.7) | 17 (58.6) | 0.534 | | |
| **Disease status** | | | | **0.045** | | |
| Complete control of tumor | 30 (53.6) | 19 (70.4) | 11 (37.9) | | | 0.977 |
| Partial control of tumor | 21 (37.5) | 7 (25.9) | 14 (48.3) | | | 0.965 |
| Tumor still in progression | 5 (8.9) | 1 (3.7) | 4 (13.8) | | | 0.841 |
| **Comorbidities (Yes)** | 25 (44.6) | 11 (40.7) | 14 (48.3) | 0.571 | | |
| **Recurrence (Yes)** | 36 (64.3) | 14 (51.9) | 22 (75.9) | 0.061 | | |
| **Time since firstly receiving Olaparib** | | | | **0.014** | | |
| <3 months | 17 (30.4) | 7 (25.9) | 10 (34.5) | | 6.369 (0.501–81.022) | 0.154 |
| 3–6 months | 24 (42.9) | 8 (29.6) | 16 (55.2) | | 15.115 (1.309–174.584) | **0.030** |
| >6 months | 15 (26.8) | 12 (44.4) | 3 (10.3) | | Reference | 0.089 |
| **Adverse events** | | | | | | |
| **Fatigue (Yes)** | 49 (87.5) | 21 (77.8) | 28 (96.6) | **0.048** | | 0.114 |
| **Anemia (Yes)** | 20 (35.7) | 6 (22.2) | 14 (48.3) | **0.042** | | 0.976 |
| **Leukopenia (Yes)** | 19 (33.9) | 6 (22.2) | 13 (44.8) | 0.074 | | |
| **Neutropenia (Yes)** | 10 (17.9) | 2 (7.4) | 8 (27.6) | 0.080 | | |
| **Thrombocytopenia (Yes)** | 6 (10.7) | 2 (7.4) | 4 (13.8) | 0.671 | | |
| **Stomatitis (Yes)** | 12 (21.4) | 6 (22.2) | 6 (20.7) | 1.000 | | |
| **Nausea & vomiting (Yes)** | 29 (51.8) | 12 (44.4) | 17 (58.6) | 0.289 | | |
| **Diarrhea (Yes)** | 6 (10.7) | 2 (7.4) | 4 (13.8) | 0.671 | | |
| **ALT/AST elevation (Yes)** | 4 (7.1) | 3 (11.1) | 1 (3.4) | 0.343 | | |
| **Myalgia & arthralgia (Yes)** | 14 (25.0) | 9 (33.3) | 5 (17.2) | 0.165 | | |
| **Pandemic-related Status** | | | | | | |
| **Delay in cancer care (Yes)** | 35 (62.5) | 17 (63.0) | 18 (62.1) | 0.945 | | |
| **Mental health problems** | | | | | | |
| **Insomnia symptoms (Yes)** | 21 (37.5) | 9 (33.3) | 12 (41.4) | 0.534 | | |
| **Depressive symptoms (Yes)** | 29 (51.8) | 6 (22.2) | 23 (79.3) | **<0.001** | | |
| **Anxiety symptoms (Yes)** | 21 (37.5) | 1 (3.7) | 20 (69.0) | **<0.001** | 80.393 (6.661–970.348) | **0.001** |
| **Stress symptoms (Yes)** | 17 (30.4) | 6 (22.2) | 11 (37.9) | 0.201 | | |

P-values in bold indicate statistical significance. Insomnia symptoms, Insomnia Severity Index $\geq$ 8; Depressive symptoms, Patient Health Questionnaire-9 $\geq$ 5; Anxiety symptoms, Generalized Anxiety Disorder-7 $\geq$ 5; Stress symptoms, Impact of Event Scale-Revised $\geq$ 25; Low QoL, General Functional Assessment of Cancer Therapy $\leq$ 70. ALT, alanine aminotransferase; AST, aspartate aminotransferase; BMI, body mass index; CI, confidence interval; OR, odds ratio; SD, standard deviation.

[a] Independent sample t-test for continuous variables and $\chi 2$ test for categorical variables.

[b] Multivariate binary logistic regression adjusted for age (enter method) in block 1, other social demographics, clinical factors and pandemic-related status significantly associated with a certain kind of mental health problems were incorporated in block 2 (forward likelihood ratio method).

symptoms or got accustomed to taking timely and effective medical measures to alleviate adverse events. Besides, receiving regular oral olaparib treatment for a long period has become their part of their daily life and may obviously benefit certain patients whose disease under well controlled. The underlying mechanisms between olaparib treatment and depression remain unknown. Regarding the adverse physical symptoms, we found that patients who had nausea or vomiting were more likely to experience depression symptom, which was also observed in another study on cancer patients (35).

Delay in cancer care has arisen as one of the most noteworthy concerns in oncology community since the COVID-19 pandemic outbroke. The accumulated increasing number of confirmed cases has occupied extensive medical resources and caused a generalized fear of contracting COVID-19 from the hospital or clinic while receiving their oncologic treatment or follow-up (36). A total of 62.5% OC patients self-reported varying degrees of delay in cancer care in this study. In a recent study on general OC patients conducted in the United States, 33% OC patients experienced a delay in some component of their cancer care among which 26.3% scheduled for surgery and only 8.3% scheduled for nonsurgical treatment experienced a delay (10). Another study observed a surgery delay in 15.7% of patients with ovarian cancer, which was associated with disease progression and death (37). This disparity might be attributed to the study populations in terms of a previous study observed an association between delay in oncology care and anxiety or depression among OC patients (10), while in our study, similar associations were not found, but we found delay in cancer care was significantly related to insomnia symptom. This was possibly due to that the COVID-19 pandemic in China had been past its peak time at the time of our investigation, thus OC patients have got resigned to the situation and were not significantly susceptible to anxiety or depression.

In this research, pandemic-related stress happened in 30.4% of the respondents. It was reported that treatment discontinuation, poor general condition by self-identification were associated with higher rates of severe symptoms of insomnia, depression, anxiety and stress in patients with breast cancer (38). In a longitudinal study on the general population during the pandemic, physical symptoms, and history of chronic illness were significantly correlated with higher IES-R scores (39). In this study, various adverse effects of olaparib were not found to be associated with stress symptom, nor were the presence of comorbidities or disease recurrence. A small sample size should be considered. Besides, the severity degree of adverse events was mostly mild, probably lessening the impact of adverse effects on susceptibility to developing stress symptom in OC survivors. Interestingly, it should not be neglected that receiving oral olaparib treatment as a substitute or adjuvant therapy for unfinished chemotherapy courses might fit for certain groups of OC patients, especially those who had to go a long distance to receive chemotherapy in hospital and take risks of getting infected by the COVID-19. Because in this study, the exact number of participants who ought to receive olaparib treatment considering their disease status or had to take olaparib at home to minimize viral infection due to the COVID-19 pandemic was not clear and difficult to find out *via* online questionnaires. Still, this oral agent seemed safe enough given that most adverse events were in lower grade. We suggested that patients who had oral olaparib administration for <3 months were vulnerable people and should gain more oncologic care and timely access to healthcare in the management of adverse events and psychological distress during the COVID-19 pandemic.

Cancer patients tend to experience decreased QoL in various domains after diagnosis. In this study, 51.8% of participants reported a decreased QoL (FACT-G total scores ≤70). The multivariate analyses suggested that shorter duration of receiving olaparib treatment and anxiety problem were associated with decreased QoL. The alteration from prior treatment patterns to oral olaparib administration seemed to have an adverse effect on QoL for the first few months, possibly arising from newly-occurred physical discomforts and the simultaneous mental health exhaustion. While in the clinical trials of Study 19 and SOLO2, no apparent adverse impact on health-related QoL was observed during olaparib maintenance therapy without the setting of COVID-19 pandemic (11, 40). Additionally, we noticed that depressive and anxiety symptoms significantly influenced QoL except for social well-being. Similar findings were found in another study (30).

Notably, in OC patients receiving olaparib administration, anxiety symptom and time duration of olaparib treatment affected patients' QoL most. We observed that there is a significant positive correlation between the scores of four mental health problems and scores of physical and emotional well-beings of QoL in OC survivors. Multivariate analysis indicated that anxiety was a strong and independent predictor of decreased QoL levels. Quite a few researches (41, 42) have also suggested that psychological problems negatively associated with QoL despite that depression and anxiety were interrelated. Indeed, mental health constitutes one of the greatest aspects that involve a good QoL.

To our knowledge, this is the first study to investigate mental distress and QoL in women with OC who were receiving olaparib treatment during the COVID-19 pandemic. Study limitations included the cross-sectional study design and a limited number of participants, which may limit the generalizability of the current study. Second, the response rate was unable to know exactly for the exact whole group of patients who had received our online questionnaire *via* WeChat group were unclear. Third, self-administered questionnaires were applied to data collection and eventual analyses on both mental distress and QoL, which probably resulted in recalling bias. And our survey was conducted web-based instead of phone-based or in-person, not removing computer access and literacy a participation bias.

Previous research has focused more on ovarian cancer patients who were scheduled for surgery or under chemotherapy, but little on women who received maintenance treatment despite numerous clinical trials are conducting to verify safety and efficacy of PARP inhibitors; still, psychological problems are not arousing adequate concern for healthcare workers. Our findings highlight the importance of management on psychological well-beings in women diagnosed with OC receiving maintenance treatment during the COVID-19 pandemic. The most attention-getting components include the duration since they received olaparib treatment, disease status evaluation, hematological toxicities, nausea or vomiting and depressive or anxiety symptoms. Surveillance on adverse events and psychological counseling interventions should be guaranteed to improve QoL in various dimensions and decrease the emergence of mental health problems during the COVID-19 pandemic, in the hope of achieving an actual patient-centered model and preparing cancer survivors changes in functioning and health, as well as better expectations for subsequent course of treatment. Appropriate interventions for psychological disorders are likely to play a favorable role in improving cancer survivors' health conditions, but evidence-based screening method and treatments still require more trials and research to develop.

## Conclusions

Our findings suggested that an unexpectedly large number of patients with OC who were receiving olaparib treatment suffered mental health problems and decreased QoL during the COVID-19 pandemic, especially in those with unfavorable disease status and who had only received a shorter duration of olaparib treatment. Physical symptoms also call for timely interventions to avoid developing mental distress. The COVID-19-related delay in oncology care should be minimized through optimized coping strategies. Appropriate psychological screening schemes and professional healthcare assistance could be required in addition to traditional physical and functional assessment of cancer patients to improve the psychological status and QoL of women with OC receiving olaparib treatment at home during the COVID-19 pandemic.

## Data availability statement

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

## Ethics statement

This study was reviewed and approved by the Ethics Committees of the National Cancer Center/Cancer Hospital at the Chinese Academy of Medical Sciences. Written informed consent was obtained from all participants for their participation in this study.

## Author contributions

WM: formal analysis, investigation, data curation, visualization, and writing—original draft. FL, YL, XZ, and ZO: investigation and resources. BL: methodology, investigation, and resources. SL: conceptualization, methodology, resources, editing, data curation, and supervision. DZ: conceptualization, methodology, investigation, resources, editing, supervision, writing—review and editing, project administration, and funding acquisition. 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

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EDITED BY
Jerome T. Galea,
University of South Florida,
United States

REVIEWED BY
Ehsan Sarbazi,
Tabriz University of Medical Sciences,
Iran
Aleksandra Kołtuniuk,
Wroclaw Medical University, Poland

*CORRESPONDENCE
Mohammed Ayalew
mameayale@gmail.com

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# Quality of life among patients with chronic non-communicable diseases during COVID-19 pandemic in Southern Ethiopia: A cross-sectional analytical study

Mohammed Ayalew[1]*, Bedilu Deribe[1], Siraj Hussen[2], Semira Defar[3] and Abel Gedefaw[4]

[1]School of Nursing, College of Medicine and Health Sciences, Hawassa University, Hawassa, Ethiopia, [2]School of Medical Laboratory, College of Medicine and Health Sciences, Hawassa University, Hawassa, Ethiopia, [3]Department of Midwifery, College of Medicine and Health Sciences, Hawassa University, Hawassa, Ethiopia, [4]Department of Obstetrics and Gynecology, School of Medicine, College of Medicine and Health Sciences, Hawassa University, Hawassa, Ethiopia

**Background:** The COVID-19 outbreak became a continuing global health agenda. It has a significant impact on individuals' quality of life (QOL). Patients with preexisting medical conditions may have severely reduced QOL. The aim of this study was to assess QOL and its associated factors among patients with chronic non-communicable diseases (NCDs) during COVID-19 pandemic at Sidama Regional State, southern Ethiopia.

**Methods:** We conducted a multicenter, cross-sectional study from 1 June to 1 September 2021. A total of 633 participants took part in the study, using an interviewer-administered structured questionnaire. The QOL was measured using the World Health Organization Quality of Life (WHOQOL-BREF) Scale, which has 12 items. To describe different variables, descriptive statistics were employed. To find independent factors associated with QOL, we used multivariable linear regression analysis. *P*-value of $< 0.05$ was declared statistically significant at 95% confidence interval (CI).

**Results:** The majority (56.4%) of participants were male and about half (53.1%) had a diagnosis of diabetes mellitus. The multivariable linear regression model showed statistically significant negative association between different independent variables such as age ($\beta = -0.188$, 95% CI = −0.238 to −0.139), being female ($\beta = -1.942$, 95% CI = −3.237 to −0.647), duration of illness $\leq$ 5 years ($\beta = -4.222$, 95% CI = −6.358 to −2.087), alcohol use in the past 3 months ($\beta = -4.574$, 95% CI = −6.905 to −2.243), common mental disorder (CMD) ($\beta = -1.512$, 95% CI = −2.924 to −0.100), insomnia ($\beta = -0.274$, 95% CI = −0.380 to −0.168), and QOL. Also, there is a statistically significant positive association between QOL and being illiterate (β = 3.919, 95% CI = 1.998–5.841) and living in the rural area (β = 2.616, 95% CI = 1.242–3.990).

**Conclusion:** In general, the findings confirmed that the COVID-19 pandemic had a negative impact on patients with chronic NCDs QOL. The QOL was significantly influenced by age, gender, educational status, residence area, duration of illness, alcohol use, CMD, and insomnia during COVID-19 pandemic. Thus, this study suggests that addressing insomnia, co-morbidities of mental disorders, and alcohol use has the potential effect to improve the QOL of patients with chronic medical illnesses.

KEYWORDS

**COVID-19, quality of life, QOL, predictors, Ethiopia**

## Introduction

The coronavirus disease (COVID-19) pandemic, which began in China in December 2019, is still posing a global health risk (1). Over 304 million confirmed cases and 5.4 million deaths had been reported globally in the 2 years since its emergence, as of the first week of January 2022 (2). As of 2 January 2022, there were over 400 thousand COVID-19 confirmed cases in Ethiopia, and the virus was responsible for about 7,000 fatalities. Risk communication and awareness campaigns are being used to address worries about the alarming rise in COVID-19 cases and the widespread dissemination of flu-like symptoms among Ethiopians. Additionally, the COVID-19 vaccine has been given in doses totaling close to 11 million up to January 2022 (3).

The severity and mortality of COVID-19 infections are thought to be increased in patients with preexisting medical conditions like diabetes mellitus (DM), hypertension, and malignancies (4). The case-fatality ratio was higher in patients with cardiovascular diseases (10.5%), diabetes (7.3%), and hypertension (6%) compared to the general population (2.3%) (5). Aside from physical health, COVID-19 has had a negative impact on mental health, causing significant anxiety and depression in people (6), and interfering with daily lives, jobs, and relationships. People are afraid of infection, dying, and losing family members during the COVID-19 outbreak. At the same time, many people have lost or are in danger of losing their jobs, have become socially isolated and separated from loved ones, and have seen stay-at-home orders implemented in some countries in drastic ways (7).

As a result, whether infected or not, COVID-19 has had a significant impact on people's quality of life (QOL) (8, 9). The COVID-19 outbreak is regarded as an unforeseen traumatic life event that has harmed individuals' QOL in general and particularly their health-related quality of life (HRQOL). HRQOL is a multidimensional concept that describes how an individual assesses his or her mental, physical, emotional, and social wellbeing (10). Many studies have been conducted to investigate the QOL of recovered COVID-19 cases in the general population, hospitalized patients, and chronic illness patients (9, 11–13).

The COVID-19 pandemic has a significant negative impact on QOL, especially in terms of physical, mental, social, and spiritual wellbeing (9, 14–17). A recent study in Bangladesh found a link between chronic diseases such as hypertension (HTN), diabetes mellitus (DM), heart disease, asthma, kidney diseases, and cancer and significantly lower QOL in all domains (18). According to a recent Egyptian study, 64% and 62% of diabetic patients reported poor physical and mental QOL, respectively. (19). In a similar study conducted in the Netherlands, 43% of patients with chronic kidney disease reported that the COVID19 pandemic had reduced their QOL (20).

People with non-communicable chronic diseases (NCDs) found it challenging to see a doctor and have their prescriptions filled (21) during the COVID-19 pandemic. During the peak of the COVID-19 pandemic, movement restrictions and social isolation became the new normal, contributing to a substantial reduction in people' activities, which is associated with a significant decline in overall QOL (22). As a result, it is essential to look into how the COVID-19 pandemic affected the QOL of individuals living with chronic NCDs.

The unbearable impact of the COVID-19 pandemic may have had a significant impact on the QOL of patients with chronic medical conditions. To the best of our knowledge, data on QOL assessment among chronic disease patients in response to the COVID-19 pandemic are scarce, particularly in low-income countries like Ethiopia. Furthermore, there is a scarcity of data on the relationship between COVID-19-related psychological complications (such as depression, anxiety, and stress) and QOL among chronic disease patients during the COVID-19 pandemic. Therefore, this study fills a research gap by (1) describing QOL among patients with chronic medical conditions and (2) identifying the association between various socio-demographic, clinical, and psychological factors and QOL to identify significant predictors of QOL among patients with chronic medical conditions during the era of COVID-19 pandemic.

# Methods and materials

## Study design, area, and period

We conducted a cross-sectional study between 1 June and 1 September 2021 at four selected hospitals [Hawassa University Comprehensive Specialized Hospital (HUCSH), Adare General Hospital (AGH), Yirgalem General Hospital (YGH), and Leku Primary Hospital (LPH)] in Sidama National Regional State, southern Ethiopia.

## Study participants

This study was conducted among patients with chronic non-communicable diseases such as diabetes mellitus, hypertension, chronic cardiovascular diseases, and respiratory diseases (e.g., asthma) that have regular follow-up visits. Patients receiving follow-up care in the outpatient departments of the four hospitals were consecutively requested to participate in the study, if they met the following criteria: (I) age ≥18 years with chronic NCDs confirmed by physicians; (II) clinically stable and able to understand the purpose of the study; and (III) patients without any known psychiatric and neurocognitive disorders. However, patients with chronic NCDs who were admitted to the emergency/inpatient department for any reason were excluded from the study. We were planning to include 650 patients with chronic NCDs from the four hospitals based on the monthly patient flow (250 from HUCSH, 150 from AGH, 125 from YGH, and 125 from LPH). We used a consecutive sampling technique, and patients with chronic NCDs who visited hospitals during the study period and met the inclusion criteria were included in the study until the final study sample size was reached.

## Data collection methods

A structured self-administered questionnaire was used to gather data. The questionnaire is divided into various sections, such as the socio-demographic and clinical characteristics of the patient, the Oslo Social Support Scale (OSSS), the Self-Reporting Questionnaire-20 (SRQ-20) to evaluate common mental disorders (CMD), the Insomnia Severity Index (ISI) to evaluate insomnia, and the World Health Organization Quality of Life Instruments (WHOQOL-BREF) to evaluate QOL. The questionnaire was prepared in English and translated to the local language Amharic. The Amharic version of the questionnaire was used to collect the data.

### Social support

The level of social support among patients with chronic NCDs was assessed using the 3-item Oslo Social Support Scale (OSSS), and the scores range from 3 to 14. It is categorized as poor [3–8], moderate [9–11], and strong [12–14] social support (23).

### Common mental disorder

A 20-item (SRQ-20) WHO screening tool was used to assess CMDs (24). Only binary (yes/no) questions are included, with "1" indicating the presence of a symptom and "0" indicating the absence of a symptom. The SRQ-20 item questions cover depression, anxiety, and psychosomatic complaints, which are all classified as CMD (25). The SRQ-20′s validity, reliability, and cutoff score vary by population (culture, language, setting, and gender) in different settings (25–28). With a sensitivity of 78.6% and specificity of 81.5%, the SRQ-20 had good internal reliability ($\alpha$ = 0.78) and an optimal cutoff score of 5/6 (29). The SRQ-20 measure demonstrated good internal consistency (Cronbach's $\alpha$ = 0.89) in our study.

### Insomnia

The ISI is a 7-item self-assessment questionnaire that assesses the nature, severity, and impact of insomnia (30). The dimensions evaluated are severity of sleep onset, sleep maintenance, early morning awakening problems, sleep dissatisfaction, interference of sleep difficulties with daytime functioning, noticeability of sleep problems by others, and distress caused by the sleep difficulties in the last month. Each item is rated on a 5-point Likert scale (e.g., 0 = no problem; 4 = very severe problem), yielding a total score ranging from 0 to 28. The total score is divided into four categories, namely, no insomnia [0–7], sub-threshold insomnia [8–14], moderate insomnia [15–21], and severe insomnia [22–28]. A higher score indicates a severe insomnia (30–32). The ISI measure demonstrated very good internal consistency (Cronbach's $\alpha$ = 0.96) in our study.

### Quality of life

We used the adapted version of 12 items (9), from the WHOQOL-BREF Scale to assess the impact of the COVID-19 pandemic on QOL (33, 34). The adapted WHOQOL-BREF Scale had 12 items, each with a five-point rating from 1 = very low to 5 = very high; thus, the lowest possible score was 12, and the highest possible score was 60 for the total scale. Low scores indicate a lower QOL as a result of the COVID-19 pandemic's negative effects. The QOL measure demonstrated good internal consistency in the previous study (Cronbach's $\alpha$ = 0.81) (9). The WHOQOL-BRIEF 12 items (**Supplementary File 1**) used in our study demonstrated good internal consistency (Cronbach's α = 0.82).

## Data analysis

Collected data were entered to Epi-data version 3.1 and exported to SPSS (Statistical Package for Social Sciences) version 24 for analysis. Descriptive statistics such as frequency, percentage, mean, standard deviation, and median were used to describe different variables. Assumptions such as normality, lack of multi-collinearity among explanatory variables, presence of linearity relationship, independence, and homoscedasticity of the errors were checked. Simple and multivariable linear regressions were performed to identify independent predictors of QOL. *P*-values of $< 0.05$ were declared statistically significant at 95% confidence interval (CI).

# Results

This study included 633 participants. The majority of study participants (56.4%) were male, and 64.8% were married. About half (55.6%) were Protestant religious followers, followed by Orthodox Christians (25.9%), and about one-fourth (27.6%) were illiterate. More than one-fifth (22.7%) worked as a farmer, while 55.8% lived in urban. The mean age of the respondents was 46.49 ± 17.71 years as described in Table 1.

About half of the participants (53.1%) had diabetes mellitus, followed by hypertension (17.5%), and nearly one-third (31.6%) had a comorbid diagnosis. The majority of participants (57.5%) had been sick for 5 years, and 9.6% and 7.7% had used alcohol and khat in the previous 3 months, respectively. More than one-third (35.4%) of all participants had poor social support, while about half (52.4%) had moderate social support. The mean SRQ-20 and ISI scores were 6.06 ± 5.09 and 6.62 ± 6.89, respectively (Table 2).

## Quality of life of participants

According to the WHOQOL-Brief (12-items) scale score, the mean QOL score of the participants was 33.07 ± 8.90 with a minimum score of 12 and a maximum score of 53.

## Independent factors associated with quality of life

Estimates of the multivariable linear regression model showed a statistically significant and negative association between different independent variables such as age ($\beta = -0.188$, 95% CI = −0.238 to −0.139), CMD (SRQ-20 scale) ($\beta = -1.512$, 95% CI = −2.924 to −0.100), insomnia (ISI scale) ($\beta = -0.274$, 95% CI = −0.380 to −0.168), being female ($\beta = -1.942$, 95% CI = −3.237 to −0.647), duration of illness ≤5 years ($\beta = -4.222$, 95% CI = −6.358 to −2.087), alcohol use in the past 3 months ($\beta = -4.574$, 95% CI = −6.905 to −2.243), and the outcome variable QOL during COVID-19 pandemic. On the contrary, there is a statistically significant and positive association between QOL and being illiterate ($\beta = 3.919$, 95% CI = 1.998–5.841) and living in the rural area ($\beta = 2.616$, 95% CI = 1.242–3.990) (see Table 3).

# Discussion

The global COVID-19 outbreak has wreaked havoc. Millions of lives were lost, and billions of people suffered psychologically and economically as a result. This study was used to assess the QOL of people who had chronic medical illnesses, as well as factors that were found to be significantly associated with QOL during the COVID-19 pandemic.

When the total WHOQOL-BRIEF score was compared to the sample socio-demographic characteristics, age was found to

TABLE 1 Socio-demographic characteristics of study participants at Sidama National Regional State, southern Ethiopia, 2021 (*n* = 633).

| Variable | Categories | Frequency | Percentage (%) |
|---|---|---|---|
| Age (mean ± SD) | 46.49 ± 17.71 | | |
| Sex | Male | 357 | 56.4 |
| | Female | 276 | 43.6 |
| Marital status | Single | 135 | 21.3 |
| | Married | 410 | 64.8 |
| | Divorced | 36 | 5.7 |
| | Widowed | 52 | 8.2 |
| Religion | Protestant | 352 | 55.6 |
| | Orthodox | 164 | 25.9 |
| | Muslim | 103 | 16.3 |
| | Others | 14 | 2.2 |
| Educational status | Illiterate | 175 | 27.6 |
| | Primary | 162 | 25.6 |
| | Secondary | 131 | 20.7 |
| | College and above | 165 | 26.1 |
| Occupation | Gov't employee | 121 | 19.1 |
| | Private employee | 67 | 10.6 |
| | Merchant | 90 | 14.2 |
| | Student | 68 | 10.7 |
| | House wife | 102 | 16.1 |
| | Farmer | 144 | 22.7 |
| | Jobless | 21 | 3.3 |
| | Other | 20 | 3.2 |
| Place of residence | Rural | 280 | 44.2 |
| | Urban | 353 | 55.8 |

TABLE 2 Clinical characteristics of study participants at Sidama National Regional State, southern Ethiopia, 2021 (*n* = 633).

| Variable | Categories | Frequency | Percentage (%) |
|---|---|---|---|
| Diagnosis | Diabetes mellitus | 336 | 53.1 |
| | Hypertension | 111 | 17.5 |
| | Asthma | 49 | 7.7 |
| | CVD | 82 | 13.0 |
| | Others* | 55 | 8.7 |
| Comorbid diagnosis | Yes | 200 | 31.6 |
| | No | 433 | 68.4 |
| Duration of illness | ≤5 years | 364 | 57.5 |
| | 6–10 years | 210 | 33.2 |
| | ≥11 years | 59 | 9.3 |
| Alcohol Use in the past 3 months | Yes | 61 | 9.6 |
| | No | 572 | 90.4 |
| Cigarette Use in the past 3 months | Yes | 17 | 2.7 |
| | No | 616 | 97.3 |
| Khat Use in the past 3 months | Yes | 49 | 7.7 |
| | No | 584 | 92.3 |
| Social support | Poor | 224 | 35.4 |
| | Moderate | 332 | 52.4 |
| | Strong | 77 | 12.2 |
| Common mental disorders | Yes | 209 | 33.0 |
| | No | 424 | 67.0 |
| Insomnia | Yes | 249 | 39.3 |
| | No | 384 | 60.7 |

CVD, Cardiovascular disorders.
*Epilepsy, stroke, neurological, renal, or hepatologic disorders.

be a significant predictor, with QOL decreasing as age increased. This result was consistent with recent follow-up studies that found out older age was a risk factor for poor QOL (11, 35). This association can be explained by the fact that older age is associated with lower levels of overall health and physical function (12). QOL is projected to decline as people age, as they are more likely to suffer from many health problems (36). Another explanation could be that when people become older, the risk of COVID-19 infection increases severely (37). This suggests that during the COVID-19 pandemic, aging had a detrimental impact on QOL scores among chronic medical ill individuals.

In our study, the QOL scores of female patients were significantly lower than that of male patients, indicating that their QOL was significantly worse. Similar associations have been discovered in earlier studies, which supports our conclusion (12, 35). During the COVID-19 outbreak, women were shown to be more vulnerable to a variety of psychological problems (such as anxiety and depression) as compared to men (38, 39). Moreover, it is a known fact that females are more likely to have a lower income, more hurdles to healthcare access, and more domestic task obligations. All of these reasons may have contributed to the poor QOL in females.

We found out that educational status is significantly associated with QOL, i.e., lower educational attainment has better QOL scores. This is supported by a recent study, which found that QOL scores were shown to be lower in patients with a higher degree of education (8), due to a higher level of awareness and concern about COVID-19 and its negative effect on QOL. In addition, according to Nguyen et al. those with a high level of education had a higher prevalence of depression during the pandemic, resulting in a stress burden that adversely affects their health-related QOL (40). On the contrary, previous studies also found that, with higher levels of education, there was a general increment in QOL scores (18, 41). Higher educational attainment is often associated with greater career prospects and higher earnings, hence improving an individual's QOL (41). However, uneducated participants claimed that their QOL was barely adequate in terms of thinking capacity, perceived physical safety and security, and vitality (41). Another rationale is that highly educated people may have a lot of wants and requirements in their daily lives, which may be jeopardized by the COVID-19 pandemic.

In our study, rural resident participants had higher QOL scores as compared to their counterparts. This is in line with previous study conducted by Hawlader et al. in Bangladesh (18). In urban areas, high population density and pollution levels may also have a negative impact on subjective QOL (42).

Duration of illness is another significant predictor of QOL in our study. Those patients with ≤5 years duration of illness have lower QOL score as compared to those with ≥11 years. This may be because of the fact that QOL can improve over time as patients adjust to chronic illness, symptoms stabilize, and more effective treatment alternatives become available over the course of long-term illness (43–45).

Our study showed that the QOL score was found to be lower among alcohol users when compared to non-alcohol users. Similar findings were reported in previous studies such that alcoholism is related to a reduced QOL (46, 47). Alcohol use has been shown to rise during stressful times such as pandemics (48). Alcohol consumption has a variety of intangible negative consequences, such as suffering, loss of healthy living, and deterioration of social and familial bonding, all of which contribute to a decrease in the individual's QOL (49). In addition, alcohol is related to an increased risk of weakening the immune system, making people more susceptible to infectious disorders such as COVID-19 (50). Individuals use alcohol to cope with COVID-19′s stressful adaptive challenges (51). Some studies have revealed that those who drink have a much lower QOL, particularly in terms of their mental health and social functioning (52, 53).

Our study also showed that participants who had CMD had a higher probability of having lower QOL scores. The findings

TABLE 3 Simple and multiple linear regression for quality of life among patients with chronic medical illness during COVID-19 pandemic at southern Ethiopia, 2021 ($n = 633$).

| Variables | | Simple linear regression | Multiple linear regression† |
|---|---|---|---|
| | | β (95% CI) | β (95% CI) |
| Age | | −1.158 (−0.195, −0.121)* | −0.188(−0.238, −0.139)* |
| CMD (SRQ−20 scale) | | −0.524 (−0.655, −0.394)* | −1.512(−2.924, −0.100)*** |
| Insomnia (ISI scale) | | −0.490 (−0.583, −0.396)* | −0.274(−0.380, −0.168)* |
| Sex | Male | Reference | |
| | Female | −0.563 (−1.964, 0.839) | −1.942(−3.237, −0.647)** |
| Marital status | Single | Reference | |
| | Married | 1.958 (0.275, 3.641)*** | 0.654 (−1.105, 2.413) |
| | Divorced | −7.438 (−10.386, −4.491)* | −2.543 (−5.430, 0.345) |
| | Widowed | −3.729 (−6.225, −1.233)** | 0.163 (−2.874, 3.200) |
| Educational status | Illiterate | 5.302 (3.450, 7.154)* | 3.919(1.998, 5.841) * |
| | Primary | 3.646 (1.758, 5.534)* | 1.913 (0.194, 3.632) |
| | Secondary | 2.223 (0.225, 4.221)*** | 0.698 (−1.051, 2.448) |
| | Tertiary | Reference | |
| Residence | Rural | 4.106 (2.743, 5.468)* | 2.616 (1.242, 3.990) * |
| | Urban | Reference | |
| Diagnosis | Asthma | Reference | |
| | Hypertension | 1.631 (−1.249, 4.511) | 2.007 (−0.431, 4.445) |
| | Diabetes | −0.473 (−3.014, 2.067) | −0.084 (−2.241, 2.073) |
| | CVD | −0.388 (−3.819, 3.043) | 0.865 (−2.029, 3.758) |
| | Others[a] | 0.512 (−2.532, 3.556) | 1.538 (−0.987, 4.063) |
| Duration of illness | ≤5 years | −1.770 (−4.223, 0.6684) | −4.222 (−6.358, −2.087)* |
| | 6–10 years | −1.572 (−4.148, 1.004) | −2.087 (−4.206, 0.031) |
| | ≥11 years | Reference | |
| Comorbid diagnosis | Yes | −3.649 (−5.117, −2.181)* | 1.107 (−0.352, 2.565) |
| | No | Reference | |
| Alcohol use in the past 3 months | Yes | −9.567 (−11.801, −7.332)* | −4.574 (−6.905, −2.243)* |
| | No | Reference | |
| Cigarette use in the past 3 months | Yes | −10.168 (−14.395, −5.941)* | −3.890 (−7.972, 0.192) |
| | No | Reference | |
| Khat Use in the past 3 months | Yes | −6.005 (−8.564, −3.446)* | −0.386 (−3.062, 2.291) |
| | No | Reference | |

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

CVD, cardiovascular disorders; CMD, common mental disorders; ISI, Insomnia Severity Index; SRQ-20, Self-Reported Questionaire-20.

[a] Epilepsy, stroke, neurological, renal, and hepatologic disorders.

† Multiple linear regression model reported that $F(21, 621) = 17.811$, $p < 0.001$, with $R^2 = 0.380$.

were consistent with a prior study, which found lower QOL scores in those who reported higher levels of anxiety, depression, and stress (9). Depression and anxiety have been linked to cognitive dysfunction (54), physical distress (55), and poor social functioning (56), all of which have been associated with a reduction in patients' QOL. Previous studies well established that there is an inverse association between QOL and mental health problems such as depression and anxiety (57). As a result, it is not surprising that having more perceived CMDs lowers the QOL of patients with chronic medical illness, as found by this study.

This study found a statistically significant negative association between the insomnia severity index scale and the QOL scale. Similarly, recent studies indicated that impaired QOL was found to be independently associated with lower sleep quality and insomnia (58, 59). Insomnia's impact on QOL could be due to physical or mental health comorbidities, medications, and/or a variety of psychosocial issues, or it could be a symptom of a primary disease. Furthermore, insomnia causes significant impairments in occupational and social functioning, as evidenced by decreased productivity of work, recurrent absenteeism, decreased cognition and mood, and increased physical and psychological morbidity (60). These directly or indirectly affects QOL of individuals.

This study has some limitations. First, we recognize that a cross-sectional study could not detect the continuing impact of the COVID-19 pandemic on different dimensions of QOL; thus, future research could be done using data based on a longitudinal design. Second, we did not use preferred tools to assess QOL such as SF-6D that was primarily designed to measure QOL in clinical populations. Third, because only participants from south Ethiopia were included in the study, the results cannot be applied to all Ethiopians who have chronic NCDs. These results need to be verified by additional research using a larger sample size and perhaps even a qualitative assessment. Additionally, the use of the non-probability consecutive sampling method could be viewed as a limitation. Fourth, there is a potential for social desirability bias. For instance, when data were collected using an interviewer-administered method, participants may have over- or underreported their responses for a variety of reasons.

## Conclusion

In general, increase in age, higher SRQ-20 score (having CMD), increased ISI score (insomnia), being female, shorter duration of illness (<5 years), and alcohol use have a significant negative association with high QOL in patients with chronic medical condition during COVID-19 pandemic, whereas being illiterate and living in rural residence have a positive association with high QOL. Overall, the findings confirmed that the COVID-19 pandemic had a negative impact on an individual's QOL in a variety of ways. Thus, this study suggests that addressing insomnia, co-morbidities of mental disorders, and alcohol use has the potential effect to improve the QOL of patients with chronic medical illnesses.

## Data availability statement

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

## Ethics statement

The studies involving human participants were reviewed and approved by Hawassa University, College of Medicine and Health Sciences, Institutional Review Board (IRB) with reference number: IRB/076/13. The participants provided their written informed consent to participate in this study.

## Author contributions

MA, BD, AG, and SH participated in the conception, designed the study, and were involved in the data collection. MA, BD, and SD performed the analysis of the study. MA and SD prepared the manuscript for publication. BD, AG, SH, and SD critically reviewed the manuscript. All authors 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.

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## Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2022.855016/full#supplementary-material

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EDITED BY
Aliya Naheed,
International Centre for Diarrhoeal Disease Research, Bangladesh

REVIEWED BY
Sayward Elizabeth Harrison,
University of South Carolina,
United States
Alexandre Sizilio,
Faculdade Israelita de Ciências da Saúde Albert Einstein Hospital Israelita Albert Einstein, Brazil

*CORRESPONDENCE
Flavio Mandlate
fmachado14@gmail.com

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# Lay HIV counselors' knowledge and attitudes toward depression: A mixed-methods cross-sectional study at primary healthcare centers in Mozambique

Flavio Mandlate[1,2]*, M. Claire Greene[3], Luis F. Pereira[4], Annika C. Sweetland[4], Donald Kokonya[5], Cristiane S. Duarte[4], Francine Cournos[4], Maria A. Oquendo[6], Milton L. Wainberg[4], Mohsin Sidat[7], Esperança Sevene[7] and Marcelo F. Mello[2]

[1]Department of Mental Health, Ministry of Health, Maputo, Mozambique, [2]Department of Psychiatry, Federal University of Sao Paulo (UNIFESP), Sao Paulo, Brazil, [3]Program on Forced Migration and Health, Heilbrunn Department of Population and Family Health, Columbia University Mailman School of Public Health, New York, NY, United States, [4]New York State Psychiatric Institute, Columbia University, New York, NY, United States, [5]School of Medicine, Masinde Muliro University of Science and Technology, Kakamega, Kenya, [6]Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, United States, [7]Faculty of Medicine, Eduardo Mondlane University, Maputo, Mozambique

**Introduction:** Depression is the most common mental disorder among people living with HIV/AIDS and has a negative impact on HIV treatment outcomes. Training lay HIV counselors to identify and manage depression may contribute to improved patient access and adherence to treatment, and reduce stigma and discrimination among lay health workers toward both HIV and depression. The purpose of this study was to assess the current knowledge and attitudes of lay HIV counselors toward managing depression in primary care in Mozambique.

**Methods:** We conducted a mixed-methods cross-sectional study to assess depression-related knowledge and attitudes among lay HIV counselors in 13 primary healthcare facilities in Mozambique. We used the quantitative Depression Attitude Questionnaire (DAQ) scale, followed by open-ended questions to further explore three key DAQ domains: the nature of depression, treatment preferences, and professional attitudes or reactions.

**Results:** The sample included 107 participants (77.6% female, mean age: 32.3 years, sd = 7.4). Most (82.2%) had less than a high/technical school education. Findings suggested that some HIV counselors had knowledge of depression and described it as a cluster of psychological symptoms (e.g., deep sadness, anguish, apathy, isolation, and low self-esteem) sometimes leading to suicidal thoughts, or as a consequence of life stressors such as loss of a loved one, abuse, unemployment or physical illness, including being diagnosed with HIV infection. HIV counselors identified talking to trusted people about their problems, including family and/or counseling with a psychotherapist, as the best way for patients to deal with depression. While acknowledging challenges, counselors found working with patients with depression to be rewarding.

**Conclusion:** Lay health counselors identified HIV and psychosocial issues as key risk factors for depression. They believed that the treatment approach should focus on social support and psychotherapy.

KEYWORDS

**depression, knowledge, attitude, lay health counselors, HIV/AIDS**

## Introduction

In 2019, UNAIDS estimated that 38 million people were living with HIV infection worldwide, and over 54.47% of the people with HIV and AIDS in Sub-Saharan Africa (1, 2). Mozambique is disproportionately affected by HIV and AIDS; in 2019, it had an estimated 2,183,786 people living with HIV (PWH), with 59% on antiretroviral treatment (3), and 23% who did not know their HIV status and therefore were not in treatment (2). The burden of depression among people with HIV in sub-Saharan Africa is estimated at 27% (4). The prevalence of major depressive disorder in Mozambique is 12.1% while the prevalence of depressive symptoms is 26.9% (4). Results from studies from 15 sub-Saharan countries found an estimated prevalence of depression between 6 and 59% among people living with HIV using screening tools such as the PHQ-9 (5).

Psychiatric disorders are commonly diagnosed among PWH, and depression is the most common diagnosis; some studies estimate a prevalence of over 50% (6). Depression and HIV infection have a bidirectional relationship. First, HIV infection increases the risk for depressive symptoms due to direct viral effects (HIV infects central nervous system cells), activation of the hypothalamic-pituitary-adrenal axis, increase in various inflammatory markers (TNFα, IFNγ, IL-1, and IL-6), side effects of antiretrovirals, as well as psychological stressors and vulnerabilities commonly seen in populations affected by HIV, including stigma, disability, isolation, discrimination, and poor social support (7). Second, depression has been shown to increase the progression of HIV infection, in part by affecting adherence to medications and medical care (8) as well as by its association with higher morbidity and mortality (9, 10). Depression can also be seen as a risk factor for HIV infection due to the increased likelihood of risky behaviors such as unprotected sex, multiple sex partners, and the use of intravenous drugs (7, 11). Despite the known burden and public health effects of depression on HIV infection (4), this psychiatric disorder is still underdiagnosed and undertreated in PWH (5, 12, 13).

Due to the shortage of health workers in low- and middle-income countries (LMICs) lay health counselors play a crucial role in service delivery and psychosocial support in HIV and AIDS services, mainly in primary health care (14, 15). Non-communicable disease providers in Malawi reported limited knowledge and lack of training about depression, along with inadequate resources (e.g., staff shortages, drug supply, high workload, long patient waiting times for appointments, lack of physical space) as the greatest barriers to integrating depression treatment into primary care (16). The shortage of mental health specialists in low-income countries is associated with low capacity for diagnosing and treating depression (4). To overcome this shortage, a task-shifting approach (i.e., training non-specialists to deliver mental health interventions) has been utilized in many LMICs to treat mental health problems such as depression, anxiety, and substance use in primary care and other healthcare settings (17). Mounting evidence suggests that lay health workers can be trained to deliver evidence-based treatments for depression through task-shifting when provided adequate clinical supervision (18, 19). Evidence-based interventions delivered by non-specialized health workers in primary health care settings for the treatment of depression could relieve or improve depressive symptoms and medical treatment outcomes for patients (20).

Many approaches to task shifting have been successfully tested and implemented in LMICs, indicating that through appropriate capacity building, non-mental health professionals and community health workers can assess and successfully manage mental health problems, including as part of HIV care (21, 22). As an example, depression treatment was successfully integrated into HIV care in Malawi; non-mental health care service providers were trained to screen, diagnose, and treat depression using antidepressants and psychotherapy (23–25). However, some implementation challenges arose regarding sustainability, patient retention, and providers' workloads given

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Abbreviations: AIDS, Acquired Immunodeficiency Syndrome; ART, Antiretroviral Treatment; ARV, Antiretroviral; ART, Highly Active Antiretroviral Therapy; DAQ, Depression Attitude Questionnaire; HIV/AIDS, Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome; IL, Interleukin (IL-1; IL-6); IFNγ, Interferon gama; LMIC, Low and Middle Income Country; PWH, People Living With Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome; PHQ-9, Patient Health Questionnaire 9; TB, Tuberculosis; TNFα, Tumor Necrosis Factor alfa.

the limited-resource setting (23). Another study conducted in Cameroon found that primary care providers demonstrated poor knowledge and negative attitudes toward depression (26). Lay counselors often have different educational backgrounds and usually receive short-term intensive courses in counseling skills, but they do not receive any training in other mental health care topics (17, 19, 27). Skills development and technical ability are essential for effective counseling services, which goes beyond empathy and understanding of the client (17). Ongoing clinical supervision beyond the intensive training phase is a critical component of this approach (28).

Effective interventions for the treatment of depression delivered by lay health workers in low resource settings, such as group interpersonal therapy and problem-solving therapy, have demonstrated improvement in ART adherence and depressive symptoms among PWH in South Africa and Zimbabwe (29–31). Among patients with HIV, additional behavioral interventions have reduced depression relapses and improved wellness (28). However, additional studies are needed to understand the best way to implement evidence-based depression treatment (32). Gaps and challenges in integrating mental health into HIV treatment in general care health systems are evident, particularly in primary health care settings (33, 34). These gaps call for adaptation and implementation of feasible mental health interventions targeting community health workers and other stakeholders to improve the mental health of PWH (35), and have shown promising outcomes (24).

In Mozambique, lay health counselors play a key role in providing HIV counseling and testing services and psychosocial support follow-up for PWH on antiretroviral treatment (ART) (27, 36, 37). However, lay HIV health counselors are only assigned to facilities that treat a minimum of 1,000 PWH; smaller rural facilities lack support from this cadre of workers (37). The training of lay HIV counselors aims to improve overall communication, differentiate and apply diverse counseling techniques, with an emphasis on adherence counseling, and provide essential psychosocial support to PWH (36, 38). Because these HIV counselors are not trained in mental health and do not have appropriate instruments for depression screening (38, 39), referrals to mental health professionals are rare and usually occur only when there are overt changes in mood or poor adherence to ART. A task-shifting approach to mental health could minimize these challenges in HIV care if lay HIV counselors were trained to identify and manage depression (20), as they are the first contact point for PWH with health services at the primary care level (40). Notably, advocacy for mental health integration may also help to reduce HIV-associated stigma and discrimination and contribute to enhanced treatment outcomes among PWH (41). This task-shifting approach must be accompanied by adequate and continuous training, supervision, mentorship, and emotional support for lay health workers to effectively integrate mental health in HIV treatment services (14, 28, 42).

In this study, we evaluated the knowledge and attitudes of lay HIV counselors in Mozambique regarding depression to better understand the potential gaps in their practice. The secondary aim was to gather evidence that could be used to improve any future training program for lay counselors in the management of depression and other mental health related issues among PWH.

# Methods

## Participants

This study was a mixed-methods cross-sectional study investigating knowledge and attitudes among lay HIV counselors in Mozambique toward depression. Between April and November 2019, we randomly selected 13 primary health care centers from two provinces: six in Maputo Province and seven in Maputo city, and invited all HIV counselors to participate. This yielded a convenience sample of 107 providers (93.04% response rate). We considered the following eligibility criteria: currently working as a lay HIV counselor at primary care health centers (HIV, TB, Maternal and Child Health), having been a lay HIV counselor for more than 3 months, and providing written informed consent to participate in the study.

## Measures and procedures

Participants provided basic information about their clinical background as well as sociodemographic information, including age, sex, education, marital status, type of counselor, years of counseling experience, and whether they had prior training in managing mental health problems. A research assistant administered the Depression Attitudes Questionnaire (DAQ) (43). We chose the DAQ because it was relevant to the research question, available in Portuguese, and culturally adaptable to Mozambique context. The DAQ includes 20 statements with 5-point Likert Scale response options ranging from strongly agree to strongly disagree. For the analysis, we collapsed the 5-point Likert scale responses to 3 points "disagree"; "neutral" and "agree." The 20 statements/questions are grouped into three domains. The three domains include: nature of depression (nine items: Q1, Q2, Q4, Q5, Q6, Q7, Q8, Q10 and Q11); treatment of depression (eight items: Q3, Q12, Q14, Q16, Q17, Q18, Q19, and Q20), and professional attitudes (three items: Q9, Q13 and Q15). The domain "nature of depression" corresponded to depression risk factors and clinical features (44). The "treatment of depression" domain describes the treatment orientation and confidence in types of treatment, and the "professional reaction" domain is the professional confidence and ease in managing the needs of depressed patients (45).

After completing the DAQ, each participant was asked a brief set of open-ended qualitative questions to further explore participants knowledge about diagnosis, symptoms, related risk factors, management and prevention of depression. These follow up questions were structured around the three domains of the DAQ, in order to further elucidate the participants' perspectives on these topics. For the first domain, "nature of depression," after administering the series of structured questions from the DAQ, we asked providers to use their own words to define depression, the common symptoms, and the perceived risk factors. We also asked specifically whether they considered HIV and AIDS to be a risk factor for depression, as well as to identify barriers to mental health treatment among people with HIV. For the second domain, "treatment of depression," after asking their agreement to various statements about treatment alternatives for depression from the DAQ, we asked participants to use their own words to describe the types of depression treatment available locally, and where the services were provided. For the third domain, "professional attitudes," we asked counselors to describe in their own words how they help patients with depression, and if they knew of any strategies to prevent depression in people with and without HIV. The qualitative interviews were recorded and then transcribed by the research assistants. The researcher revised each transcript to verify the accuracy of the data. After transcription of the interview, the voice records were stored on a password-protected computer, only accessed by the researcher. The average duration of each interview was 25 to 30 minutes. All interviews were conducted in Portuguese.

All study procedures were reviewed and approved by the two Ethics Committees (from Federal University of São Paulo in Brazil and Eduardo Mondlane University in Mozambique).

## Mixed-methods analysis

We used an explanatory QUANT=>QUAL sequential mixed-methods approach to data collection and analysis whereby the quantitative questions were asked first, and the qualitative questions were used to further explain and expand upon each domain (46, 47). For the quantitative data, we used frequency statistics to describe the distribution of demographic characteristics, training, and clinical experience in the sample for the quantitative data. We used Stata, Version 17 for the quantitative analysis. We also calculated the internal consistency of the three DAQ subscales using Cronbach's alpha.

For the qualitative data, we used software NVIVO version 10 to file and organize verbatim transcriptions of the interviews. We utilized a directed content analytic approach wherein we began analysis examining the three sub-domains of the DAQ and then broadened our analysis to include additional pre-defined topics (47). We thereafter quantified all qualitative data by coding, thematic analysis and describing patterns that emerged in the data (48, 49). All qualitative data were coded according to predominant themes identified by FM and LFG independently. The raters worked collaboratively to develop a taxonomy of the initial themes that emerged from the data. MCG and ACS supervised the coding and re-coding at different steps of this process to verify that findings were grounded in the data. Finally, we compared the qualitative responses by domain to the quantitative findings to help interpret those observations. When there was overall agreement in the sentiment of the qualitative statements and the quantitative findings, we had more confidence that questions were being understood in the correct way. When apparent contradictions emerged between the qualitative and quantitative data, we looked to the qualitative data to try to understand if those differences were real or if another explanation–such as the misunderstanding of one or more questions–could better explain the observations.

## Results

In this sample of 107 study participants, the average age was 32.3 years (SD = 7.4), 77.6% were female, 82.2% reported their educational level as being less than middle/technical school, and 42.1% were married. About one-third of the study participants provided HIV testing and counseling, and few had prior mental health training (15.0%). On average, participants had 4 years of HIV counseling experience (range 1–15, SD = 3.5, Median = 2) (Table 1). Examination of the psychometric properties of the DAQ revealed poor internal consistency across the subscales: nature of depression (alpha = 0.393), depression treatment (alpha = 0.422), and professional attitudes (alpha = 0.338). A *post-hoc* analysis revealed that the internal consistency of the scales was slightly higher, but still relatively low, among the study participants with prior mental health training (nature of depression: alpha = 0.648; depression treatment: alpha = 0.512; professional attitudes: alpha = 0.586) (Table 2).

There was substantial variation in the proportion of participants who agreed with certain statements regarding the nature of depression, depression treatment, and professional attitudes, which are detailed below (Table 3).

## Domain 1: Nature of depression

Almost all (98.1%) participants reported that they had heard of depression, but fewer than half of the participants reported personally knowing someone with depression. The majority of the counselors reported having learned about depression through their professional practice, while a few learned about it through in-service training and academia or had found information about depression through reading books. On the DAQ scale, a majority (64.49%, $n = 71$) disagreed that "becoming depressed is a natural part of being old" (question 11) and 52.34% ($n = 56$) disagreed that "depression reflects a characteristic response in patients which is not amenable to change" (question 10). Almost half of participants 50.47% ($n = 54$) agreed that during the last 5 years, [they] have observed an

TABLE 1 Characteristics of the sample.

| | **Full sample, *n* = 107** |
|---|---|
| Age, M (SD) | 32.29 (7.39) |
| Years of counseling experience, M (SD) | 4.05 (3.46) |
| Nature of depression (DAQ), M (SD) | 52.87 (11.11) |
| Professional Reaction (DAQ), M (SD) | 53.19 (11.93) |
| Treatment preferences (DAQ), M (SD) | 61.55 (11.22) |
| **Gender, *n* (%)** | |
| Female | 83 (77.57) |
| Male | 24 (22.43) |
| **Education level, *n* (%)** | |
| Basic complete | 22 (20.56) |
| Middle/technical/pre-university incomplete or complete | 66 (61.68) |
| Attended higher education or upper level | 19 (17.76) |
| **Marital status, *n* (%)** | |
| Single | 57 (53.27) |
| Married/civil union/living as married | 45 (42.06) |
| Divorced, separated, or widowed | 5 (4.67) |
| **Mental health training, *n* (%)** | |
| No | 91 (85.05) |
| Yes | 16 (14.95) |
| **Counseling type, *n* (%)** | |
| APSS: psychosocial counseling | 29 (27.10) |
| Testing and counseling (ATS, ATIP, ATSC) | 41 (38.32) |
| Specialty counselors (SMI and CCR/TB) | 13 (12.15) |
| More than 1 type of counseling | 24 (22.43) |
| Oher types of counseling | 37 (34.58) |

APSS, psychosocial and support; ATS, counseling and testing in health; ATIP, couseling and testing intiated by the provider; ATSC, Community counseling and testing, SMI, Maternal and Child health; CCR, Child at Risk Consultation and TB, tuberculosis.

increase in the number of patients presenting with depressive symptoms (question 1) and most (70.09%, $n = 75$) agreed that "the majority of depression seen in general practice originates from patients' recent misfortunes (disgrace, tragedy)" (question 2). However, many counselors 60.75% ($n = 65$) revealed some stigmatizing attitudes by agreeing that becoming depressed is a way that "fragile" people deal with life's difficulties (question 7) (Table 3).

For other statements relating to the nature of depression, including biochemical and biological origins, there was limited agreement (34.58%, $n = 37$ disagreed; 28.97%, $n = 31$ were neutral; and 36.45%, $n = 39$ agreed) among participants (question 4); 60.75% ($n = 69$) considered that it was possible to distinguish different presentations of depression (psychological, biochemical, or related to adversity); and almost half 45.79% ($n = 49$) of the participants believed that patients with depression probably experienced more childhood deprivation than other people (question 8) (Table 3). When asked about risk factors for depression, only a few participants considered heredity as a biological risk factor, whereas most cited psychosocial factors such as marital, social, and financial problems; unemployment; and trauma, sexual, physical, or verbal violence happening in childhood and adulthood.

Subsequent qualitative inquiry revealed a more nuanced conceptualization of depression, characterized in two ways. The first description included one or more of the following words: a psychological or psychiatric illness that is characterized by a feeling of deep sadness, anguish, apathy, altered mood, isolation, low self-esteem, inactivity, guilt, and sometimes suicidal thoughts or ideation.

> *"Depression is a psychiatric illness characterized by a feeling of deep sadness, apathy, mood swings, inactivity, and sometimes suicidal thoughts or ideation…"* Male HC, 46 years old

The second type was depicted as more of an emotional reaction to unexpected stressful situations (e.g., results of an HIV test) and difficulties in dealing with problems.

> *"(depression) is a disease that affects people with difficulties in overcoming certain problems in life; when it is not treated, it can become chronic and lead to suicide…"* Female HC, 36 years old

Participants described depression in five main ways: (1) isolation (feeling alone, social isolation, being isolated, abandoned, not wanting to be with others, withdrawing, bashful, staying in your corner, hiding); (2) sadness (deep sadness, feeling depressed, distraught, disappointed, dysphoric mood; negative mood and behavior); (3) apathy (weak, haggard, passive); (4) restlessness (being out of your mind, becoming stressed, upset); and (5) suicidal ideation (loses desire to live, loses interest in living, thinking about wanting to die, wanting to take one's life) (Table 4).

When asked about risk factors for depression, participants mentioned low self-esteem; lack of resilience; heredity (genetic predisposition); isolation; marital, social, and financial problems; unemployment; trauma (verbal, physical, sexual, or psychological violence); alcohol and drug abuse; and/or death or loss of loved one. Nearly all believed HIV was a risk factor for depression due to learning of the HIV diagnosis as a chronic disease requiring medication for life, as well as introducing problems of discrimination, stigmatization, and prejudice (Table 5).

The four of the most commonly cited risk factors for depression were marital, social, financial, and unemployment problems followed by learning the diagnosis of chronic conditions such as HIV; death or loss of loved ones; and traumatic experiences during childhood and adulthood (verbal, physical, psychological, domestic and sexual abuse). Other risk factors mentioned were discrimination, stigmatization and prejudice, solitude and isolation, anxiety and worry, difficulty expressing oneself, unhealthy lifestyle (addiction, alcohol and substance abuse), low self-esteem, lack of

TABLE 2 Psychometric characteristics.

| | | Nature of depression | Treatment preferences | Professional reaction | Alpha if item deleted |
|---|---|---|---|---|---|
| DAQ1 | During the last 5 years, I have seen an increase in the number of patients presenting with depressive symptoms. | X | | | 0.383 |
| DAQ2 | The majority of depression seen in general practice originates from patients' recent misfortunes (disgrace, tragedy). | X | | | 0.361 |
| DAQ3 | Most depressive disorders seen in general practice improve without medication. | | X | | 0.410 |
| DAQ4 | An underlying biochemical abnormality is at the basis of severe cases of depression (biochemical changes in the brain). | X | | | 0.369 |
| DAQ5 | It is difficult to differentiate whether patients are presenting with unhappiness or a clinical depressive disorder that needs treatment. | X | | | 0.405 |
| DAQ6 | It is possible to distinguish two main groups of depression: one psychological in origin and the other caused by biochemical mechanisms (biochemical changes in the brain). | X | | | 0.406 |
| DAQ7 | Becoming depressed is a way that people with poor stamina deal with life difficulties. | X | | | 0.309 |
| DAQ8 | Depressed patients are more likely to have experienced deprivation in early life than other people. | X | | | 0.323 |
| DAQ9 | I feel comfortable in dealing with depressed patients' needs. | | | X | 0.082 |
| DAQ10 | Depression reflects a characteristic response in patients which is not amenable to change. | X | | | 0.395 |
| DAQ11 | Becoming depressed is a natural part of being old. | X | | | 0.313 |
| DAQ12 | Nursing professionals working in primary care can be useful in supporting depressed patients. | | X | | 0.437 |
| DAQ13 | Working with depressed patients is heavy going. | | | X | 0.096 |
| DAQ14 | There is little to be offered to those depressed patients who do not respond to what GPs do. | | X | | 0.401 |
| DAQ15 | It is rewarding to spend time looking after depressed patients. | | | X | 0.487 |
| DAQ16 | Psychotherapy tends to be unsuccessful with depressed patients. | | X | | 0.470 |
| DAQ17 | If depressed patients need antidepressants, they are better off with a psychiatrist than with a general practitioner. | | X | | 0.375 |
| DAQ18 | Antidepressants usually produce a satisfactory result in the treatment of depressed patients in general practice. | | X | | 0.369 |
| DAQ19 | Psychotherapy for depressed patients should be left to a specialist. | | X | | 0.328 |
| DAQ20 | If psychotherapy were freely available, this would be more beneficial than antidepressants for most depressed patients. | | X | | 0.301 |
| | **Internal consistency** | 0.3926 | 0.4215 | 0.3383 | |
| *Secondary analysis of internal consistency by Mental health training* | | | | | |
| | Cronbach's alpha among people without mental health training | 0.3549 | 0.4366 | 0.2913 | |
| | Cronbach's alpha among people with mental health training | 0.6484 | 0.5118 | 0.586 | |

TABLE 3 Summary of quantitative findings by domain.

| | | Disagree | Neutral | Agree |
|---|---|---|---|---|
| | **Domain 1: Nature of depression** | | | |
| DAQ1 | During the last 5 years, I have seen an increase in the number of patients presenting with depressive symptoms. | 31 (28.97) | 22 (20.56) | 54 (50.47) |
| DAQ2 | The majority of depression seen in general practice originates from patients' recent misfortunes (disgrace, tragedy). | 18 (16.82) | 14 (13.08) | 75 (70.09) |
| DAQ4 | An underlying biochemical abnormality is at the basis of severe cases of depression (biochemical changes in the brain). | 37 (34.58) | 31 (28.97) | 39 (36.45) |
| DAQ5 | It is difficult to differentiate whether patients are presenting with unhappiness or a clinical depressive disorder that needs treatment. | 54 (50.47) | 6 (5.61) | 47 (43.93) |
| DAQ6 | It is possible to distinguish two main groups of depression: one psychological in origin and the other caused by biochemical mechanisms (biochemical changes in the brain). | 15 (14.02) | 23 (21.50) | 69 (64.49) |
| DAQ7 | Becoming depressed is a way that people with poor stamina deal with life difficulties. | 36 (33.64) | 6 (5.61) | 65 (60.75) |
| DAQ8 | Depressed patients are more likely to have experienced deprivation in early life than other people. | 49 (45.79) | 11 (10.28) | 47 (43.93) |
| DAQ10 | Depression reflects a characteristic response in patients which is not amenable to change. | 56 (52.34) | 14 (13.08) | 36 (33.64) |
| DAQ11 | Becoming depressed is a natural part of being old. | 71 (66.36) | 8 (7.48) | 28 (26.17) |
| | **Domain 2: Treatment preference** | | | |
| DAQ3 | Most depressive disorders seen in general practice improve without medication. | 32 (29.91) | 11 (10.28) | 64 (59.81) |
| DAQ12 | Nursing professionals working in primary care can be useful in supporting depressed patients. | 13 (12.15) | 7 (6.54) | 86 (80.37) |
| DAQ14 | There is little to be offered to those depressed patients who do not respond to what GPs do. | 68 (63.55) | 15 (14.02) | 24 (22.43) |
| DAQ16 | Psychotherapy tends to be unsuccessful with depressed patients. | 78 (72.90) | 12 (11.21) | 17 (15.89) |
| DAQ17 | If depressed patients need antidepressants, they are better off with a psychiatrist than with a general practitioner. | 7 (6.54) | 5 (4.67) | 95 (88.79) |
| DAQ18 | Antidepressants usually produce a satisfactory result in the treatment of depressed patients in general practice. | 12 (11.21) | 21 (19.63) | 74 (69.16) |
| DAQ19 | Psychotherapy for depressed patients should be left to a specialist. | 19 (17.76) | 7 (6.54) | 81 (75.70) |
| DAQ20 | If psychotherapy were freely available, this would be more beneficial than antidepressants for most depressed patients. | 11 (10.28) | 10 (9.35) | 85 (79.44) |
| | **Domain 3: Professional reaction** | | | |
| DAQ9 | I feel comfortable in dealing with depressed patients' needs. | 26 (24.30) | 15 (14.02) | 66 (61.68) |
| DAQ13 | Working with depressed patients is heavy going. | 94 (87.85) | 5 (4.67) | 8 (7.48) |
| DAQ15 | It is rewarding to spend time looking after depressed patients. | 6 (5.61) | 10 (9.35) | 91 (85.05) |

Domain 1: Nature of depression; Domain 2: Treatment preference and Domain 3: Professional reaction.

resilience, expression difficulty, being postpartum, and heredity (Table 5).

> "*... Loss of a loved one, consumption of psychoactive substances, unresolved grief, job loss, unemployment and chronic illnesses ...*" Female HC, 37 years old
>
> "*... Abuses and mistreatment in childhood without opening up to someone can cause trauma in adult life; cost of living and wars that can lead to future depression...*" Female HC. 37 years
>
> "*... Lack of employment, lack of family support, discrimination and grief ...*" Female HC, 41 years old

## HIV as a risk factor

Almost all participants believed that HIV was a risk factor for depression. The association between HIV and depression was explained through difficulty accepting the test result; fear of disclosing the diagnosis to a partner and/or family member; fear of discrimination; hopelessness; difficulty facing HIV and AIDS as a chronic disease without cure requiring treatment for life. According to the health counselors, the main problems described by HIV positive patients that could increase the risk of depression were lack of family support, discrimination, and lack of support and conflict with a partner; not speaking or speaking little; not knowing what depression is; difficulty/fear in disclosure to the partner and acceptance of the diagnosis; taking medication and its side effects; poverty, hopelessness,

TABLE 4 Symptoms of depression.

| Symptoms of depression | *n* | % |
|---|---|---|
| Isolation (isolation, feeling alone, social isolation, being isolated, abandoned, not wanting to be with others, withdrawing, bashful, staying in your corner, hiding) | 32 | 18.9 |
| Sadness (stay / sad, sad mood, deep / advanced sadness) | 29 | 17.2 |
| Depressed, weak, haggard, distraught, disappointed, state of mood and negative behavior, apathy, passive | 16 | 9.5 |
| Dysphoric mood, restlessness, be out of your mind, become stressed, upset | 11 | 6.5 |
| Suicide ideation (loses desire to live, lose interest in living, thinking want to die, want to take one's life) | 11 | 6.5 |
| Lack pleasure (loses will to do things you love, unwilling to do anything, to feel inhibited in things, do not accept the things you love, stop doing activities that previously did, inactivity) | 10 | 5.9 |
| Desperate, demoralized, inferior, weakened, devalued | 9 | 5.3 |
| Difficulty talking (not want to talk to nobody is not want to share, do not want to talk, afraid to open up, unwilling to count the problems) | 9 | 5.3 |
| Lack of interest in many aspects of life, nothing has importance, feel guilty, not being satisfied with your life | 9 | 5.3 |
| Thinking that life stopped, unable to deal with problems, do not accept the reality | 7 | 4.1 |
| Low self esteem | 6 | 3.6 |
| Neglected, lack of hygiene care, no bathing | 6 | 3.6 |
| Physical and psychological discomfort, confusion, inactivity, thinking about pain and hurt | 5 | 3 |
| Crying | 4 | 2.4 |
| Lack appetite, do not eat, lose weight | 3 | 1.8 |
| Difficulty to withhold certain information and difficult to face situations | 2 | 1.2 |
| Total | 169 | 100.0 |

TABLE 5 Depression factors.

| | *n* | % |
|---|---|---|
| Lack of resilience, isolation, marital, social, financial problems, unemployment. | 39 | 36.45 |
| Diagnostic disclosure of HIV and chronic disease | 21 | 19.63 |
| Death or loss of a loved one | 17 | 15.89 |
| Trauma, violence verbal, physical, sexual, psychological and abuse of alcohol and drugs | 15 | 14.02 |
| Low self-esteem, discrimination, stigmatization and prejudice | 13 | 12.15 |
| No reply | 2 | 1.87 |

TABLE 6 HIV/AIDS associated with depression.

| | *n* | % |
|---|---|---|
| People find it difficult to accept their serostatus in the initial phase, because they know that HIV is a chronic disease, with no cure and because they comply with treatment for life, a factor that can lead to depression | 73 | 68.2 |
| Sociocultural issues, habits, beliefs and values associated with HIV culminate in discrimination, stigma and lack of support by the partner and family as well as the community | 27 | 25.2 |
| I believe that HIV is not a risk factor for depression | 4 | 3.7 |
| If the form of revelation by the health provider to the patient is not preceded by psychological preparation, this can lead to depression | 3 | 2.8 |

financial/transportation/food difficulties; and poor treatment (Table 6).

> *"… Generally speaking, it can (cause depression). Those people who do not want to accept their status, think that HIV is the end of life and the person alone begins to feel discriminated against without others knowing what their status is …"* Female HC, 33 years old
>
> *"… Yes, for example, when the person is tested and the result is positive (for HIV), he goes into depression because he thinks it is the end of his life and he is afraid to tell his family.… "* Female HC, 34 years
>
> *"… Currently, since the care is integrated and people are informed about HIV, (depressive symptoms) do not develop. Years ago, people could develop depression because they thought it was the end of life …"* Male HC, 24 years old

TABLE 7 Lay counselors' description of barriers reported by patients.

| Main (barriers) reported by patients | n | % |
|---|---|---|
| Lack of partner and family support, discrimination, stigma and conflict | 34 | 31.8 |
| Do not speak or speak little and some do not know what is depression | 30 | 28 |
| Difficulty/fear in disclosing the partner and accepting the diagnosis, taking medication, side effects and poor care | 29 | 27.1 |
| Socio-economic factors such as poverty, unemployment, financial difficulties, transport and food | 14 | 13.1 |

> *"... I think (HIV can cause depression), first because it is a disease that is not curable, and second, because the person with HIV is vulnerable to being discriminated against, the long-time treatment, and at some point, the side effects of the treatment ..."* Male HC, 41 years old.

## Problems reported by PWH

Providers also talked about the main problems described to them by patients, which included the lack of social and financial support, lack of partner and family support, discrimination, stigma, and interpersonal conflict. Other patient concerns reported by the counselors were uncertainty, the fear of revealing their diagnosis to their partners, and the fear of medication's side effects (Table 7).

> *"… There are people who talk. Sometimes they talk about lack of money for transport and food, abuse in the family and even in the hospital, they face some shame…"* Male HC, 60 years old
>
> *"… They even talk when we do not have time to talk to them. Many of them do not open up. The problems are poverty, the illness itself and frequent losses in the family …"* Female HC, 28 years old
>
> *"… Yes, they do (talk about depression). (They) often question whether they still will be the same individuals and are concerned too often with medication and what family or friends think of it ..."* Female HC, 33 years
>
> *"… The lack of acceptance of the diagnosis and the fact that he is not debilitated makes him not accept his status …"* Male HC, 23 years old
>
> *"…Some talk (about their problems), that they feel alone, that they don't have enough money (for transportation), stigma, lack of family support, non-acceptance of the (HIV) positive diagnosis and fear of going to the health facility…"* Male HC, 26 years old.

TABLE 8 Depression prevention mechanisms reported by lay health counselors.

| Depression prevention mechanism | n | % |
|---|---|---|
| Communication (conversation/dialogue) with family or trusted people about your problems and concerns. | 29 | 27.1 |
| Seek support from friends, counseling and follow-up at the psychologist | 21 | 19.6 |
| Self-esteem, socialization, avoiding and dealing with stress, stigma, violence and other life situations. | 19 | 17.8 |
| Dissemination of information and lectures on depression (TV, radio, community). | 17 | 15.9 |
| Does not know or considers that there is no prevention. | 11 | 10.3 |
| Relaxation, sports and facing problems. | 10 | 9.3 |

## Depression prevention

The most cited preventive mechanisms for depression were communication (conversation/dialogue) with family members or trusted people about problems and concerns; seeking support from friends; counseling and follow-up with a psychologist; and self-esteem, socialization, avoiding stress, stigma, violence, and other life situations. The other forms of prevention were disseminating information and lectures on depression through social media (TV, radio), relaxation, and sports to cope with problems (Table 8).

> *"… Talking more to people, someone trustworthy exposing the problems. Having the habit of looking for a psychologist to express concerns…"* Female HC, 29 years old
>
> *"… Talk to trusted and experienced people in case of any discomfort or difficulty, seek support at the level of health units for better clarification…"* Female HC, 37 years old
>
> *"… More community involvement and events, as an alternative for dissemination …"* Male HC, 26 years old
>
> *"… First, there must be dialogue in a family, health providers must try to listen or listen to the patient and help him …"* Female HC, 36 years old
>
> *"… I believe that conversation and counseling help to distract the mind so that the person does not always think about being HIV positive …"* Female HC, 38 years old

## Domain 2: Treatment of depression

Most lay HIV counselors supported psychotherapy and medication to treat depression but most believed mental health specialists should provide it. The majority 75.70% ($n = 81$) agreed with the statement "psychotherapy in patients with depression should be left to the specialist" (question 19) and 59.81% ($n = 64$) agreed with the statements "most

TABLE 9 Types of treatment for depression.

| Forms/types of treatment for depression | n | % |
|---|---|---|
| Counseling, psychological and drug treatment | 77 | 72.0 |
| Counseling and family and community support sessions | 29 | 27.1 |
| None | 1 | 0.9 |

TABLE 10 Treatment setting.

| Where can you find treatment for depression | n | % |
|---|---|---|
| Psychology and psychiatry consultation, physician, trained counselor | 34 | 31.8 |
| The health facility (center health, hospital, pharmacy, clinic). | 32 | 29.9 |
| In hospitals where there are psychologists. | 17 | 15.9 |
| At the health services, at home (talking to a health provider or a family member or friends) | 15 | 14 |

TABLE 11 Lay health counselors attitude toward depression.

| Health counselors attitude toward patient with depression | n | % |
|---|---|---|
| Refer to psychologist, psychiatry technician or specialist. | 57 | 53.3 |
| Conversation, Reception and Advice. | 32 | 29.9 |
| Create empathy and active listening to the patient's difficulties. | 15 | 14 |
| Communication (conversation/dialogue) with family or trusted people about your problems and concerns. | 3 | 2.7 |

depressive disorders seen in general practice improve without medication" (question 3) and 80.37% ($n = 86$) believed that "nursing professionals working in primary care can be useful in supporting depressed patients" (question 12). Many 63.55% ($n = 68$) did not endorse the statement "there is very little to offer patients with depression who do not get better with the treatment proposed by the general practitioner" (question 14); however 72.90% ($n = 78$) disagreed that "psychotherapy in patients with depression does not usually give good results" (question 16), and 79.44 ($n = 85$) agreed that "if psychotherapy were freely available, it would have more benefits than antidepressants for most patients with depression" (question 20) (Table 3). When asked qualitatively, the counselors reported that they believed it was possible to treat depression, and this treatment could be through a psychologist, psychiatric technician or specialist for medications and the other option was counseling, psychosocial support and/or through support groups (family and community) (Table 9).

> *"… I think it is possible (to treat depression), there are several forms of treatment, through counseling, empathy, medication, lectures and socializing with people who have already been through the same situation.…"* Male HC, 24 years old
>
> *"… It is (treatable), depending on the type, there are cases in which the treatment can be through physical exercises, some relaxation techniques. In other cases, specific treatment with antidepressants indicated by the specialist is necessary.…"* Male HC, 41 years old
>
> *"… I think so, doing some sessions with psychologists or psychiatrists…"* Female HC. 30 years
>
> *"Some people have chronic depression, which is difficult to treat but still treatable. It is talking to the person or meeting with a psychologist …"* Female HC, 36 years old

For the treatment of depression, participants suggested patients could seek psychological and psychiatric consultation with a doctor or trained counselor at health facilities (health center, hospital, pharmacy, clinic) or home, with family and/or friends. The participants said that at health facilities, treatment for depression could be found at the following services: Health Counseling and Testing, Psychosocial Support, and Young and Adolescent Friendly Services (Table 10).

## Domain 3: Professional attitudes

Most participants 85.05% ($n = 91$) agreed that it was rewarding to spend time caring for depressed patients (question 15) and 87.85% ($n = 94$) disagreed that working with depressed patients is "heavy going" (question 13). Most lay HIV counselors 61.68% ($n = 66$) reported feeling comfortable dealing with depressed patients' needs (question 9). Participants suggested the strategies for helping patients presenting with depressive symptoms were: to refer to a psychologist, psychiatric technician, or specialist; conversation, welcoming, and counseling; and demonstrating empathy and actively listening to the patients' difficulties (Table 11).

# Discussion

This is, to our knowledge, the first study exploring knowledge and attitudes about mental health among lay HIV counselors in Mozambique. The key findings in our study are: first, the counselors demonstrated limited knowledge regarding the biological risk factors for depression (such as genetic and biochemical changes in the brain) and considerable knowledge about depression symptoms, psychosocial risk factors and management. Few had received specific or formal training in mental health and thus much of their knowledge about the presentation and management of depression was acquired through self-learning, books, or information from the media. Participants' conception of depression was based on their experiences in dealing with HIV positive patients in their daily routine, with considerable social and financial hardship. Most providers believed healthy lifestyles, family and community support, counseling, psychotherapy, medication treatment with mental health specialists could help to prevent and treat depression.

In contrast with other settings, non-mental health specialists and family practitioners in Saudi Arabia displayed high levels of knowledge and positive attitudes regarding depression and anxiety (50); this was attributed to their additional training in the management of mental disorders. When the R-DAQ was used among non-psychiatric physicians in Saudi Arabia, they showed optimism and confidence in managing depression, a positive attitude toward depression, but discriminatory and stigmatizing explanations for causes of depression–such as lack of willpower, poor stamina, part of the aging process (51). Furthermore, participation in any training related to mental health during the previous 5 years improved attitudes by 17% compared to other professionals (45). Moreover, despite their lack of mental health training, lay health counselors did not report religious or supernatural explanations for depression (such as witchcraft, evil spirits, divine punishment), which were reported by physicians not specialized in psychiatry in Pakistan (52) and by church volunteers in Nigeria (53). The participants demonstrated weak knowledge regarding the nature of depression. Only 52% disagreed that "depression reflects a characteristic response in patients which is not amenable to change" (DAQ 10) and 60% considered depression to be a way that "fragile people deal with life's difficulties" (DAQ 7). The former observation is similar to what was found in a study among general practitioners in Brazil (54). Similarly, consideration that depression is how fragile people deal with life's difficulties was also observed among nurses in Spain before receiving training on mental health (44). These findings suggest that more targeted training on depression is needed, with active components of stigma reduction to address negative stereotypes and false conceptions.

In our study, most participants had heard of depression, although most did not personally know people with depression. Most believed that depression was associated with HIV and AIDS. Providers also recognized the relationship between depression and other chronic conditions as contributing to low self-care with negative impact to patients' health (55). HIV and AIDS leads to depression through stigma and self-blame (56) or because of the challenge of accepting the diagnosis and the chronic demands involved in taking medications. Lack of income associated with unemployment and other difficulties associated with subsistence living, older age, distance to facility, stigma, and concerns about diagnostic disclosure and side-effects from ART (5, 57, 58) were also reported in our study as mental health stressors. Fear of disclosing one's HIV status to their partners can reduce the likelihood that people will adopt protective measures (such as condom use), which can increase the risk of transmission to others (59–62). Futhermore, HIV disclosure can have negative consequences such as stigma and discrimination, divorce and partner violence (63, 64) which are risk factors for depression (65). Disclosure of HIV serostatus has also been related to optimal adherence and freedom to use ART (58) as well as increased emotional and financial support (63, 66).

Our sample considered counseling, psychological and drug treatment and effective treatment strategies. The use of antidepressants was less frequently mentioned, which may be related to a false belief that treating depression with antidepressants may have a negative impact on HIV treatment adherence and outcomes (67). This is consistent with the fact that most counselors felt that psychologists and psychiatrists should manage depression, and that the HIV counselors lacked the skills to manage it. As seen in our study, active and empathic listening of patients' concerns, distress, and questions about treatment were seen as ways to improve engagement in treatment. Similar findings have been reported in studies conducted among other types of healthcare professionals, such as pharmacists (68).

The preventive measures and treatments reported by lay health counselors are in line with those recommended for populations outside of Mozambique, which include physical and recreational activity, social interactions, relaxation techniques, and seeking counseling either by professionals (licensed psychotherapists, psychiatrists, family medicine physicians, pharmacists) or by family members, friends, and acquaintances (69). This is consistent with the answers provided in the DAQ which suggested counselors believed that psychotherapy is more beneficial than antidepressants for the treatment of depression.

Training health providers to manage mental illness, mainly depression, is essential in resource-limited settings, and such training has been shown to improve knowledge and competence, as well as the delivery of effective mental health services (26, 45, 50). There was general agreement, not only among the lay health counselors but other non-mental health providers, that a psychiatrist or psychologist would better manage depression, not only because of the lack of integration of mental health services in primary care settings but also because of self-reported challenges in the identification of depressive symptoms by primary care providers (26, 45, 54, 70–72); there is ample evidence demonstrating that both lay health counselors and other non-mental health providers can be trained to effectively identify depression (73, 74). Mental health training may improve depression-related knowledge, attitudes, and practices in this group (45, 75). Our study suggests that training lay health counselors has the potential to improve their knowledge and attitudes toward depression in PWH and also care and outcomes as part of mental health in HIV services within primary healthcare setting.

## Study limitations

The data for this study were collected in primary care health centers at the level of primary care located in Maputo city and Maputo province, so they may not be generalized to the rest of the country. The instrument for this study may be subject to information bias due to the poor mental health literacy of the participants. That said, one strength of our study–in light of the low internal consistency of the DAQ instrument–was the qualitative component. After each set of quantitative "agreement statements" by domain, we encouraged participants to use their own words to describe the same concepts. This extra step proved invaluable to us in order to be able to interpret some of the findings that were apparently in contrast. The small sample size for the quantitative survey limits the generalizability of its findings; however, having collected a small amount of qualitative data from such a large sample was a strength in this study. Other studies have also shown weak internal consistency of the DAQ in general and its subscales (45, 76). Since the qualitative interviews were conducted after administering the DAQ, the degree to which the answers may have been influenced by the survey questions is unclear. For this reason, it is reasonable to suggest adjustments that include additional items tailored to the professionals being assessed (71).

The DAQ is a tool primarily used to determine attitudes toward depression among medical doctors and other health professionals, but one of its limitations is low internal consistency (70). Studies provided insufficient information regarding psychometric properties and did not include internal consistency (45, 76). In the first Portuguese version study of the DAQ, the factorial analysis was omitted due to the small sample size for each item (54).

## Conclusions and implications

This study describes the knowledge and attitudes of lay HIV counselors regarding depression associated with their daily practice/routine, especially those already providing psychosocial support. Training lay counselors in mental health is associated with better knowledge, attitudes, and practices in LMICs (75). Additional research will be needed to understand sustainable ways of incorporating evidence-based interventions and community-based participatory methods in order to reduce mental health disparities (73). Training and supervising lay health workers to deliver effective counseling interventions (39) can address depression among PWH in LMIC. Since lay counselors are the first point of contact for PWH in primary care, and given the shortage of mental health professionals, the training of HIV counselors in the identification and management of depression could enhance access to and improvements in care. Depression among PWH is associated with poor social connections, lower help-seeking, and adverse health behaviors (77). Health counselors have the potential to improve patient care in HIV clinics. By improving their competency to screen for and manage depression, they can potentially mitigate the negative impact of depression on adherence to ART and, hopefully, improve the prognosis of HIV infection.

Understanding medical practitioners' attitudes can guide and assess the needs for training at the primary healthcare level. This is also true for lay HIV counselors, who organize service delivery specifically for PWH and manage treatment outcomes (54, 78). Of note, most of our participants accurately linked the conditions of depression and HIV/AIDS.

Basic brief training positively impacts non-mental health professionals' knowledge and attitudes toward depression and impacts patients' education and care, especially for those with chronic disease and/or involved in long-term treatment (79, 80). Investing in the training of lay health counselors can significantly impact patient care for PWH and people with other chronic illnesses where depressive symptoms may affect patients' quality of life, adherence, and prognosis.

## Data availability statement

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

## Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committees (from Federal University of São Paulo in Brazil and Eduardo Mondlane University in Mozambique). The patients/participants provided their written informed consent to participate in this study.

## Author contributions

FM, MG, LP, and AS drafted the manuscript. MG did statistical analysis. AS did qualitative analysis. MG, CD, FC, MS, ES, DK, MO, and MW reviewed the manuscript. FM and MM designed the protocol. All authors agreed to the final version of the manuscript.

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## Conflict of interest

Author MO receives royalties from the Research Foundation for Mental Hygiene for the Columbia Suicide Severity Rating Scale's commercial use and owns shares in Mantra, Inc. She serves as an advisor to Alkermes and Fundacion Jimenez Diaz (Madrid). Her family owns stock in Bristol Myers Squibb.

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

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EDITED BY
Jerome T. Galea,
University of South Florida,
United States

REVIEWED BY
Celeste Annemarie De Jager Loots,
Imperial College London,
United Kingdom
Oksana Zayachkivska,
Danylo Halytsky Lviv National Medical
University, Ukraine

*CORRESPONDENCE
Hye Young Jang
white0108@hanyang.ac.kr

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# COVID-19-related anxiety and lifestyle changes

Song Yi Han[1], Hye Young Jang[2]* and Young Ko[3]

[1]Department of Nursing Science, Sunmoon University, Asan-si, South Korea, [2]College of Nursing, Hanyang University, Seoul, South Korea, [3]College of Nursing, Gachon University, Incheon, South Korea

This study aimed to identify factors that affect lifestyle changes and focused on coronavirus disease (COVID-19)-related anxiety since the COVID-19 outbreak in South Korea. Data from 213,848 individuals from the 2020 Korean Community Health Survey were analyzed using a complex sampling design. Descriptive statistics, *t*-tests, one-way ANOVA, and multiple regression analyses were performed. Participants reported a high level of COVID-19-related anxiety, with a score of 19.28 out of 25. The score of healthy behavioral change index was −0.51, indicating negative changes in physical activity, dietary habits, and sleep patterns. A slight positive change was reported for addictive behavioral change index, such as smoking and alcohol consumption, at 0.27 scores, indicating a decrease in these behaviors. COVID-19-related anxiety was an important factor that negatively affected health behavior. The high-risk groups that were vulnerable to anxiety included older adults and those who have little social support or few social encounters. Thus, identifying high-risk groups with the potential for worsened health behavior and providing interventions to reduce the anxiety caused by COVID-19 are necessary.

KEYWORDS

**coronavirus (COVID-19), anxiety, lifestyle, healthy behavior, addictive behavior**

## Introduction

The coronavirus disease (COVID-19) pandemic, which began in 2019, has led to a global public health emergency and has continued to spread. The World Health Organization (WHO) declared a pandemic in March 2020, and as of December 2021, there have been reports of more than 200 million infections and 5 million deaths (1). Recently, as the Omicron variant has spread rapidly, the WHO has emphasized the need for continuous implementation of physical distancing, refraining from non-essential outings, quarantining, and isolating and has requested national cooperation to prevent the spread of COVID-19 (2). Since 2019, many countries including Korea have taken strong measures to prevent and control COVID-19, which has resulted in many changes in daily lives. Changes in health behaviors such as decreased physical activity (3–6), changes in sleeping patterns (3, 6, 7), and increased consumption of an unhealthy diet have been reported (3, 6). Stress and isolation during COVID-19 have also led to an increase in cigarette smoking and alcohol consumption, which both have negative impacts on health (8). These changes in health behaviors will result in various health problems (9). Therefore, identifying high-risk groups with adverse changes in lifestyle behaviors during the COVID-19 pandemic and factors influencing these behaviors is necessary.

The COVID-19 pandemic has been highly associated with psychological problems, such as anxiety and depression. In previous studies, high levels of mental health problems such as depression and anxiety symptoms were reported during COVID-19 (10, 11). Increase in COVID-19-related anxiety with the spread of this novel infectious disease may come from fear of infection, social isolation, physical distancing to prevent transmission, and worsening economic issues (12–14). COVID-19-related anxiety is reportedly higher with advanced age (15–17), low socioeconomic status (18), and low social support (14, 17). High anxiety levels have been attributed to lifestyle changes such as decreased physical activity or quality of sleep (18, 19). In particular, for older adults, high COVID-19-related anxiety is known to decrease health-related quality of life (20).

Previous studies have been conducted to assess changes in health behavior during the COVID-19 pandemic (7) or to examine the relationship between psychological factors, such as depression, stress, and anxiety, and changes in health behavior (4, 8, 18, 19, 21). Some studies have utilized assessment tools for general anxiety instead of those focused on COVID-19 (8, 18, 19), and inconsistent findings have thus been reported on the association between anxiety and lifestyle changes. Moreover, there are limitations in generalizing these findings as the studies involved specific populations (8, 18, 19, 21).

Therefore, using data representative from the Korean population, this study aims to examine the degree of lifestyle changes associated with COVID-19-related anxiety (Aim 1) and to identify factors that affect these lifestyle changes by focusing on COVID-19-related anxiety (Aim 2). We hypothesized that COVID-19-related anxiety would be associated with lifestyle changes. Higher levels of COVID-19-related anxiety would be related with negative changes in health behaviors, which include physical activity, sleep and diet. Addictive behaviors, which include alcohol consumption and smoking, would occurred with higher levels of COVID-19-related anxiety. This study will help to promote positive lifestyle changes and to establish health promotion strategies during the ongoing COVID-19 pandemic.

# Materials and methods

## Study design

This study involved a secondary data analysis of the 2020 Korean Community Health Survey (KCHS) to identify the factors influencing lifestyle changes by focusing on COVID-19-related anxiety since the onset of the COVID-19 pandemic.

## Participants and data

The KCHS has been conducted annually since 2008 at 255 community health centers across the nation among adults aged 19 years or older. This survey was conducted by the Korea Disease Control and Prevention Agency. The questionnaire of this survey was reviewed and finalized by community health survey expert group. Raw data were collected from August 16, 2020, to October 31, 2020. Trained investigators visited household selected as samples and conducted one-on-one computer assisted personal interviews (CAPI). Informed consent was obtained from all subjects before participation. The 2020 KCHS involved 229,269 participants in total. In this study, 213,848 individuals were included in the analysis, excluding subjects with missing values. The data can be obtained in accordance with the regulations on the disclosure procedure of raw data established by the Korea Disease Control and Prevention Agency. This study was conducted with the approval from the institutional review board (IRB) at the author's university (IRB No. 1044396-202111-HR-227-01).

## Measurements

### Lifestyles

Lifestyle factors were classified into healthy behavior and addictive behavior. We reconstructed these items based on previous studies (7, 8, 18). Each behavioral change was measured as follows.

### Healthy behavioral change index

The Healthy Behavioral Change Index included physical activity, sleep duration, and unhealthy diet. The following three items were included: "Compared with prior to the COVID-19 pandemic, what kind of changes have you noticed in (1) physical activity, such as walking or exercising (including indoor and outdoor activities), (2) sleep duration, and (3) consumption of instant foods or carbonated beverages?" The response options were as follows: 1 = increased; 2 = similar; 3 = decreased; and 4 = not applicable. The responses were recoded for physical activity and sleep duration: 1 = increased; 0 = similar and not applicable; and −1 = decreased. The responses for unhealthy diet were recoded as follows: 1 = decreased; 0 = similar and not applicable; and −1 = increased. The total score of the above three items was calculated. Total scores ranged from −3 to 3, with higher scores indicating a positive change in healthy behavior.

### Addictive behavioral change index

The Addictive Behavioral Change Index included smoking and alcohol consumption. The following two items were included: "Compared with prior to the COVID-19 pandemic, what kind of changes have you noticed in your (1) alcohol consumption and (2) smoking?" The response options were as follows: 1 = increased; 2 = similar; 3 = decreased; and 4 = not applicable. These responses were recoded as follows: 1 = decreased; 0 = similar and not applicable; and −1 = increased.

TABLE 1 General characteristic and social factors of the participants ($N = 213,848$).

| Variables | Category | Unweighted n or M ± SE | Weighted % |
|---|---|---|---|
| Gender | Male | 97,524 | 49.9 |
| | Female | 116,324 | 50.1 |
| Age (years) | 19–39 | 49,274 | 33.7 |
| | 40–64 | 98,462 | 47.3 |
| | ≥65 | 66,112 | 18.9 |
| | | 48.32 ± 0.054 | |
| Education level | ≤Middle school | 69,220 | 18.6 |
| | ≥High school | 144,628 | 81.4 |
| Household income (units: KRW 1,000 won/month) | <1,000 | 33,141 | 8.8 |
| | 1,000–3,000 | 66,670 | 25.9 |
| | 3,000–5,000 | 53,259 | 27.9 |
| | ≥5,000 | 60,778 | 37.4 |
| Employment | No | 81,803 | 37.1 |
| | Yes | 132,045 | 62.9 |
| Living arrangement | Living alone | 33,259 | 12.1 |
| | Living with others | 180,589 | 87.9 |
| Subjective health status | Good | 103,924 | 53.4 |
| | Fair | 82,675 | 37.7 |
| | Poor | 27,249 | 8.9 |
| Anxiety of COVID-19 | | 19.281±0.013 | |
| Social encounters due to COVID-19 | Not decreased | 28,463 | 10.4 |
| | Decreased | 185,385 | 89.6 |
| Number of people to ask for help | 0 | 36,032 | 15.1 |
| | 1–2 | 93,694 | 44.5 |
| | ≥3 | 84,122 | 40.3 |
| Lifestyle change | | −0.241 ± 0.004 | |
| Healthy behavioral change index | | −0.506 ± 0.003 | |
| Addictive behavioral change index | | 0.265 ± 0.002 | |

The total score of the above two items was calculated. Total scores ranged from −2 to 2, with higher scores indicating a positive change (decreased alcohol consumption and smoking).

## COVID-19-related anxiety

COVID-19-related anxiety was measured using the following five items.

(1) I am concerned about getting infected with COVID-19. (2) I am concerned that I might die if I get infected. (3) I am concerned that I will be criticized or harmed by those around me. (3) I am concerned that those who are immunocompromised or my family members will become infected. (4) I am concerned about financial hardships.

Each question was rated on a 5-point Likert scale (1 = very to 5 = not at all), and the total score was calculated by an inverse conversion. Scores ranged from 5 to 25 points, where a higher score indicated a higher level of anxiety. Cronbach's alpha in the present study was 0.80.

## Social factors

Social factors included social encounters and social support pertaining to the context of COVID-19. COVID-19-related social encounters was examined using the following item: "What kind of changes have happened in your frequency in engaging with your friends or neighbors compared with prior to the COVID-19 pandemic?" The response options were as follows: 1=increased; 2=similar; and 3=decreased. The responses "increased" or "similar" were classified as "not decreased." The response "decreased" was classified as "decreased."

TABLE 2 Healthy behavioral and addictive behavioral changes.

| Variables | Category | Healthy behavioral change index | | | Addictive behavioral change index | | |
|---|---|---|---|---|---|---|---|
| | | M ± SE | T or modified Wald F | *p* | M ± SE | T or modified Wald F | *p* |
| Gender | Male | −0.233 ± 0.005 | 29.298 | <0.001 | 0.241 ± 0.004 | 45.555 | <0.001 |
| | Female | −0.384 ± 0.005 | | | 0.081 ± 0.003 | | |
| Age (years) | 19–39$^{a}$ | −0.638 ± 0.005 | 1305.664 | <0.001 | 0.313 ± 0.004 | 263.881 | <0.001 |
| | 40–64$^{b}$ | −0.499 ± 0.004 | a<b<c | | 0.254 ± 0.003 | a>b>c | |
| | ≥65$^{c}$ | −0.287 ± 0.004 | | | 0.207 ± 0.003 | | |
| Education level | ≤Middle school | −0.177 ± 0.006 | 44.444 | <0.001 | 0.132 ± 0.004 | −14.880 | <0.001 |
| | ≥High school | −0.439 ± 0.005 | | | 0.189 ± 0.003 | | |
| Household income (unit: KRW 1,000 won/month) | <1,000$^{a}$ | −0.359 ± 0.007 | 231.130 | <0.001 | 0.195 ± 0.005 | 134.027 | <0.001 |
| | 1,000–3,000$^{b}$ | −0.435 ± 0.005 | a>b>c>d | | 0.234 ± 0.003 | a<b<c<d | |
| | 3,000–5,000$^{c}$ | −0.541 ± 0.006 | | | 0.263 ± 0.004 | | |
| | ≥5,000$^{d}$ | −0.564 ± 0.005 | | | 0.305 ± 0.003 | | |
| Employment | No | −0.292 ± 0.005 | 5.753 | 0.003 | 0.149 ± 0.004 | −6.311 | <0.001 |
| | Yes | −0.325 ± 0.005 | | | 0.172 ± 0.003 | | |
| Living arrangement | Living alone | −0.325 ± 0.007 | −4.400 | <0.001 | 0.156 ± 0.005 | −1.827 | 0.068 |
| | Living with others | −0.291 ± 0.004 | | | 0.166 ± 0.003 | | |
| Subjective health status | Good$^{a}$ | −0.487 ± 0.004 | 34.664 | <0.001 | 0.298 ± 0.003 | 284.615 | <0.001 |
| | Fair$^{b}$ | −0.535 ± 0.005 | b<c, a | | 0.241 ± 0.003 | a>b>c | |
| | Poor$^{c}$ | −0.500 ± 0.008 | | | 0.169 ± 0.005 | | |
| Social encounters due to COVID-19 | Not decreased | −0.152 ± 0.007 | 42.453 | <0.001 | 0.059 ± 0.005 | −41.745 | <0.001 |
| | Decreased | −0.465 ± 0.004 | | | 0.262 ± 0.003 | | |
| Number of people to ask for help | 0$^{a}$ | −0.491 ± 0.007 | 10.198 | <0.001 | 0.200 ± 0.004 | 158.320 | <0.001 |
| | 1–2$^{b}$ | −0.519 ± 0.004 | b<c, a | | 0.262 ± 0.003 | a<b<c | |
| | ≥3$^{c}$ | −0.497 ± 0.005 | | | 0.294 ± 0.003 | | |

*Post hoc, Bonferroni test (a–d = subgroups of each variable).

Social support was measured as the number of people the participant could ask for help if quarantining due to COVID-19. The number of people was classified as 0, 1–2, or 3 or more.

## General characteristics

General characteristics including gender, age, education level, monthly household income, employment, living arrangements, and subjective health status were recorded. Age was categorized as younger than 40 years, 40–64 years, and 65 years or older. Education level was categorized into "middle school or less" and "high school or higher." Monthly household income was categorized as follows: under 1,000,000 KRW; 1,000,000–2,990,000 KRW; 3,000,000–4,990,000 KRW; and 5,000,000 KRW or over. Employment was categorized into "employed" or "unemployed." Living arrangements were categorized into "living alone" or "living with others." Subjective health status was categorized as "good" (very good or good), "fair" (fair), or "poor" (poor or very poor).

## Data analysis

The data were analyzed using a complex sample design using the SPSS/WIN 23.0 program. A descriptive statistical analysis was conducted on the measured variables. The changes in lifestyle and COVID-19-related anxiety according to the general participant characteristics were analyzed using *t*-tests and one-way ANOVA, followed by a *post-hoc* Bonferroni test (Aim 1). A multiple regression analysis was conducted to identify the factors affecting lifestyle changes (Aim 2). Statistical significance was defined as $p < 0.05$.

# Results

## General characteristics and social factors

Among the participants, 49.9% were male, and 50.1% were female. The average age was 48.32 years. Approximately 81.4% of the participants had an educational level of high school or higher. An average monthly household income of 5,000,000

TABLE 3 COVID-19-related anxiety.

| **Variables** | **Category** | **COVID-19-related anxiety** | | |
|---|---|---|---|---|
| | | **M ± SE** | **T or modified Wald F** | ***p*** |
| Gender | Male | 18.745 ± 0.025 | −45.622 | <0.001 |
| | Female | 19.688 ± 0.024 | | |
| Age (years) | 19–39$^{a}$ | 18.637 ± 0.022 | 1372.465 | <0.001 |
| | 40–64$^{b}$ | 19.331 ± 0.017 | (a<b<c) | |
| | ≥65$^{c}$ | 20.284 ± 0.023 | | |
| Education level | ≤Middle school | 19.965 ± 0.027 | 57.081 | <0.001 |
| | ≥High school | 18.468 ± 0.024 | | |
| Household income (units: KRW 1,000 won/month) | <1,000$^{a}$ | 19.965 ± 0.035 | 323.830 | <0.001 |
| | 1,000–3,000$^{b}$ | 19.651 ± 0.023 | (a>b>c>d) | |
| | 3,000–5,000$^{c}$ | 19.268 ± 0.023 | | |
| | ≥5,000$^{d}$ | 18.872 ± 0.023 | | |
| Employment | No | 19.192 ± 0.026 | −2.118 | 0.034 |
| | Yes | 19.241 ± 0.024 | | |
| Living arrangement | Living alone | 19.017 ± 0.033 | −12.180 | <0.001 |
| | Living with others | 19.416 ± 0.021 | | |
| Subjective health status | Good$^{a}$ | 18.965 ± 0.018 | 819.482 | <0.001 |
| | Fair$^{b}$ | 19.448 ± 0.018 | (a<b<c) | |
| | Poor$^{c}$ | 20.448 ± 0.033 | | |
| Social encounters due to COVID-19 | Not decreased | 18.751 ± 0.037 | −24.600 | <0.001 |
| | Decreased | 19.682 ± 0.017 | | |
| Number of people to ask for help | 0$^{a}$ | 19.844 ± 0.030 | 529.885 | <0.001 |
| | 1–2$^{b}$ | 19.479 ± 0.017 | (a>b>c) | |
| | ≥3$^{c}$ | 18.850 ± 0.019 | | |

*Post hoc, Bonferroni test (a–d = subgroups of each variable).

KRW or higher was most common at 37.4%. Regarding living arrangements, 87.9% of participants were living with others. Finally, 53.4% of the participants reported having "good" subjective health status (Table 1).

The average score on COVID-19-related anxiety was 19.28 out of 25. Regarding social support, 44.5% of the participants reported having 1–2 individuals to ask for help during COVID-19 quarantine, 40.3% had 3 or more individuals, and 15.1% had none. In addition, 89.6% of the participants responded that their social encounters had decreased due to COVID-19. The mean scores on the Healthy Behavioral Change Index and Addictive Behavioral Change Index were −0.51 and 0.27, respectively (Table 1).

## Healthy behavioral change index and addictive behavioral change index

Healthy Behavioral Change Index scores, which assessed physical activity, sleep, and unhealthy diet, were higher in male than female, higher in older adults (≥65) than in their younger counterparts, higher in those with an educational level of middle school or than in those with an education level of high school or higher, higher in those with a lower monthly household income (< 1,000,000 KRW) than in those with a higher monthly household income, higher in unemployed individuals than in employed individuals, higher in individuals with a good subjective health status than in those with a poor subjective health status, higher in those living with others than in those living alone, higher in those who did not experience a decrease in social encounters than in those who did, and higher in those who had more than 3 individuals to ask for help than in those who had 1–2 individuals (Table 2).

Addictive Behavioral Change Index scores were higher in male than female, higher in those with a good subjective health status than in those with a poor subjective health status, and higher in those with a greater number of individuals to ask for help than in those with fewer social contacts, indicating that these groups had a lower level of alcohol consumption and smoking than the others. In contrast to the Health Behavioral Change Index scores, decreased alcohol consumption

TABLE 4 Factors influencing the healthy behavioral change index and addictive behavioral change index.

| Variables comparison (reference) | Healthy behavioral change index | | | | Addictive behavioral change index | | | |
|---|---|---|---|---|---|---|---|---|
| | B | 95% CI | | p | B | 95% CI | | p |
| Gender | | | | | | | | |
| Male (female) | 0.119 | 0.108 | 0.130 | <0.001 | 0.167 | 0.160 | 0.175 | <0.001 |
| Age | 0.007 | 0.006 | 0.007 | <0.001 | −0.002 | −0.002 | −0.002 | <0.001 |
| Education level | | | | | | | | |
| ≤Middle school (≥High school) | 0.141 | 0.125 | 0.156 | <0.001 | 0.016 | 0.006 | 0.026 | 0.002 |
| Household income (units: KRW 1,000 won/month) | | | | | | | | |
| <1,000 (≥5,000) | 0.073 | 0.050 | 0.095 | <0.001 | −0.018 | −0.033 | −0.002 | 0.026 |
| 1,000–3,000 (≥5,000) | 0.067 | 0.051 | 0.083 | <0.001 | −0.032 | −0.043 | −0.021 | <0.001 |
| 3,000–5,000 (≥5,000) | 0.011 | −0.005 | 0.026 | 0.169 | −0.031 | −0.041 | −0.021 | <0.001 |
| Employment | | | | | | | | |
| Unemployed (Employed) | 0.016 | 0.003 | 0.028 | 0.014 | −0.010 | −0.018 | −0.003 | 0.007 |
| Living arrangement | | | | | | | | |
| Living alone (Living with others) | −0.070 | −0.087 | −0.053 | <0.001 | 0.002 | −0.010 | 0.014 | 0.769 |
| Subjective health status | | | | | | | | |
| Good (poor) | 0.145 | 0.125 | 0.165 | <0.001 | 0.057 | 0.044 | 0.070 | <0.001 |
| Fair (poor) | 0.056 | 0.036 | 0.075 | <0.001 | 0.025 | 0.012 | 0.037 | <0.001 |
| Social encounters due to COVID-19 | | | | | | | | |
| Not decreased (decreased) | 0.307 | 0.292 | 0.322 | <0.001 | −0.209 | −0.218 | −0.199 | <0.001 |
| Number of people to ask for help | | | | | | | | |
| 0 (≥3) | −0.044 | −0.061 | −0.027 | <0.001 | −0.055 | −0.065 | −0.044 | <0.001 |
| 1–2 (≥3) | −0.022 | −0.034 | −0.010 | <0.001 | −0.010 | −0.018 | −0.002 | 0.011 |
| COVID-19-related anxiety | −0.017 | −0.018 | −0.015 | <0.001 | 0.000 | −0.001 | 0.001 | 0.386 |

and smoking were observed in younger individuals (aged 19–34 years), those with a higher education level, those with a monthly household income at or > 5,000,000 KRW, employed individuals, and those who experienced a decrease in social encounters (Table 2).

## COVID-19-related anxiety

COVID-19-related anxiety was higher in female than male, higher in older adults (aged ≥65 years) than their younger counterparts, higher in those with a lower education level (middle school or lower) than in those with a higher education level, higher in those with a low monthly household income (< 1,000,000 KRW) than in those with a high monthly household income, higher in employed individuals than in unemployed individuals, higher in those with a bad subjective health status than in those with a good subjective health status, higher in those who living with others than in those living alone, higher in those who experienced a decrease in social encounters than in those who did not, and higher in those with fewer individuals to contact for help than in those with more social contacts (Table 3).

## Factors influencing the healthy behavioral change index and addictive behavioral change index

Negative changes in health behaviors occurred with higher levels of COVID-19-related anxiety (B = −0.017, 95% CI = −0.018 to −0.015), in individuals living alone (B = −0.070, 95%

CI= −0.087 to −0.05), and in those with fewer individuals to ask for help (B = −0.044, 95% CI = −0.061 to −0.027). Namely, their physical activity levels and sleep duration decreased and unhealthy eating increased. On the other hand, health behaviors increased in male (B = 0.119, 95% CI = 0.108 to 0.130), older participants (B = 0.007, 95% CI = 0.006 to 0.007), those with a lower education level (middle school or less) (B = 0.141, 95% CI = 0.125 to 0.156), those with an average monthly household income of <1,000,000 KRW (B = 0.073, 95% CI = 0.050 to 0.095), unemployed individuals (B = 0.016, 95% CI = 0.003 to 0.02), those with good subjective health status (B = 0.145, 95% CI = 0.125 to 0.165), and those who did not experience a decrease in social encounters (B = 0.307, 95% CI = 0.292 to 0.322) (Table 4; Figure 1).

In addictive behaviors, alcohol consumption and smoking decreased in male (B = 0.167, 95% CI = 0.160 to 0.175), those with a lower education level (middle school or less) (B = 0.016, 95% CI = 0.006 to 0.026), and those with a good subjective health status (B = 0.057, 95% CI = 0.044 to 0.070). On the other hand, alcohol consumption and smoking increased in older individuals (B = −0.002, 95% CI= −0.002 to −0.002), those with higher average monthly household income (B = −0.031, 95% CI= −0.041 to −0.021), unemployed individuals (B = −0.010=, 95% CI = −0.018 to −0.003), those with fewer individuals to ask for help (B = −0.055, 95% CI = −0.065 to −0.044), and those who did not experience a decrease in social encounters (B = −0.209, 95% CI = −0.218 to −0.199). Unlike the Healthy Behavioral Change Index, addictive behavior was not significantly associated with COVID-19-related anxiety (B = 0.000, 95% CI = −0.001 to 0.001) (Table 4; Figure 2).

## Discussion

This study aimed to examine Koreans' COVID-19-related anxiety and lifestyle changes throughout the COVID-19 pandemic and to identify factors affecting these lifestyle changes.

First, participants demonstrated a high level of COVID-19-related anxiety (19.28 out of 25 points) in this study. No previous studies have used the COVID-19-related-anxiety scale used in this study. Although it is difficult to directly compare with the results of previous studies, this finding is similar to those of other studies conducted in China, the US, and the UK that reported an increase in anxiety due to COVID-19 uncertainties (10, 12–14, 22). From these studies, people showed high levels of anxiety during the COVID-19 pandemic. High levels of anxiety were significantly associated not only with age but also with social factors. Increased levels of COVID-19-related anxiety were observed in older adults, which was similar to the findings of previous studies (15–17). Older adults are more vulnerable to infection and have higher rates of hospitalization and mortality than younger adults due to an increased risk of severe illness following infection (23, 24). These are reasons why older adults may have had increased COVID-19-related anxiety. Furthermore, older adults may experience fear of COVID-19 due to misinformation (23). Thus, it may be necessary to assess their health literacy, which refers to the ability to access and understand accurate information. As a result of this study, increased levels of anxiety were related to lower levels of social support or fewer social encounters. This finding is similar to those of previous studies that have demonstrated decreased anxiety with increased perceived social support (14, 17). It is important to assess anxiety levels and isolation of older adults or individuals with weak social support to detect high-risk groups. However, this study only dealt with COVID-19-related anxiety. Future studies are needed to use a proper diagnostic tool in order to identify specific mental health problems such as anxiety or depression.

Second, this study showed that the Healthy Behavioral Change Index scores negatively changed to −0.51. This result supports the findings of previous studies on negative changes in physical activity (3–6), dietary habits (3, 6) and sleeping patterns (3, 6, 7) during the COVID-19 pandemic.

In this study, high levels of COVID-19-related anxiety were associated with decreased physical activity, such as walking and exercising, increased consumption of unhealthy food, such as instant food or carbonated beverages, and decreased sleep duration. Mental health, such as anxiety and depression, and physical health are interrelated (6). Findings that psychological distress involving anxiety has a negative impact on health behavior support the findings of this study (18, 19). High level of COVID-19-related anxiety can lead to maladaptive coping such as avoidance, rumination, suppression, etc. (25). For this reason, there is a possibility that people with higher level of COVID-19- related anxiety have reduced social contact more excessively than the quarantine standards. More delivered food intake and less outside activities may result in unhealthier behaviors.

Negative lifestyle changes such as increased unhealthy diet and decreased physical exercise can worsen well-being (26). Therefore, these findings indicate a need for interventions to reduce COVID-19-related anxiety.

Our findings showed that in addition to COVID-19-related anxiety, a decrease in social encounters was associated with negative changes in health behavior. In terms of dietary lifestyle, the consumption of delivered or take-out instant foods and unhealthy food increased as the number of outings and social encounters decreased with the onset of the COVID-19 pandemic. A previous study reported that Korea has a social environment in which services such as food delivery applications are well-developed (27), which could have led to an increase in food deliveries following the onset of the pandemic, and that most delivered foods were unhealthy options such as fast food (28). Changes in eating habits due to the COVID-19 pandemic have manifested differently in different nations. An American study, for instance, reported an increase in healthy food consumption during the COVID-19 pandemic (8). This

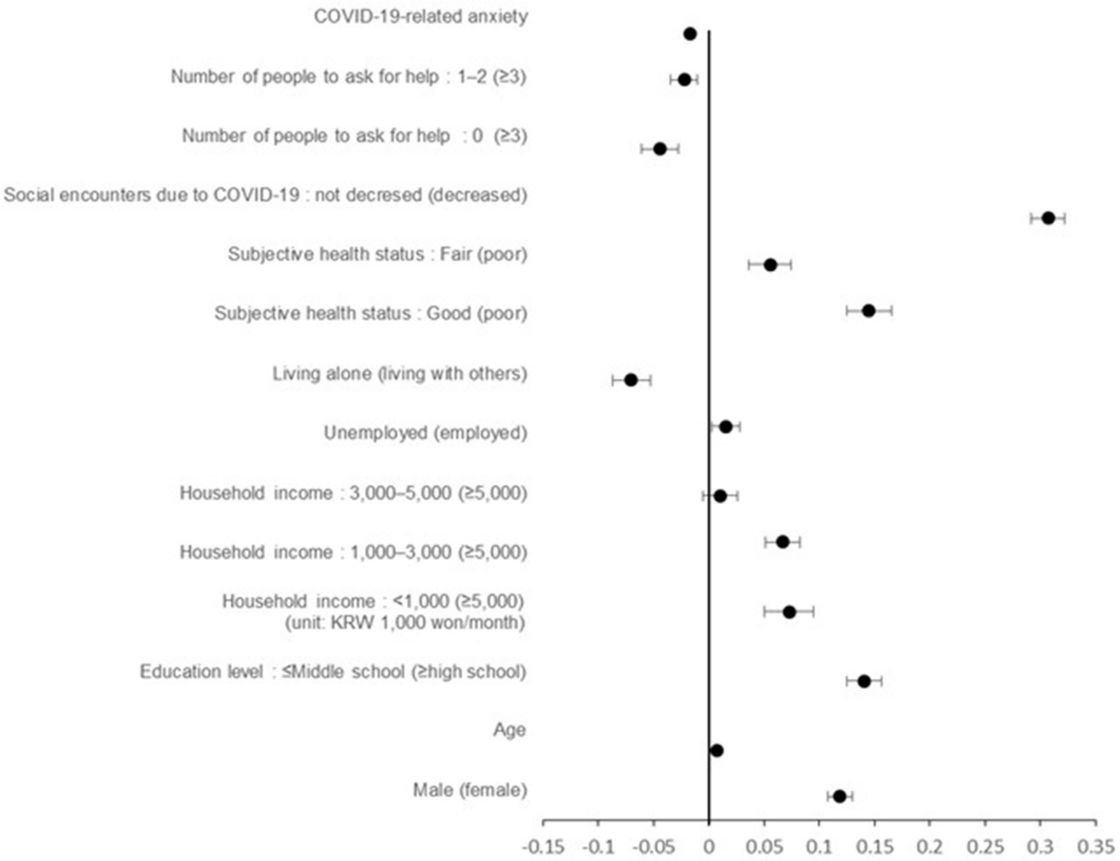

FIGURE 1
Forest plot of healthy behavioral change index related factors.

increase in the consumption of healthy food may be attributed to more time being spent at home and cooking (8). Fast food consumption will likely continue to increase among Koreans with the prolonged COVID-19 pandemic. Fast food may have negative impacts on health, such as obesity from high caloric intake (29). Thus, interventions to correct poor dietary habits are urgently needed.

This study found that negative changes also occurred in physical activity and sleeping patterns. This finding was similar to those of previous studies that suggested that physical activity levels have decreased as people stayed at home (4), which in turn has had a negative impact on sleeping patterns (6). During the COVID-19 pandemic, home-based online exercise programs have developed, and this can be helpful to promote healthy lifestyles (30). Based on these results, increasing awareness of the need for regular exercise and actively making online workouts programs that can be done at home available are necessary.

The findings of this study showed that negative changes in physical activity, diet, and sleeping behavior were more likely for individuals who are living alone or do not have others to ask for help. This implies that social factors have an effect on health behavior. This result supports the findings of previous studies that suggest that having more family members (5) and increased social support (19) promote positive changes in health behavior. Thus, developing interventions that help to maintain social networks while complying with social distancing guidelines is important.

However, this study used cross-sectional data which was collected since the onset of the COVID-19 pandemic. It is careful to make a conclusion that these influencing factors will persist once COVID-19-related anxiety abates. Therefore, a longitudinal study is necessary to identify the factors affecting health behavior in the post-COVID-19 era.

Third, a score of 0.27, indicating a slightly positive change, was noted for addictive behavior such as smoking or alcohol consumption. Namely, rates of smoking and drinking decreased in this study. This finding is supported by those of previous studies that indicated a decrease in alcohol consumption (5, 7) and an increase in decisions to quit smoking or reduce smoking frequency (31) during the COVID-19 pandemic. In this study, unlike the factors affecting health behavior, addictive behavior was not associated with COVID-19-related anxiety.

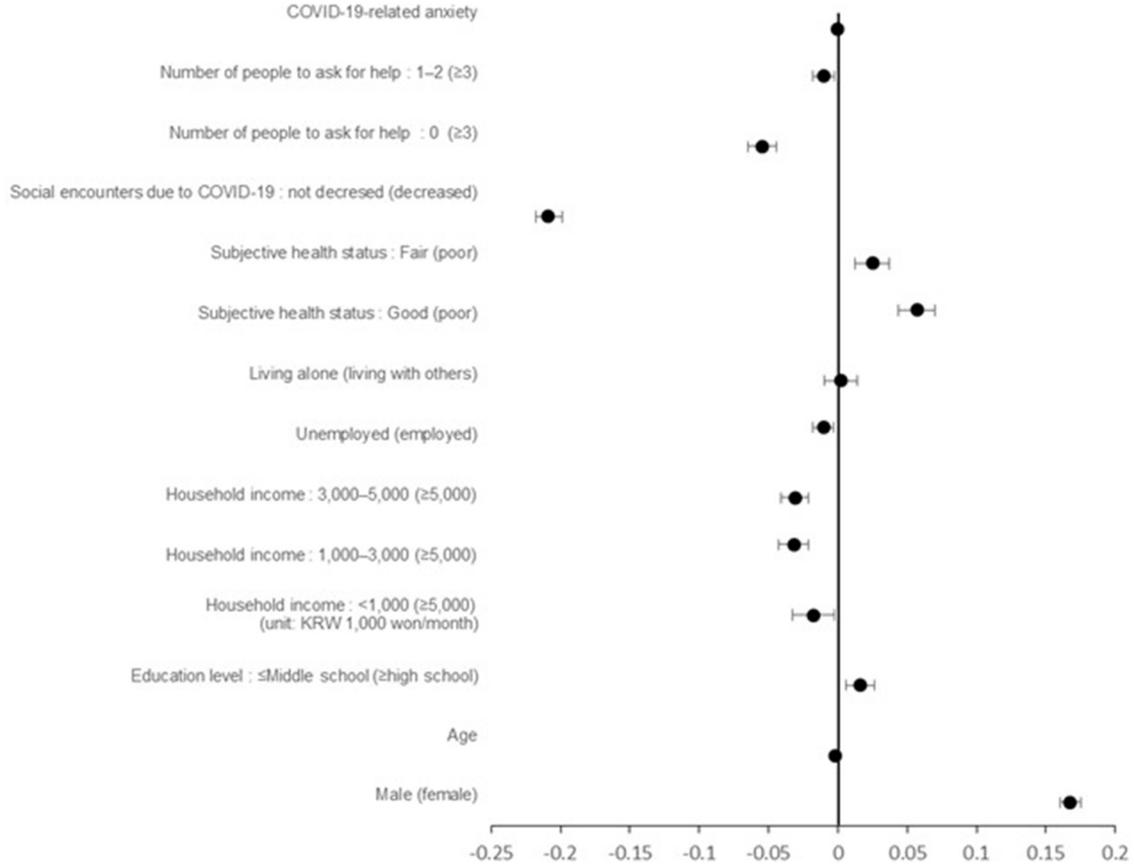

FIGURE 2
Forest plot of addictive behavioral change index related factors.

Addictive behaviors were negatively related in cases in which social encounters did not decrease.

This finding implies that alcohol consumption or smoking are everyday habits that were not–or were very rarely–affected by COVID-19. Rather, decreased alcohol consumption was likely observed with a reduction in social encounters during the COVID-19 pandemic because of the decrease in social drinking since social activities were restricted by the lockdowns (32). Addictive behaviors such as smoking or alcohol consumption can have a negative impact on the severity of COVID-19 (33). In particular, cigarette smoking is a risk factor for respiratory diseases, is closely associated with an adverse disease prognosis, and is known to impact COVID-19 outcomes (including severe symptoms, negative progression of symptoms and increased mortality) (34). The dangers of cigarette smoking have thus been widely publicized at the national level (35, 36), which may have resulted in a decrease in smoking behavior during the COVID-19 pandemic.

The negative changes in healthy behaviors were related to the more educated, the more employed, and the higher income groups. Yet the same groups showed positive changes in addictive behaviors. These results are different from previous studies that reported the association between high socioeconomic levels and positive health behaviors (37). This inconsistence may be due to the fact that higher socioeconomic levels may increase the chances of engaging in unhealthy behaviors under the specific COVID-19 pandemic.

Healthy behaviors may be related to economic status. Consumption of delivery food requires high costs. The consumption of delivered foods was associated with higher income and the more educated groups in Korea (38). Most delivered foods were unhealthy options such as fast food and high-caloric food (28). We also could expect that higher income and higher level of education groups can address their needs by staying at home as a protective action against COVID-19. The higher rate of working from home is related to higher income and a more stable job (39). Working from home can lead to a reduction in exercise (40).

On the other hand, addictive behaviors were associated with positive changes in the same groups in this study. Social drinking is likely to decrease as social activity decreases (32). In a higher socioeconomic position, they can have a chance to work from home (39), so this may be the result of a decrease in face-to-face behavior and social drinking. However, future research is needed to identify the exact reasons for the unusual results.

Although many countries around the world are preparing for a "post-COVID-19 era," as the pandemic prevails, COVID-19-related anxiety is still high. This study demonstrates that COVID-19-related anxiety has negatively impacted health behaviors involving physical activity, diet, and sleep. Older adults and those with lower social support were identified as high-risk groups. This study is significant as its findings can guide the direction of health promotion interventions for the upcoming post-COVID-19 era. Nevertheless, this study has some limitations. First, it used cross-sectional data, which makes it impossible to determine an exact causal relationship between anxiety and health behavior. Second, we used COVID-19-related anxiety scale. This is not standardized and has not been validated in previous studies. The future study is suggested to use the scale that verified the reliability and validity. Third, the effect that decreased health behaviors have on health status and the relationship between these two factors could not be identified.

## Conclusion

This study aimed to identify factors affecting lifestyle changes focusing on COVID-19-related anxiety. The findings of this study indicate that anxiety and decreased social encounters due to COVID-19 have resulted in negative changes in health behaviors involving physical activity, diet, and sleep. Based on these results, the following suggestions can be made. First, modification of health behaviors is needed, especially targeting those with negative changes related to COVID-19. Second, given that there are high levels of COVID-19-related anxiety among older adults and those with lower social support, health care providers should make an effort to identify high-risk groups for deteriorating health behaviors early. Furthermore, developing interventions for individuals who are vulnerable to anxiety is necessary. In addition, considering ways to improve health literacy in older adults or maintain and strengthen social networks for online communication is important. The practice of health behaviors must be encouraged, particularly through virtual programs such as the distribution of home-based online workout and education programs on the importance of proper calorie and nutrient intake. Finally, long-term studies on the effect of changes in health behavior throughout the whole COVID-19 era are needed along with lifestyle changes due to COVID-19.

## Data availability statement

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

## Ethics statement

The studies involving human participants were reviewed and approved by Institutional Review Board of the Gachon University (IRB No. 1044396-202111-HR-227-01). The patients/participants provided their written informed consent to participate in the 2020 Korean Community Health Survey.

## Author contributions

SYH, HYJ, and YK were responsible for the study conception and design and responsible for the drafting of the manuscript. SYH and YK performed the data analysis and supervised the study. HYJ provided statistical expertise. SYH provided administrative, technical, material support, and wrote the first draft. All authors read and approved the final manuscript.

## 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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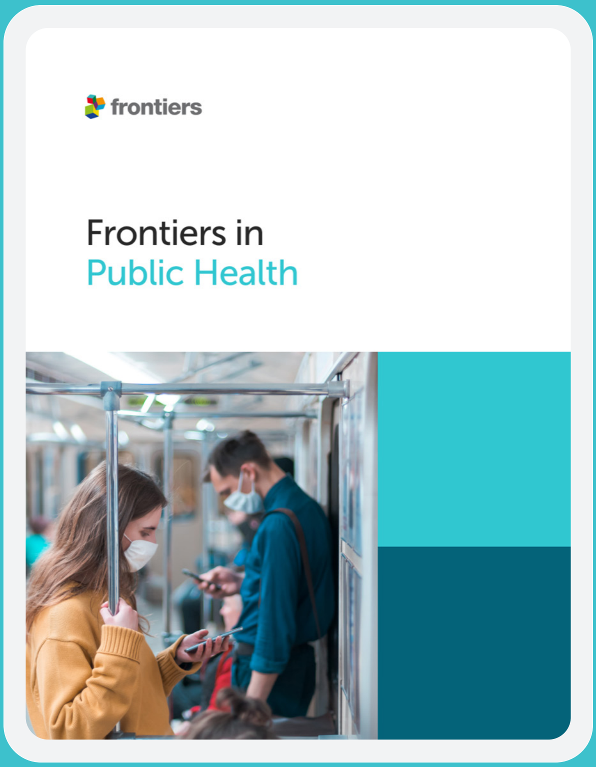

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