

Community series in mental health promotion and protection, volume II

Edited by

Naseem Akhtar Qureshi, Harshavardhan Sampath
and Samrat Singh Bhandari

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Community series in mental health promotion and protection, volume II

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Editorial: Community series in mental health promotion and protection, volume II

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Editorial on the Research Topic

Community series in mental health promotion and protection, volume II

If you cannot fly then run, if you cannot run then walk, if you cannot walk then crawl, But whatever you do you have to keep moving forward.
— Martin Luther King Jr.

On this momentous occasion of the release of the second volume of the Community Series in Mental Health Promotion and Protection, the editorial team wishes to draw inspiration from the immortal quote of the civil rights activist Martin Luther King Jr. Witnessing the overwhelming reception to the first volume, we were under pressure to replicate our success. We wish to thank all the peer reviewers who despite their commitments took their invaluable time to review the articles. The tireless and dynamic efforts of the Frontiers publication team in coordinating this complex process needs special endorsement.

The breadth and depth of areas covered in this Research Topic span diverse populations, countries, methods and methodologies, and domains. The mental health of young adults, women, LGBTQ2+, elderly, their caregivers, healthcare workers, and students are extensively explored in this Research Topic. The areas researched are not limited to mental disorders but transcend to occupational, social, and spiritual wellbeing. Such diversity is a testimony to the originality, ingenuity, and perceptive insight of mental health professionals and academic researchers who have contributed to this Research Topic.

Steering across the experiences of menopause can be a journey filled with feelings of stress, anxiety and depression. One potential solution to prepare and travel the transition may be mindfulness-based interventions (MBIs) which are techniques that empower individuals to better handle their emotional wellbeing (1). A systematic review and meta-analysis conducted by Liu H. et al. explored how effective MBIs are, in reducing these symptoms and effect on mindfulness among women going through menopause. Although the findings indicated decreases in stress levels, further research is necessary to confirm their impact on anxiety, depression and mindfulness. By embracing MBIs, women may discover a pathway toward resilience during menopausal phase.

In a groundbreaking study led by [Nawaz et al.](#), the impact of #PsychTwitter on global psychiatry is unveiled. Twitter, a platform often characterized by its brevity, has proven to be a rich source of mental health discussions. The study demonstrates that the #PsychTwitter movement has generated a staggering 492,565,230 impressions, emphasizing its role as an important platform for disseminating mental health knowledge globally. Notably, this research also highlights the prominent role played by psychiatrists, academic organizations, and advocacy groups in shaping mental health discourse.

Recognizing the significance of youth mental health promotion, [Jenkins et al.](#) started on an innovative journey. They studied “Agenda Gap”, an intervention that allows young people to be involved in advocating policies designed to promote wellbeing and mental health. The youth involved have had a profound impact on their own mental health by raising their voices and making positive changes. Giving young people a voice and a platform to advocate for policies that address issues like mental health stigma, access to resources, and support systems, not only improves their own wellness but also helps build a more cohesive and resilient community (2). Youth mental health finds special focus in this Research Topic. Depression, anxiety, and stress experienced by school students of Bangladesh awaiting their entry into college after appearing for their entrance examination are captured by [Rabby et al.](#). Dissatisfaction with physical appearance is a growing concern, particularly among youth in non-Western societies (3). Body dissatisfaction among Chinese University students, explored by [Hao et al.](#), found that female students had greater levels of dissatisfaction and it correlated significantly with depression, sleep quality, and physical activity.

An Iranian study on the social wellbeing of its citizens by [Mahmoodi et al.](#) reported a significant but weak positive correlation of mental health literacy (MHL) and Subjective Well Being (SWB) scores. Use of mental health services in the past or having someone familiar having mental illness was associated with poor SWB. While improved MHL can have positive effects on mental health outcomes, it is not a guaranteed predictor of high SWB. Even with good MHL, individuals who suffer from severe mental illness like schizophrenia may face enacted or perceived stigma, which may impair the SWB. An improved MHL may help individuals recognize the need for mental health support, but access to quality mental health services and resources can be limited in many countries (4). Other factors like lack of access to appropriate care, poor social support and economic hardship can contribute to poor SWB despite adequate MHL. The role of education and awareness about both mental illnesses and physical illnesses (5) has an important role to play in adherence and better prognosis.

The COVID-19 pandemic has cast a spotlight on mental health like never before. Multiple studies have examined its multifaceted impact, from the relationship between exposure and psychological distress during lockdowns ([Liu Y. et al.](#)) to the disparities in fear and anxiety experienced by different genders ([Alibudbud](#)). [Chen et al.](#) delved into the complex interplay between family context and psychological distress during the pandemic, highlighting the dual role families play as both a source of support and stress. Meanwhile, [Ding et al.](#) explored how the pandemic exacerbated insomnia symptoms in older adults and their caregivers. These studies emphasize the need for comprehensive mental health interventions

including early diagnosis treatment and prevention in the face of global crises in future. The mental health professionals can promote mental wellbeing through different strategies during and after such crises (6).

Workplace mental health explored by [Cabrera-Aguilar et al.](#), among nurses in Peru reported that workplace engagement was mediated by self-efficacy, which had a positive impact on resilience and stress levels. These revelations have important ramifications for nursing management in healthcare institutions. It is essential that strategies are developed to support nurses’ self-efficacy and resilience to promote a resilient and engaged nursing workforce. Harnessing the power of artificial intelligence, [Kim et al.](#), have used machine-learning models to predict depression in young Korean employees. The significance of the study lies in its potential to improve early diagnosis and prevention of workplace depression by providing specialized therapies and support networks.

A community-based survey in Ethiopia by [Abdeta et al.](#), on common mental disorders reported a prevalence of 21.31%, which was significantly associated with female gender, elderly, being single, widowed, and unemployed. Data from the Understanding Society: UK Household Longitudinal Study was used by [Kang](#) to conclude that psychological distress in angina sufferers was not limited to depression and anxiety but also independently affected social functioning, confidence levels, and ability to enjoy life. Using data on intimate partner violence, depression, and suicide in women across 151 countries, a population ecological study by [Rajkumar](#) found an association between cultural collectivism and intimate partner violence, which was significantly influenced by national income and women’s educational level.

Mental health disorders affects people of all backgrounds and necessitates a shift toward proactive prevention and promotion. This involves fostering awareness, debunking stereotypes, and early education to equip individuals with emotional tools. Prevention also involves addressing risk factors such as adverse experiences and social disparities through policies and community support. Promotion goes beyond absence of disorders, empowering individuals to cultivate positive wellbeing through exercise, diet, mindfulness, and creative outlets. Workplaces should prioritize psychological safety and work-life balance, while society must collectively fund mental health services, enact policy changes, and destigmatize mental health concerns through advocacy and personal stories.

In Summary as William Shakespeare said “All’s Well that Ends Well” and accordingly with the help of Chief Executive Officer and Frontiers publication department, we successfully completed the Research Topic on community series in *Mental health promotion and protection: volume II* which is ready for publication. For the knowledge of health researchers, mental health Professionals and Academicians, our editor team and frontiers have also launched Research Topic—*Developmental trajectories of early life trauma-volume III* which is getting good response from the research contributors at global level.

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NQ: Conceptualization, Writing—review and editing.
HS: Conceptualization, Writing—original draft. SB:

Conceptualization, Writing—original draft, Writing—review and editing.

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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Gender in mental health: Relationship of spirituality, social support, and COVID-19-related fear among heterosexual and LGBTQ+ youth

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Introduction: The youth is a vulnerable population to COVID-19-related fear. Among them, those with LGBTQ+ identities are at higher risk. Given the posited protective effects of spirituality and social support on fear, this study explored their effects on COVID-19-related fear among heterosexual and LGBTQ+ youth.

Materials and methods: This cross-sectional study recruited 137 respondents Filipinos aged 18–30 years old. The respondents answered a survey containing a sociodemographic questionnaire, 12-items Multidimensional Scale of Perceived Social Support (MSPSS), 20-items Core Dimensions of Spirituality Questionnaire (CDSQ), and 7-items Fear of COVID-19 Scale (FCS). After, the data were analyzed using means, frequencies, Mann-Whitney *U*-tests, and correlation coefficients.

Results: Social support from friends was negatively correlated with COVID-19-related fear among heterosexual respondents, $R = -0.219$, $p = 0.029$. Search for meaning positively correlated with COVID-19-related fear among LGBTQ+ respondents, $R = 0.395$, $p = 0.016$. Heterosexual respondents also have a higher belief in God ($U = 1,004$, $p < 0.001$) and feelings of security ($U = 1,110.5$, $p < 0.001$) than their LGBTQ+ counterparts.

Discussion: These findings suggest that social support from friends is protective against COVID-19-related fear among heterosexual youth but not among LGBTQ+. In addition, a high search for meaning can heighten COVID-19-related fear among LGBTQ+. Finally, these findings can be explained by the higher rates of discrimination against LGBTQ+ than heterosexual youth. Thus, gender-responsive mental healthcare is needed to address the youth's fears as society recovers from the pandemic.

KEYWORDS

COVID-19, Philippines, social support, spirituality, mental health, gender, LGBT persons, sexual and gender minorities

1. Introduction

The COVID-19 pandemic has caused significant anxiety and fear among Filipinos, with the youth at higher risk than other age groups (Tee et al., 2020). Similar to other countries in Southeast Asia, LGBTQ+ Filipinos have also shown greater vulnerability to ill mental health than their peers (Alibudbud, 2021). Their higher rates of mental health problems have been attributed to the high rates of discrimination against them (Tan and Saw, 2022).

Previous studies among Filipinos found that fear and anxiety can be mitigated by providing adequate health information and economic support and lessening quarantine and lockdown periods (Tee et al., 2020). However, factors stemming from Filipino cultural features have yet to be compared (Tee et al., 2020). Among others, Filipino culture has closely knitted communities that provide social support. Among the youth, this is manifested in closely bonded peer support groups called “barkadahan” (Alibudbud, 2021). Filipino culture also emphasizes spirituality and religion based on Roman Catholicism (Lagman et al., 2014; Alibudbud, 2021). This high spirituality among populations is protective against fear and anxiety (Morgan and Bhugra, 2010). However, LGBTQ+ Filipinos are reportedly marginalized from this Filipino cultural practice that may be protective of heightened fear and anxiety (UNDP USAID., 2014; Human Rights Watch, 2017; Alibudbud, 2021). Thus, they may not have the same protection from these cultural features compared to their peers.

Given the heightened COVID-19-related fear among the youth and the higher vulnerability of those LGBTQ+ identities, social support and spirituality can be explored and compared as possible determinants of COVID-19-related fear among Filipino heterosexual and LGBTQ+ youth.

2. Materials and methods

This cross-sectional study determined the relationship between social support, spirituality, and COVID-19-related fear among heterosexual and LGBTQ+ youth. This study was a component of a larger study that investigated the relationship between COVID-19-related fear and election participation among young Filipino adults. Local ethical approval and informed consent were secured before data collection. Likewise, numerical codes were used in lieu of identifying data.

The sample size for this study was computed using G*power 3.1, a statistical power analysis program (Faul et al., 2007). The present study utilized the suggested parameters for sample size computation by Cohen (1988) and Lakens (2013), including a moderate effect size of 0.5, an alpha error of 0.05, and a power of 0.8. The minimum total sample size needed was 132. This study included individuals with Filipino citizenship and an age range of 18–30 years old. Filipino citizens aged 17 or lower

and 31 or higher were excluded from this study. To avoid the health risks during the COVID-19 pandemic, the study opted to invite and recruit potential respondents through convenience sampling in online mediums, such as social media and public forum platforms. The data collection lasted for 2 months. After the data collection period had elapsed, a community sample of 137 respondents was recruited.

Before answering the survey questionnaire, the respondents indicated their informed consent. The survey contained several sections, including a sociodemographic questionnaire, 12-items Multidimensional Scale of Perceived Social Support (MSPSS), 20-items Core Dimensions of Spirituality Questionnaire (CDSQ), and 7-items Fear of COVID-19 Scale (FCS). The MSPSS, CDSQ, and FCS measured the respondents' social support, spirituality, and COVID-19-related fear. These questionnaires have previously confirmed validity and reliability (Zimet et al., 1990; Hardt et al., 2012; Ahorsu et al., 2022). For this study, the MSPSS, CDSQ, and FCS showed acceptable internal consistency with a Cronbach's alpha of 0.847, 0.883, and 0.866, respectively.

The data were described using means and frequencies and analyzed using Mann-Whitney U-tests to determine the significant differences between spirituality and social support among heterosexual and LGBTQ+ respondents. In addition, the relationship between spirituality and social support with COVID-19-related fear was analyzed using correlation coefficients. A p -value of <0.05 was considered significant. All statistical tests were analyzed using SPSS.

3. Results

The average age of the respondents was 20.06 (SD = 2.90). The majority of the respondents were females ($n = 90$, 65.70%), had heterosexual orientation ($n = 100$, 73.00%), were high school graduates ($n = 105$, 76.6%), single ($n = 135$, 98.54%), Catholic ($n = 104$, 75.90%), and have a monthly household income of less than PHP 10,957 per month ($n = 80$, 58.40%). This income level indicates that most respondents came from the lowest income class.

Table 1 shows that social support from friends was negatively correlated with COVID-19-related fear among heterosexual respondents, $R = -0.219$, $p = 0.029$. Contrastingly, the search for meaning positively correlated with COVID-19-related fear among LGBTQ+ respondents, $R = 0.395$, $p = 0.016$. These findings suggest that social support from friends may be a protective factor for COVID-19-related fear among heterosexual respondents, while a high search for meaning may be a risk factor for COVID-19-related fear among LGBTQ+ respondents.

Table 1 also shows that heterosexual respondents have a higher belief in God ($U = 1,004$, $p < 0.001$) and feelings of security ($U = 1,110.5$, $p < 0.001$) than their LGBTQ+ counterparts.

TABLE 1 Differences and correlation of social support and spirituality with fear of COVID-19 among heterosexual and LGBTQ+ respondents ($n = 137$).

	Descriptive statistics				Mann Whitney U tests		Correlation coefficient			
	Heterosexual		LGBTQ+				Heterosexual		LGBTQ+	
	Mean	SD	Mean	SD	U	p	R	p	R	p
Social support										
Special someone	20.47	6.59	19.30	7.60	1,710	0.496	−0.164	0.102	0.163	0.335
Family	21.05	4.94	19.19	4.85	1,407	0.031	−0.026	0.799	0.187	0.268
Friend	23.57	3.89	23.84	4.29	1,699.5	0.462	−0.219*	0.029	−0.013	0.938
Spirituality										
Belief in god	19.84	4.56	14.73	6.59	1,004*	<0.001	−0.082	0.415	0.215	0.201
Search for meaning	20.09	3.08	19.92	3.65	1,848.5	0.994	0.066	0.515	0.395*	0.016
Mindfulness	21.44	2.65	21.86	2.03	1,749	0.621	−0.061	0.545	0.198	0.241
Feeling of security	15.76	4.01	12.95	4.24	1,110.5*	<0.001	0.024	0.812	0.052	0.759

* $p < 0.05$.

4. Discussion

This study found that social support from friends may be a protective factor against COVID-19-related fear among heterosexual respondents but not among LGBTQ+ respondents. Sexual and gender identity concealment can explain this lack of protective effects among LGBTQ+ since they may have higher worries about gender-based discrimination (UNDP USAID., 2014; Human Rights Watch, 2017; Alibudbud, 2021). Thus, the effect of social support may be lower in mitigating fear among LGBTQ+ since they may be unable to physically and overtly support their peers with COVID-19-related fear due to discrimination if identified as a person with an LGBTQ+ identity (UNDP USAID., 2014; Human Rights Watch, 2017; Alibudbud, 2021).

It was also found that a high search for meaning can be a risk factor for COVID-19-related fear among LGBTQ+. This finding can be explained by the gender-based discrimination they received in their families and homes (UNDP USAID., 2014; Human Rights Watch, 2017). Since their homes are not safe for exploring their sexual and gender identities, they may seek to understand their identities in their outside environment where they have higher exposure to COVID-19, resulting in greater concerns and fear of contracting COVID-19.

Notably, the study also shows that Belief In God and Feelings of Security were lower among LGBTQ+ youth than their heterosexual peers. The lower feelings of security can be due to the higher rates of discrimination against them that may cause them to feel unsafe in their environment. These discriminations against LGBTQ+ youth can be based on traditional religious beliefs (UNDP USAID., 2014; Human Rights Watch, 2017; Manalastas et al., 2017; Alibudbud, 2021). This use of religion

as a ground for discrimination may explain their lower belief in God.

While this study showed that the effect of social support and spirituality on COVID-19 fear varied based on gender, further studies are recommended. For example, future research can employ non-purposive sampling designs and recruit a larger sample size to improve the study's generalizability and power. In addition, qualitative methods can explore the mechanisms and meanings of social support and spirituality related to mental health among people of different genders and sexuality. Nonetheless, the study provides evidence that gender-responsive mental healthcare beyond traditional binary models of men and women may be needed to equitably address the youth's COVID-19-related fears as society recovers from the pandemic. As a start, the gender-related attitudes of mental healthcare and other individuals highly involved in youth interactions (i.e., schools and workplaces) can be improved. In doing so, gender awareness, sensitivity, and training programs for mental health professionals, school staff, and workplace managers can be developed and expanded to improve gender-related attitudes (Woodford et al., 2012; Alibudbud, 2021; Okanlawon, 2021).

Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: The datasets for this study is available upon request and permission from Jose Mari Gabriel Tumanan, Miranda Monserrat Bardos, Archibald Noel Po, and Kurt Travis Arbolante. Requests to access these datasets should be directed to rowalt.alibudbud@dlsu.edu.ph.

Ethics statement

The studies involving human participants were reviewed and approved by De La Salle University Integrated School. The patients/participants provided their written informed consent to participate in this study.

Author contributions

RA had substantial contributions to the design, drafting, revision, acquisition, interpretation, and final approval of the data and work.

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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.

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The effects of mindfulness-based interventions on anxiety, depression, stress, and mindfulness in menopausal women: A systematic review and meta-analysis

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Background: Mindfulness-based interventions (MBIs) are psychological interventions widely used in menopausal women. Currently, there is no evidence summary on the effectiveness of MBIs on anxiety, depression, stress, and mindfulness in menopausal women. This meta-analysis examines the effectiveness of MBIs in improving anxiety, depression, stress, and mindfulness scores in menopausal women.

Methods: A systematic search was conducted in PubMed, Embase, Web of Science, the Cochrane Library, CNKI (China National Knowledge Infrastructure), and Wanfang, using relevant terms such as MBIs as keywords and covering all studies published before March 13, 2022. The outcomes were anxiety, depression, stress, and mindfulness. The screening and extraction of data were conducted by two independent reviewers.

Results: A total of 1,138 menopausal women participated in 13 studies. Meta-analysis results showed that MBIs significantly reduced stress in menopausal women ($SMD = -0.84$, 95% CI: -1.64 to -0.05 , $p = 0.04$), but no statistical differences were found in reducing anxiety ($SMD = -0.40$, 95% CI: -0.81 to 0.01 , $p = 0.06$) and depression ($SMD = -0.19$, 95% CI: -0.45 to 0.07 , $p = 0.16$) and in raising the scores of mindfulness ($SMD = 0.37$, 95% CI: -0.06 to 0.81 , $p = 0.09$) in menopausal women.

Conclusion: MBIs may reduce stress in menopausal women, but their effect on improving anxiety, depression, and mindfulness needs further validation.

Systematic review registration: <https://www.crd.york.ac.uk/prospero/#recordDetails>.

KEYWORDS

mindfulness, menopausal, anxiety, depression, stress, meta-analysis

1. Introduction

Menopause refers to the decline of ovarian function and the cessation of menstruation (1). During the menopause, women have a series of neuropsychological symptoms, mainly the dysfunction of the autonomic nervous system, which is caused by the fluctuation or decrease of sex hormones (2).

Studies showed that the probability of anxiety and depression in menopausal women is 12.62 and 25.99%, respectively, due to the variability and complexity of emotions at this stage. The risk can be three times greater than it was before menopause (3, 4). Adverse psychological emotions will reflect the functions of body organs and systems through immune and endocrine mechanisms, which directly affect the physical and mental health of menopausal women (5). Furthermore, this will expose menopausal women to enormous psychological and social challenges, which can seriously affect their quality of life in turn (6). Therefore, scholars are actively exploring scientific and effective interventions to improve negative emotions and cope with stress in menopausal women. According to the 2018 Guideline for Evaluation and Treatment of Menopausal Depression (7), psychological interventions or pharmacotherapy could be used as the first-line treatment for anxiety and depression in menopausal women. In contrast, psychological interventions have fewer adverse effects and better long-term results than pharmacotherapy (8), which most importantly meets the willingness of 80% of women to use them (9–11). Mindfulness-based interventions (MBIs) have been shown to effectively alleviate negative emotions such as anxiety, depression, and stress as one of the psychological interventions. Moreover, MBIs are also supposed to have promising therapeutic effects on mental and chronic diseases (12–14).

Mindfulness implies that participants establish a new perspective on themselves, consciously focus on the goal of the present moment, and approach the various experiences unfolding in the present moment without judgment (15, 16). These experiences can take many forms, such as personal physical sensations, emotional reactions, mental pictures, mental conversations, and perceptual experiences (17). Historically, mindfulness, known as the “heart” of Buddhist meditation (18, 19), originated in Buddhism. Buddhist culture, therefore, provides a wealth of information for the psychological study of mindfulness, but mindfulness is by no means Buddhism or Buddhist meditation practices. MBIs are an umbrella term for a range of “mindfulness”-centered, de-religious psychological interventions, such as mindfulness-based stress reduction therapy (MBSR) (15), mindfulness-based cognitive therapy (MBCT) (20), and brief mindfulness meditation training. However, there are also many mindfulness-related interventions that incorporate mindfulness training as an integral part of a comprehensive treatment program, such

as dialectical behavior therapy (DBT) (21, 22), acceptance and commitment therapy (ACT) (23), and integrated mind-body training (24). Its basic mechanism is to focus attention on the present moment with a nonjudgmental attitude and to disengage oneself from wandering, triggering the experience of re-perception and thus self-emotional regulation, which helps reduce negative emotions more effectively (25). The purpose of MBIs is to facilitate the opening of one's thoughts and feelings when one is in an anxious or depressive thinking pattern and bodily experience, which helps to reduce anxiety and depression triggered avoidance, rumors, and self-judgment through the process of attention and consciousness turning (26). Furthermore, MBIs can foster greater awareness of inner body feelings and emotional regulation, promote stress resilience, and improve stress management and stress coping skills, which ultimately help alleviate anxiety, depression, and stress in menopausal women (17).

Currently, there is an increase in the number of RCTs on the use of MBIs in menopausal women. There are more empirical studies analyzing the effectiveness of MBIs among menopausal women. However, there is no consistent data on its effectiveness in improving anxiety, depression, stress, and mindfulness in menopausal women. Several studies have shown that MBIs can significantly reduce anxiety, depression, and stress scores (27–35), while some studies did not have statistically significant results (9, 36). Some studies have shown that interventions significantly enhanced mindfulness scores (33, 37, 38), while other studies showed no significant effect of interventions on mindfulness scores (9). Current analyses are controversial about the effectiveness of MBIs for menopausal women to improve anxiety, depression, stress, and mindfulness. These controversies need to be further clarified through a systematic integration of the available evidence. Therefore, this study systematically searched and reviewed the evidence on the effectiveness of MBIs for improving anxiety, depression, stress, and mindfulness in menopausal women, conducting a meta-analysis of existing studies in the context of global trends in integration.

This study aims at informing the implementation of more effective and sustainable community-based MBIs in different cultural contexts by providing evidence-based support for the development of interventions to improve anxiety, depression, stress, and mindfulness in menopausal women. Public health agencies, therefore, can clearly understand current effective interventions in mental health training for menopause care. The next step is to determine what measures should be taken to achieve widespread training implementation.

2. Materials and methods

The PRISMA Guidelines (39) and the Cochrane Handbook of Systematic Review (40) were used to do a systematic review

and meta-analysis of this study. We were registered in the PROSPERO Registry (CRD42022319349).

2.1. Search strategy

Two reviewers (HL and JW) independently searched the following databases: PubMed, the Cochrane Library, Embase, Web of Science, CNKI (China National Knowledge Infrastructure), and Wanfang in order to achieve a more systematic retrieval, covering all studies published before March 13, 2022. The search strategy should be as comprehensive as possible but also be modified according to the requirements of different databases ([Supplementary material](#)). Also, the available references were further filtered by searching for relevant reviews, meta-analyses, or systematic reviews. This made sure that the search was as complete as possible.

2.2. Inclusion criteria and exclusion criteria

The inclusion criteria of this study were formulated according to the PICOS principles as follows: (1) P: The subjects met the diagnostic criteria for menopause, and their age was not limited. (2) I: The experimental group needs to use MBIs for menopausal women (e.g., MBSR, MBCT, DBT, ACT, mindfulness yoga, mindfulness meditation, and so on, without limitation on intervention time). C: The control group required a different intervention (e.g., wait-list, routine health care, general conversation, and so on). (4) O: The outcomes were anxiety, depression, stress, or mindfulness in menopausal women (without specific outcome measures specified). (5) S: The study type was RCTs. Exclusion criteria are as follows: (1) repeated publication; (2) inability to obtain the full text; (3) incomplete or unavailable data; (4) studies that have not been published in Chinese or English.

2.3. Data extraction

After duplicate studies were removed (EndNote X9), titles and abstracts were screened by two reviewers (KC and JW) independently. All potentially eligible studies were independently evaluated for the full text based on inclusion and exclusion criteria. Any disagreements were resolved in consultation with the third reviewer (KC). The information extracted from the included articles contained: the author (year), country, participants, sample size (E/C), intervention (E/C), length of intervention (weeks), and outcomes (instrument).

2.4. Quality assessment

The RCT bias risk assessment tool recommended by the Cochrane Systematic Review Manual (5.1.0) ([40](#)) was used to strictly evaluate the quality of the included literature. The degree of risk of bias for each included article will be assessed as “low risk,” “unclear” or “high risk,” to be completed independently by two reviewers (KC and JW). Review of the final results and resolving disagreements will be done by the third reviewer (HL).

2.5. Statistical analysis

Statistical analysis was conducted under the guidance of the corresponding author (HL), a statistics expert. All reviewers are aware of the statistical analyses currently being carried out. Statistical analysis was performed using RevMan 5.4. Statistical heterogeneity between studies will be analyzed by the chi-square test and the I^2 statistic ([41](#)) before results are integrated. If $p \geq 0.10$ and $I^2 < 50\%$ indicate low heterogeneity, the fixed-effects model is used. The fixed-effects model is used if $p \geq 0.10$ and $I^2 < 50\%$ indicate low heterogeneity. A random-effects model was chosen if $p < 0.10$ and $I^2 \geq 50\%$, indicating high heterogeneity, and possible sources of heterogeneity were investigated using subgroup or sensitivity analysis ([42](#)). There may be potential confounding factors affecting the intervention effect and the risk of heterogeneity ([43](#)) due to the large and differentiated sample sizes of the included studies and the failure to unify the intervention methods, and a random-effects model was used to integrate ([44](#)). We used the standard mean difference (SMD) in this study, and the 95% CI was used to indicate the summary result, in which case it is necessary to mark the study's results as a unified measure unit ([40](#)). MBIs were considered statistically significant in the overall effect if $p < 0.05$, and vice versa. The clinical significance of SMD was evaluated by Marfo's explanation of effect size (low, medium, and high were respectively <0.40 , $0.40-0.70$, and >0.70) ([45](#)). If a meta-analysis includes ≥ 10 studies, publication bias needs to be assessed by a funnel plot ([46](#)).

2.6. Subgroup analyses

Subgroup analyses were conducted to explore the following moderators: continent and length of intervention (weeks).

3. Results

3.1. Study selection

The details of the literature screening process are presented in [Figure 1](#). 374 English and Chinese articles were retrieved

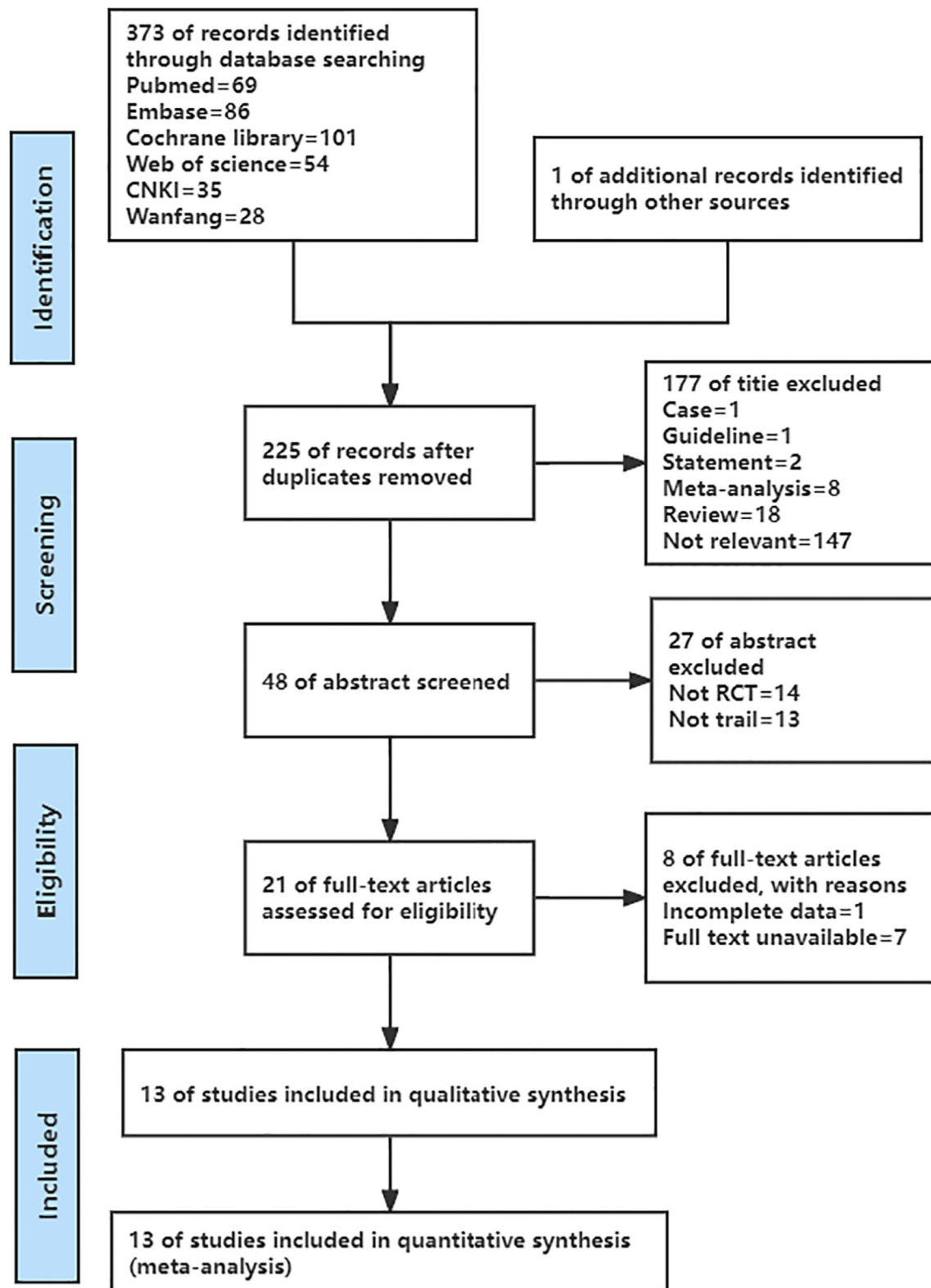


FIGURE 1
PRISMA flow chart of study selection.

initially, and 225 articles were extracted after 149 duplicates were removed. After reading the titles and abstracts, eliminate 204 articles, leaving 21 articles. After reading the full text, 13 articles met the inclusion criteria. As a result, the final 13 articles were included in this meta-analysis (9, 27–38).

3.2. Characteristics of articles

The general characteristics of the included studies are listed in Table 1. A total of 13 studies published before 2022 were included. Sample sizes for each study ranged from 27 to 197, and 1,138 menopausal women aged 40–70 years were recruited for all included studies, including 560 participants in the experimental group and 578 participants in the control group. The participants were menopausal women with menopausal symptoms who had not been diagnosed with a psychiatric disorder. According to the modes of menopause, there are natural menopause (9, 28, 38), natural menopause, and iatrogenic menopause (27, 29–37). Three studies (28, 37, 38) included women over 1 year after menopause. Four studies (9, 33, 34, 36) excluded women who had previously participated in formal MBIs. Seven studies (9, 29–32, 34, 38) excluded menopausal women treated with hormones. The interventions were all based on mindfulness and ranged in duration from 8 to 12 weeks, with interventions ranging from 0.5 to 5 hours per week. Except for Fu-Zhen Zhong (27), Chattha et al. (34), and Monfaredi et al. (35), all experimental groups adopted the method of group training combined with individual training. Four studies (29–32) further subdivided training methods into formal and informal training methods. Formal training methods include body scanning, mindful yoga, sitting meditation, mindful walking, etc. Informal methods include detecting pleasant and unpleasant events, detecting breathing, eating, walking, and other daily activities. The control group received wait-list (27, 29, 31–33, 36, 38), menopause hormone therapy (28), routine health care (30, 35), menopause education control (9), and easy body movements (34). Outcome indicators included anxiety, depression, stress, and mindfulness scores.

3.3. Risk of bias in the included literature

Of these 13 studies, eight used an appropriate sequence generation process, six had adequate concealment of allocation, four used blinding of participants and performers, four implemented blinding of outcome assessments, 12 ensured the completeness of outcome data, and 13 had selective reporting of low risk of bias. Specific information is detailed in Table 2, and the results of the risk bias assessment are provided in Figure 2. Among the 13 RCTs included, participants were randomly grouped in all the included studies, but only the

specific random allocation sequence generation method was described in five studies (9, 33–36) that employed computer software; two studies (28, 30) used a random number table; and one study (37) used the random drawing method for random grouping. Three studies (33, 35, 36) used sealed and opaque envelopes with serial numbers; one study (37) used boxes; and one study (34) used a central random allocation system for hiding distribution. In Wong's study (9), a statistician who was not part of the research team performed random number generation and allocation. Participants were unaware of the results of randomization when they filled out the baseline questionnaire. Blinding is difficult because of the nature of intervention studies. Wong et al. (9) adopted a single-blind design with participant blindness. Nurdilan et al. (38) prevented data contamination between groups by collecting experimental and control data in different health centers. Gordon et al. (33) gave participants instructions for the next step through email; Chattha et al. (34) employed a blind method to conduct random assignment and statistical analysis, and the survey questionnaire was coded and decrypted after the analysis was completed. The class time and place of the experimental group and the control group were reasonably arranged to avoid interaction and communication between the participants of the two groups. All the studies described the number of cases lost to follow-up during the study period and the reasons for the loss, but the missing rate of Nurdilan et al. (38) was > 20%, leading to a high risk of bias. In all studies and all reported study regimens, there were no statistically significant differences at baseline between the experimental and control groups.

3.4. Meta-analysis results

3.4.1. Anxiety scores

Seven existing studies (27–30, 33, 35, 36) recruited 551 menopausal women (270 in the experimental group and 281 in the control group) to evaluate the effects of MBIs on anxiety scores in menopausal women using the STAI, GAD-7, SAS, HADS, DASS 21, and bPOMS, respectively. SMD was used to deal with numerical variables due to different evaluation tools. The heterogeneity test showed significant heterogeneity among studies ($p < 0.01$, $I^2 = 96\%$). Thus, a random-effects model was used. The results showed that the experimental group significantly reduced anxiety scores in menopausal women compared to the control group (SMD = -1.47 , 95% CI: -2.52 to -0.42 , $p < 0.01$), with a high effect size. A sensitivity analysis was conducted to investigate the impact of each study by removing one study at a time. Sensitivity analysis showed an SMD range from -1.80 (95% CI: -2.97 to -0.62) to -0.40 (95% CI: -0.81 to 0.01) for each combination. Gordon's study (33) had the largest effect on the combined effect size. The results showed that after removing

TABLE 1 Characteristics of the included studies.

Author (year)	Country	Participants	Sample size	Intervention	length of intervention (weeks)	Outcomes (instrument)
			E/C	E/C		
Fu-Zhen Zhong et al. (27)	China	Menopausal women	13/14	MT/WL	8 weeks	Anxiety: STAI Depression: SDS
Fen-Xia (28)	China	Menopausal women	35/35	MHT+MBSR/ MHT	8 weeks (2 h per week)	Anxiety: GAD-7 Depression: PHQ-9
Fu-Zhen Zhong et al. (29)	China	Menopausal women	36/37	MT/WL	8 weeks (2.5 h per week)	Anxiety: bPOMS-Anxiety Depression: bPOMS-Depression
Hong-Yan Cheng and Xiao-Yan (30)	China	Menopausal women	80/80	MT/ RHC	8 weeks (2.5 h per week)	Anxiety: SAS Depression: SDS
Wen Xu et al. (31)	China	Menopausal women	35/39	MT/WL	8 weeks (2.5 h per week)	Depression: SDS
Shu-Xia Wang et al. (32)	China	Menopausal women	29/31	MT/WL	8 weeks (2.5 h per week)	Depression: SDS
Garcia et al. (38)	Brazil	Postmenopausal women	19/11	MT/GC	8 weeks (0.5 h per week)	Mindfulness: MAAS
Sener et al. (38)	Turkey	Postmenopausal women	55/63	MBSR/WL	16 weeks (2.5 h per week)	Mindfulness: MAAS
Gordon et al. (33)	Canada	Menopause transition women	44/51	MBSR/ WL	8 weeks (2.5 h per week)	Anxiety: STAI Depression: CES-D Stress: PSS Mindfulness: FFMQ
Wong et al. (9)	Hong Kong, China	Peri-menopausal or post-menopausal women	98/99	MBSR/MEC	8 weeks (2.5 h per week)	Stress: PSS Mindfulness: FFMQ
Chattha et al. (34)	India	Menopausal women	54/54	IAYT/ EBM	8 weeks (5 h per week)	Stress: PSS
Cramer et al. (36)	Germany	Menopausal women	19/21	YM/WL	12 weeks (1.5 h per week)	Anxiety: HADS-Anxiety Depression: HADS-Depression
Monfaredi et al. (35)	Iran	Postmenopausal women	43/43	ACT/ RHC	8 weeks (1-1.5 h per week)	Anxiety: DASS 21-Anxiety Depression: DASS 21-Depression Stress: DASS 21-Stress

E, experimental group; C, control group; MT, mindfulness training; WL, wait-list; MHT, menopause hormone therapy; MBSR, mindfulness-based stress reduction; RHC, routine health care; GC, general conversation; MEC, menopause education control; IAYT, integrated approach to yoga therapy; EBM, easy body movements; YM, yoga and meditation; ACT, acceptance and commitment training; STAI, State-Trait Anxiety Inventory; GAD-7, Generalized Anxiety Disease-7; SAS, Self-rating Anxiety Scale; HADS, Hospital Anxiety and Depression Scale; DASS 21, Depression, Anxiety, Stress Scale-21; bPOMS, brief Profile of Mood States; SDS, Self-rating Depression Scale; PHQ-9, Patient Health Questionnaire-9; CES-D, Center for Epidemiologic Studies Depression Scale; PSS, Perceived Stress Scale; MAAS, Mindful Attention Awareness Scale; FFMQ, Five Facet Mindfulness Questionnaire.

the maximum outlier ($I^2 = 76\%$), the anxiety scores of the experimental group were lower than those of the control group. The difference between the two groups was not statistically significant ($SMD = -0.40$, 95% CI: -0.81 to 0.01 , $p = 0.06$) (Figure 3), indicating that the MBIs had no significant effect on anxiety in menopausal women.

3.4.2. Depression scores

Nine studies (27–33, 35, 36) included 685 menopausal women (334 in the experimental group and 351 in the control group) to evaluate the effects of MBIs on depression scores in menopausal women using the SDS, PHQ-9, HADS, CES-D, DASS 21, and bPOMS, respectively. SMD was used to deal

TABLE 2 Literature quality assessment.

Author (year)	Random sequence generation	Allocation concealment	Blind method	Outcome data	Selective reporting	Other bias	Literature quality
Fu-Zhen Zhong et al. (27)	Unclear	Unclear	Unclear	Low-risk bias	Low-risk bias	Low-risk bias	B
Fen-Xia (28)	Low-risk bias	Unclear	Unclear	Low-risk bias	Low-risk bias	Low-risk bias	B
Fu-Zhen Zhong et al. (29)	Unclear	Unclear	Unclear	Low-risk bias	Low-risk bias	Low-risk bias	B
Hong-Yan Cheng and Xiao-Yan (30)	Low-risk bias	Unclear	Unclear	Low-risk bias	Low-risk bias	Low-risk bias	B
Wen Xu et al. (31)	Unclear	Unclear	Unclear	Low-risk bias	Low-risk bias	Low-risk bias	B
Shu-Xia Wang et al. (32)	Unclear	Unclear	Unclear	Low-risk bias	Low-risk bias	Low-risk bias	B
Garcia et al. (38)	Low-risk bias	Low-risk bias	Unclear	Low-risk bias	Low-risk bias	Low-risk bias	B
Sener et al. (38)	Unclear	Unclear	Low-risk bias	High-risk bias	Low-risk bias	Low-risk bias	B
Gordon et al. (33)	Low-risk bias	Low-risk bias	Low-risk bias	Low-risk bias	Low-risk bias	Low-risk bias	A
Wong et al. (9)	Low-risk bias	Low-risk bias	Low-risk bias	Low-risk bias	Low-risk bias	Low-risk bias	A
Chattha et al. (34)	Low-risk bias	Low-risk bias	Low-risk bias	Low-risk bias	Low-risk bias	Low-risk bias	A
Cramer et al. (36)	Low-risk bias	Low-risk bias	Unclear	Low-risk bias	Low-risk bias	Low-risk bias	B
Monfaredi et al. (35)	Low-risk bias	Low-risk bias	Unclear	Low-risk bias	Low-risk bias	Low-risk bias	B

with numerical variables due to different evaluation scales. The heterogeneity test showed significant heterogeneity among studies ($p < 0.01$, $I^2 = 95\%$). Thus, a random-effects model was adopted. The results showed that compared with the control group, the experimental group significantly reduced the depression score of menopausal women (SMD = -0.95 , 95% CI: -1.74 to -0.16 , $p = 0.02$), with a high effect size. A sensitivity analysis was performed to investigate the impact of each study by deleting one study at a time. A sensitivity analysis showed an SMD range from -1.12 (95% CI: -2.01 to -0.23) to -0.19 (95% CI: -0.45 to 0.07) for each combination, with Gordon's study (33) being the study that had the most significant impact on the combined effect size. The results showed that after removing the maximum outlier ($I^2 = 59\%$), the depression scores of the experimental group were lower than those of the control group. There was no statistically significant difference between the two groups (SMD = -0.19 , 95% CI: -0.45 to 0.07 , $p = 0.16$) (Figure 4), indicating that the MBIs had no significant effect on depression in menopausal women.

3.4.3. Stress scores

Four existing studies (9, 33–35) recruited 486 menopausal women (239 in the experimental group and 247 in the control group) to evaluate the effects of MBIs on stress scores in menopausal women using the PSS and DASS 21, respectively. Since the evaluation instruments were different, the numerical

variables were treated with SMD. The heterogeneity test showed significant heterogeneity among studies ($p < 0.01$, $I^2 = 98\%$). Thus, a random-effects model was used. The results showed that the experimental group significantly reduced anxiety scores in menopausal women compared to the control group (SMD = -2.68 , 95% CI: -4.39 to -0.96 , $p = 0.002$), with a high effect size. A sensitivity analysis was conducted to investigate the impact of each study by removing one study at a time. Sensitivity analysis showed an SMD range from -3.65 (95% CI: -6.44 to -0.86) to -0.84 (95% CI: -1.64 to -0.05) for each combination. Gordon's study (33) had the largest effect on the combined effect size. The results showed that after removing the maximum outlier ($I^2 = 92\%$), the anxiety scores of the experimental group were lower than those of the control group. And the difference between the two groups was statistically significant (SMD = -0.84 , 95% CI: -1.64 to -0.05 , $p = 0.04$) (Figure 5), indicating that the MBIs had a significant effect on stress in menopausal women. The result did not change when combined using the fixed-effects model (SMD = -0.60 , 95% CI: -0.81 to -0.40 , $p < 0.01$), indicating that the result of this meta-analysis was robust.

3.4.4. Mindfulness scores

Four studies (9, 33, 37, 38) included 440 menopausal women (216 in the experimental group and 224 in the control group) to evaluate the effects of MBIs on mindfulness scores in menopausal women using the MAAS and FFMQ, respectively.

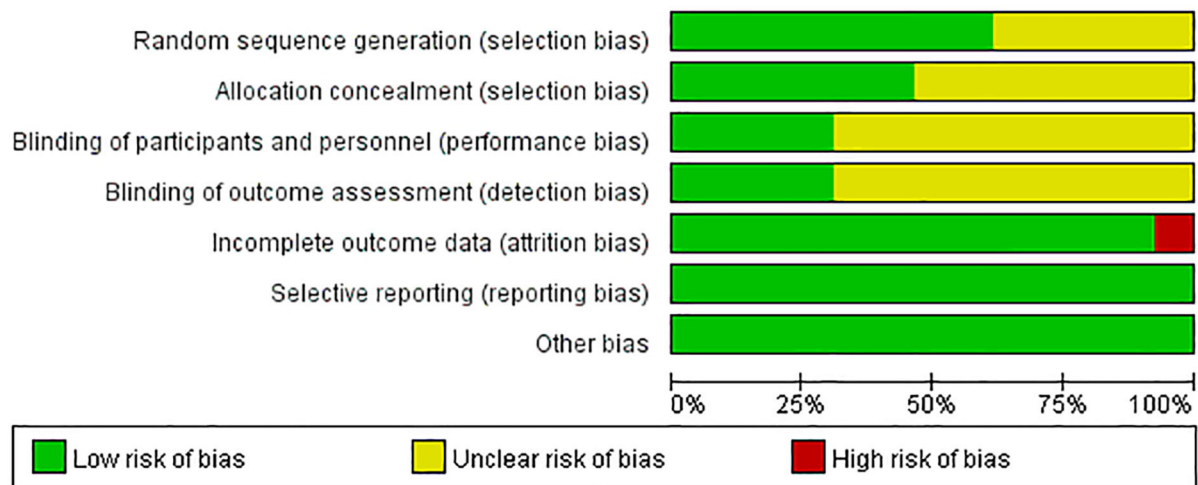


FIGURE 2
Risk of bias graph.

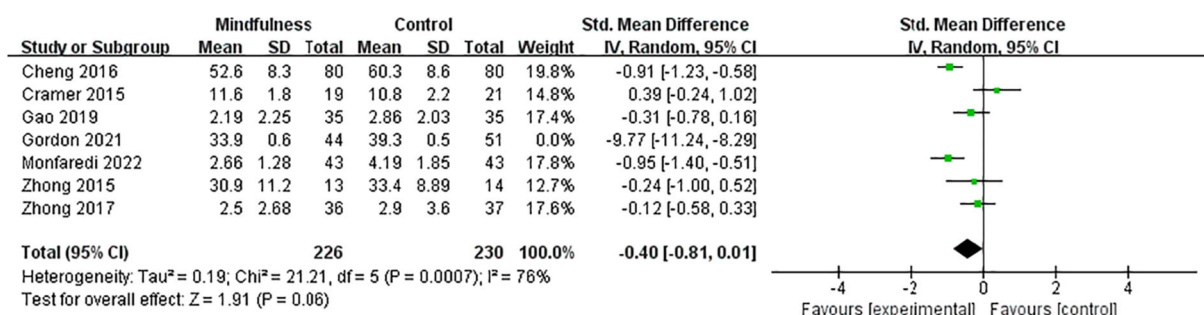


FIGURE 3
Forest plot of the anxiety scores.

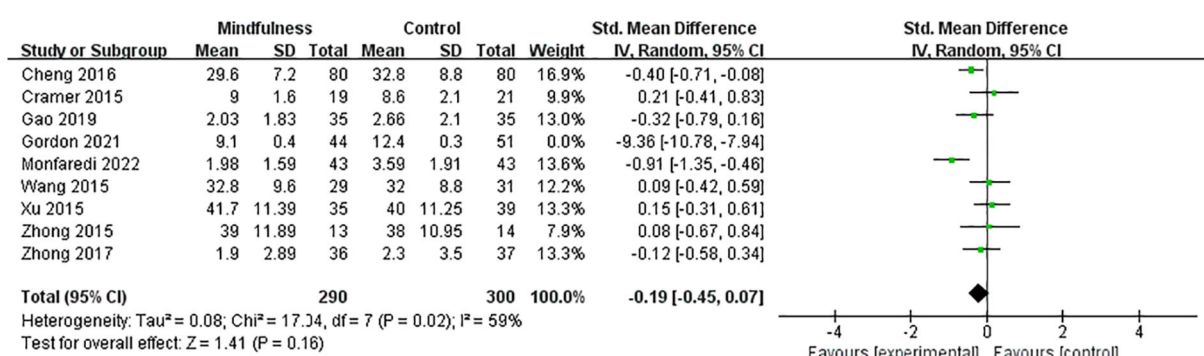


FIGURE 4
Forest plot of the depression scores.

SMD was used to deal with numerical variables due to different evaluation scales. The heterogeneity test showed significant heterogeneity among studies ($p < 0.01$, $I^2 = 98\%$). Thus, a

random-effects model was adopted. The results showed that compared with the control group, the experimental group significantly increased the mindfulness scores of menopausal

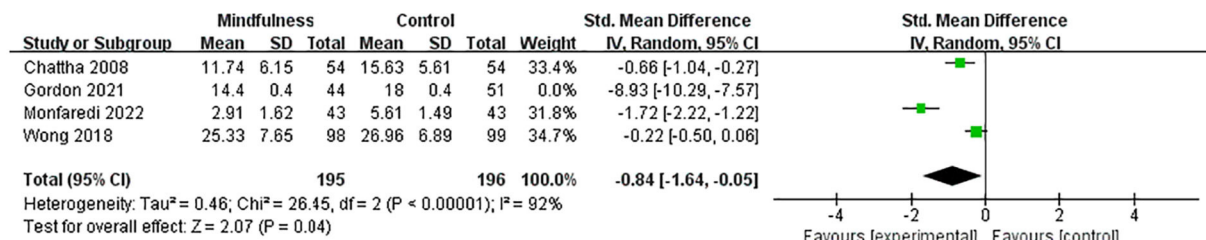


FIGURE 5
Forest plot of the stress scores.

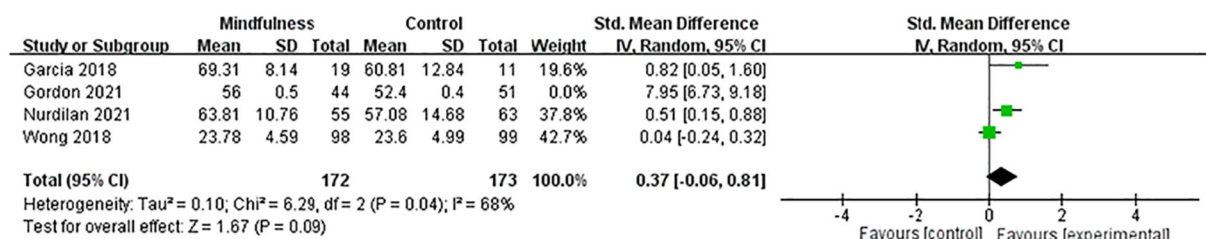


FIGURE 6
Forest plot of the mindfulness scores.

women ($SMD = 2.20$, 95% CI: 0.43 to 3.96, $p = 0.01$), with a high effect size. The sensitivity analysis was performed to investigate the impact of each study by deleting one study at a time. The sensitivity analysis showed an SMD range from 0.37 (95% CI: -0.06 to 0.81) to 3.04 (95% CI: -0.37 to 6.45) for each combination, with Gordon's study (33) being the study that had the greatest impact on the combined effect size. The results showed that after removing the maximum outlier ($I^2 = 68\%$), the mindfulness scores of the experimental group were higher than those of the control group. There was no statistically significant difference between the two groups ($SMD = 0.37$, 95% CI: -0.06 to 0.81, $p = 0.09$) (Figure 6), indicating that the MBIs had no significant effect on mindfulness scores in menopausal women.

3.5. Subgroup analyses

Subgroup analyses were conducted on the continent and length of intervention (weeks) for the outcomes—anxiety, depression, and mindfulness.

3.5.1. Continent

For anxiety, there were significant differences in SMD between the two subgroups: Asian (27–30, 35) and Europe (36) ($p = 0.01$). MBIs had significant effects among the study with Asian ($SMD = -0.55$, 95% CI: -0.91 to -0.18, $p = 0.003$).

However, no significant intervention effect was found for Europe ($SMD = 0.39$, 95% CI: -0.24 to 1.02, $p = 0.23$). For depression, there were no significant differences in SMD between the two subgroups: Asian (27–32, 35) and Europe (36) ($p = 0.20$). MBIs did not find a significant intervention effect in Asian ($SMD = -0.23$, 95% CI: -0.51 to 0.04, $p = 0.10$) and Europe ($SMD = 0.21$, 95% CI: -0.41 to 0.83, $p = 0.51$).

3.5.2. Length of intervention (weeks)

For depression, there were no significant differences in SMD between the two subgroups: 8 weeks (27–33, 35), 12 weeks (36) ($p = 0.20$). MBIs did not find a significant intervention effect at 8 weeks ($SMD = -0.23$, 95% CI: -0.51 to 0.04, $p = 0.10$) and 12 weeks ($SMD = 0.21$, 95% CI: -0.41 to 0.83, $p = 0.51$). For mindfulness, there were no significant differences in SMD between the two subgroups: 8 weeks (9, 33, 37), 16 weeks (38) ($p = 0.69$). MBIs had significant effects among the study with 16 weeks ($SMD = 0.51$, 95% CI: 0.15 to 0.88, $p = 0.006$). However, no significant intervention effect was found for 8 weeks ($SMD = 0.34$, 95% CI: -0.41 to 1.09, $p = 0.37$).

3.6. Publication bias

It was not possible to test for publication bias by drawing funnel plots due to the inclusion of <10 articles in the single meta-analysis, suggesting that potential publication bias may exist in this study.

4. Discussion

4.1. Discussion of pooled results

The results showed that the MBIs significantly reduced stress scores and produced high improvements ($SMD = -0.84$), but they had no significant effect on anxiety, depression, or mindfulness scores in menopausal women compared to the control group. It is important to note that the results should be treated with caution due to the statistical heterogeneity in the study. This study investigated the effect of each study on overall risk by using sensitivity analysis to explore the main sources of heterogeneity. Large differences in a sample size (range: 27–197), different intervention types, weekly intervention hours (range: 30–300 min/week), intervention duration (range: 8–16 weeks), control group type (e.g., wait-list, routine health care, etc.), measurement instruments, cultural background, or other confounding factors may be responsible for heterogeneity.

Although the exact mechanism of MBIs for menopausal women is currently unclear, some arguments have been made through research that MBIs can cultivate people to keep an open mind and an observational attitude, improve reaction flexibility and emotional tolerance (47), interrupt rumination on past experiences and worry about future events (48), and then improve negative emotions and cope with stress (16, 49). This helps a person more effectively decide how to respond to mental, emotional, or behavioral problems (50–52). The neurobiological mechanisms involved suggest that stress-related hormones (e.g., cortisol) negatively affect emotions by increasing the volume of the amygdala nucleus and decreasing the volume of the prefrontal cortex and hippocampus (53). In contrast, MBIs reduce the volume of the amygdala nucleus and increase the volume of the hippocampus (54, 55). Studies have shown that estrogen inhibits sympathetic activity and enhances parasympathetic activity (56, 57). Lower estrogen levels during menopause lead to increased sympathetic activity and inhibition of baroreceptors (58–60). MBIs improve body awareness and self-regulation by balancing sympathetic and parasympathetic responses and decreasing hypothalamic-pituitary-adrenal activation (61); It also increases stress-related autonomic activation (61), causes the brain to make new responses, and reorganizes neural pathways, which could change the structure of the brain in the long run (62). The stress-attenuating effects of MBIs work by reducing stress reactivity and activation (63), as well as by changing psychobiological stress markers like cortisol, C-reactive protein, and triglycerides (64). This has a long-term effect on buffering the stress response (65). Through this process, it allows individuals to better adapt to their environment (66–68), which contributes to alleviating the anxiety, depression, and stress experienced by women as they face menopause (69). In terms of application, MBIs have been widely used. Many studies have shown positive effects of MBIs

in relieving anxiety and depression (49, 70), reducing stress (71, 72), and increasing mindfulness (73, 74).

In this study, MBIs had no significant effect on anxiety, depression, or mindfulness scores in menopausal women, which is related to the missing rate due to poor participant compliance. According to Nurdilan et al. (38), the missing rate was > 20%, which has affected other participants' motivation to maintain the MBIs (75). Further subgroup analysis revealed that the effects of MBIs may depend on the continent and the length of the intervention (weeks). There were cross-cultural differences in the intervention effects of MBIs on anxiety. The effectiveness of the intervention is significantly higher in Asia than in Europe, which stems from differences in the conceptual understanding of mindfulness between East and West. Mindfulness refers more to a state of being in the present moment, which is essentially equivalent to “Vipassana” in Eastern Buddhism (76). The difference in the understanding of mindfulness between Eastern and Western due to different ideologies and political systems leads to a gap in the level of mindfulness (77); since depression and mindfulness are influenced by multiple factors, mindfulness as a moderating variable is difficult to change in a short period of time (78). It has also been shown that although MBIs can cultivate people's better insight and self-regulation abilities, they are also regarded as an idealized state in cognitive science theory and are difficult to achieve in a short period of time (79). Further high-quality studies with large samples are needed to explore the effectiveness of MBIs in menopausal women.

However, the results of this study showed no statistically significant differences between the experimental and control groups in anxiety, depression, and mindfulness scores and only statistically significant differences in stress scores. Although the results were not statistically significant, the findings also inform the development of MBIs for menopausal women. Further studies are still needed to validate these results and follow the long-term effects.

4.2. Limitations

This meta-analysis is the first to definitively show that MBIs can significantly reduce stress scores in menopausal women, but they have no significant effect on anxiety, depression, and mindfulness scores. However, there are some limitations in this study: (1) Only eight studies detailed the randomization method due to the study design limitations. While the other studies only mentioned randomization without specifying the method being used, and only four studies implemented blinding; (2) The difficulty of conducting more subgroup analyses under the limitation of the number of included studies may lead to some heterogeneity among studies; (3) Potential regulatory variables, such as subject characteristics, intervention types, control group

types, missing rates, and other factors, may have varying degrees of influence on the results. This study did not conduct a stratified analysis of potential influencing factors due to the limitations of the study design. (4) The possibility of publication bias cannot be ruled out because the number of included studies limited the ability to detect publication bias; (5) There was no uniform measurement instrument for the same outcome index. Although SMD was chosen as the effect size indicator, caution is needed when interpreting the results.

4.3. Implications for practice and research

The findings have important implications for clinical practice, as the adoption of MBIs can be effective in reducing stress in menopausal women. First, further research should be conducted in the future on how to increase participants' motivation, reduce the missing rate, and maintain the effects of MBIs; second, it was not possible to conduct subgroup analyses for the types of interventions due to the limitations of the studies included in this study. As a result, future studies should conduct stratified, in-depth comparisons and discussions of various types of interventions. In the future, researchers will need to do more high-quality studies with larger sample sizes to confirm that MBIs work for menopausal women.

5. Conclusion

The results of this study revealed that MBIs significantly reduced the stress scores of menopausal women but did not significantly improve their anxiety, depression, and mindfulness scores. The effectiveness of the MBIs on anxiety, depression, and mindfulness scores in menopausal women needs to be further validated in future studies with large, high-quality samples.

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Data availability statement

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

Author contributions

HL and HZ: conceptualization and methodology. HL: software, validation, formal analysis, and writing—original draft preparation. HZ: reviewing, editing, and supervision. HL, JW, and KC: resources and data curation. All authors contributed to the article and approved the submitted version.

Conflict of interest

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

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2022.1045642/full#supplementary-material>

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Advancing socioecological mental health promotion intervention: A mixed methods exploration of Phase 1 Agenda Gap findings

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Introduction: Protecting and promoting the mental health of youth under 30 years of age is a priority, globally. Yet investment in mental health promotion, which seeks to strengthen the determinants of positive mental health and wellbeing, remains limited relative to prevention, treatment, and recovery. The aim of this paper is to contribute empirical evidence to guide innovation in youth mental health promotion, detailing the early outcomes of Agenda Gap, an intervention centering youth-led policy advocacy to influence positive mental health for individuals, families, communities and society.

Methods: Leveraging a convergent mixed methods design, this study draws on data from $n = 18$ youth (ages 15 to 17) in British Columbia, Canada, who contributed to pre- and post-intervention surveys and post-intervention qualitative interviews following their participation in Agenda Gap from 2020–2021. These data are supplemented by qualitative interviews with $n = 4$ policy and other adult allies. Quantitative and qualitative data were analyzed in parallel, using descriptive statistics and reflexive thematic analysis, and then merged for interpretation.

Results: Quantitative findings suggest Agenda Gap contributes to improvements in mental health promotion literacy as well as several core positive mental health constructs, such as peer and adult attachment and critical consciousness. However, these findings also point to the need for further scale development, as many of the available measures lack sensitivity to change and are unable to distinguish between higher and lower levels of the underlying construct. Qualitative findings provided nuanced insights into the shifts that resulted from Agenda Gap at the individual, family, and community level, including reconceptualization of mental health, expanded social awareness and agency, and increased capacity for influencing systems change to promote positive mental health and wellbeing.

Discussion: Together, these findings illustrate the promise and utility of mental health promotion for generating positive mental health impacts across socioecological domains. Using Agenda Gap as an exemplar, this study underscores that mental health promotion programming can contribute to gains in positive mental health for individual intervention participants whilst also enhancing collective capacity to advance mental health and equity, particularly through policy advocacy and responsive action on the social and structural determinants of mental health.

KEYWORDS

youth, mental health, mental health promotion, advocacy, policy, intervention, mixed methods, community-based research

Introduction

The mental health of youth under 30 years of age has long been a public health priority. Mental health challenges are among the leading causes of health- and disability-related burden globally (1); with most mental illnesses first arising in adolescence (2). While population mental health represents a clear target for public health action, contributors to positive mental health and wellbeing – the domain of mental health promotion – are often overlooked in research, policy, and practice (3, 4). Mental health promotion is a strengths-based orientation to advancing positive mental health and equity by building individual and community capacity to identify and redress relevant barriers (5). By operating “upstream,” mental health promotion targets the social determinants of mental health, or the everyday circumstances and social and structural forces that shape opportunities for health and wellbeing. As such, mental health promotion holds the potential to impact mental health across socioecological domains, meaning that it can be designed to strengthen positive mental health at the individual (e.g., health status, coping), family (e.g., relationships, income), community (e.g., social cohesion, built environment), and societal levels (e.g., discrimination, equity) (6).

In the youth mental health sphere, mental health promotion has been implemented in a number of settings, including in schools (7, 8), online (9), and in community-based settings (10, 11). Often, this work has focused on reaching priority population groups, such as LGBTQ2+ youth (12) and urban youth living in underserved communities (13). The aims of mental health promotion interventions have ranged from building personal skills and competencies, such as coping, stress management, and self-efficacy (7); through to strengthening youth-adult relationships, empowering youth through civic engagement and shared decision making (11), and shifting community norms and practices related to how youth are prioritized in society (10).

Yet, despite its promise, mental health promotion has received a disproportionately low level of attention and investment compared to its illness-oriented counterparts – that is, prevention, treatment, and recovery (3). This has resulted in more limited and pilot-based programming and a stunted evidence base to guide intervention and funding. Indeed, in a review of youth mental health promotion programs in schools, O'Mara and Lind (8) concluded that “study populations are limited and many studies either lack clarity regarding who implemented interventions, lack theoretical foundations, process evaluations or youth viewpoints” (p. 203). Moreover, in a review of reviews conducted by Enns et al. (14), it was found that the scope of mental health promotion intervention remains predominantly focused on individual protective factors, with much less attention to interventions intended to alter the broader social and structural determinants of mental health and wellbeing for communities or populations. We argue that this reflects a missed opportunity and fails to acknowledge, as Mantoura (6) writes, that “[i]mproving mental health is social and political; it requires interventions in all sectors and settings people traverse during their life trajectory” (p. 15). Addressing the “social” and “political” requires a range of approaches and tools, including policy advocacy, which has been identified as a key mental health promotion strategy. Given the gaps and opportunities identified, the purpose of this paper is to advance

the empirical evidence base for youth mental health promotion through an exploration of the early Phase 1 findings of Agenda Gap – an innovative mental health promotion intervention that centers youth-led policy advocacy. Data collected during Phase 1, and presented here, will be used to inform the expansion of Agenda Gap in Phase 2 to additional study sites, alongside ongoing evaluation.

Materials and methods

Intervention overview

Guiding intervention theories

Agenda Gap is a social innovation supported by the Public Health Agency of Canada's Mental Health Promotion Innovation Fund (MHP-IF), which provided Phase 1 (2019–2022) funding and recently awarded Phase 2 funding (2022–2026). The MHP-IF “funds the testing and delivery of promising population health interventions in the area of mental health promotion with an emphasis on increasing health equity”, including through addressing “systemic barriers for population mental health in Canada” (15). During Phase 1, the focus was on the initial development and delivery of the Agenda Gap intervention.

The Agenda Gap intervention was developed through partnerships with youth from diverse groups and/or backgrounds in the lower mainland of British Columbia, Canada. Aligned with the goals and values of health promotion generally (16) and the MHP-IF more specifically, it is guided by the theoretical tenets of mental health promotion, positive youth development, community youth development, and liberation psychology. Specifically, the overarching framework for Agenda Gap is mental health promotion theory, which directs a focus on positive mental health, as opposed to mental ill health. It further informs the intervention focus on policy as a strategy for strengthening positive mental health across socioecological domains by enhancing conditions conducive to wellbeing (5, 17). Positive Youth Development encourages meaningful youth engagement to foster progression in developmental competencies, particularly among youth who are marginalized, while Community Youth Development brings focus to issues of social justice and equity as well as community- or population-level impacts. Finally, the Theory of Sociopolitical Development (18), which originates from the traditions of liberation psychology, drives an intervention that is responsive to the root determinants of mental health and builds “capacity to identify, analyze, and act on issues relevant to youth” (19). Together, these theories guide an intervention that centers a human rights approach to action on the social determinants of health and equity to strengthen mental health and wellbeing for individuals and their communities.

Intervention implementation

Agenda Gap centers youth expertise and prepares youth collaborators for meaningful policy engagement (i.e., multi-level and multi-sectoral action and advocacy for systems change) to promote mental health of individuals, families, communities, and society. In October 2020, Agenda Gap launched in its first two intervention sites in British Columbia, followed by an additional intervention site

in Alberta in October 2021. Forthcoming sites in the provinces of Ontario and Nova Scotia are set to launch in 2023 as part of Phase 2 activities. To date, Agenda Gap has been delivered entirely online due to the COVID-19 pandemic and associated public health protections. The intervention consists of: (1) a youth mental health promotion and policy advocacy “curriculum” delivered through a developmental relationship building process, (2) facilitator and ally (community, policy and other decision maker) capacity-generating activities, and (3) strategic knowledge mobilization.

Youth collaborators (aged 15–24 years) are recruited through partner organization networks, including schools, community organizations and health services, with an emphasis on engaging youth who experience intersecting health and social inequities (e.g., have accessed mental health services, live in poverty, are in care of the child welfare system, or who are racialized, Indigenous and/or LGBTQ2+). Interested youth are interviewed to explore interest and to curate cohorts of 5–15 youth with shared experiences or passions. Cohorts are then engaged *via* weekly 2-hour facilitated sessions over ~6 months, with youth financially compensated through an hourly honorarium. Facilitators, identified through partner organizations, are mentored through the implementation process by the research team through a train-the-trainer process. This is further supported by a Facilitation Guide detailing activities to promote skills building and collective policy advocacy beyond the conclusion of the formal intervention. Core session topics include: mental health promotion literacy, social and structural determinants of mental health and (in)equity, youth rights as a platform for policy advocacy, and influencing systems and system actors [see Jenkins et al. (20) for further details on intervention content and protocol]. Materials to equip policy and other decision makers to support meaningful youth engagement in policy making are also disseminated to adult allies engaging with youth during the intervention, while multi-pronged knowledge mobilization strategies are leveraged to broaden and deepen impacts beyond intervention participants (e.g., media interviews; school, community, and conference presentations; infographics; policy briefings; collaborative policymaking). The overarching aim of these intervention processes are to equip youth collaborators to:

- 1) Collectively identify factors in their community that impact youth mental health *and* are amenable to change through policy.
- 2) Develop strategies and action plans to effect relevant policy development/change, including through knowledge mobilization outputs.
- 3) Engage with relevant parties, including policymakers, in collaborative policymaking processes to promote youth mental health.

In this way, Agenda Gap is designed to contribute to impacts across the four socioecological domains. Youth participants benefit directly through the development of supportive relationships and sense of connectedness, as well as new skills and knowledge about the links between mental health and policy (individual level). Moreover, policy and other adult allies are engaged and leveraged through collaborative policy-making processes with youth (individual and community levels). Together, this serves to advance mental health promotion and equity for – and with – youth and others living in communities where the policy advocacy and intervention is targeted (family, community and societal levels) (21).

Study design and conceptual framework

A convergent mixed-methods design (22) guided by realist evaluation methodology (23) is utilized alongside the intervention to allow for exploration into *how* Agenda Gap works, for *whom* and in what *contexts*. It also provides data that can be used to investigate youth and adult ally perspectives and measures of intervention impact, which is the focus of the present paper. Conceptually, this exploration is guided by the Positive Mental Health Surveillance Indicator Framework, developed by the Public Health Agency of Canada (21) (see Figure 1).

Aligned with mental health promotion theory, this framework adopts a socioecological orientation to positive mental health and identifies risk and protective factors across individual, family, community, and societal domains. Utilizing this framework orients an investigation of Agenda Gap impacts for individuals as well as “ripple effects” that reach beyond those directly involved in the intervention (24).

Data collection

The overarching study comprises a variety of data sources, including anonymous pre- and post-intervention online surveys, pre-intervention qualitative interviews, post-intervention qualitative interviews, research logs, and impact mapping. This paper draws on data from the anonymous pre- and post-intervention online surveys and the post-intervention qualitative interviews. These were collected with Phase 1 youth collaborators from the first two intervention cohorts in British Columbia. Data were collected between September 2020 (pre-intervention survey) and June 2021 (post-intervention survey and interviews). Additional data comes from post-intervention qualitative interviews, conducted in June and July 2021 with a subset of policy/decision makers who were engaged in intervention activities with these cohorts. The two youth cohorts, from which the Phase 1 data used in the present analysis were drawn from, were recruited through partner organizations in the recreation and education sectors and included those living in an urban neighborhood that is characterized by high levels of poverty and other health and social inequities, as well as youth living in a suburban neighborhood that is home to a high proportion of new immigrant families. In addition to receiving an hourly honoraria for participation in the Agenda Gap intervention, all youth received \$20 CAD for each survey or interview that they participated in to acknowledge their time and contributions to the study. Adult participants were not financially compensated for their time as their participation was considered within the scope of their professional role. Ethical approval for the study was obtained by the University of British Columbia Behavioral Research Ethics Board (H17-001602). Informed consent was provided upon initiating the online survey and orally prior to the beginning of each interview.

Quantitative measures of positive mental health

Anonymous pre- and post-intervention online surveys drew on a number of measures designed to assess constructs of

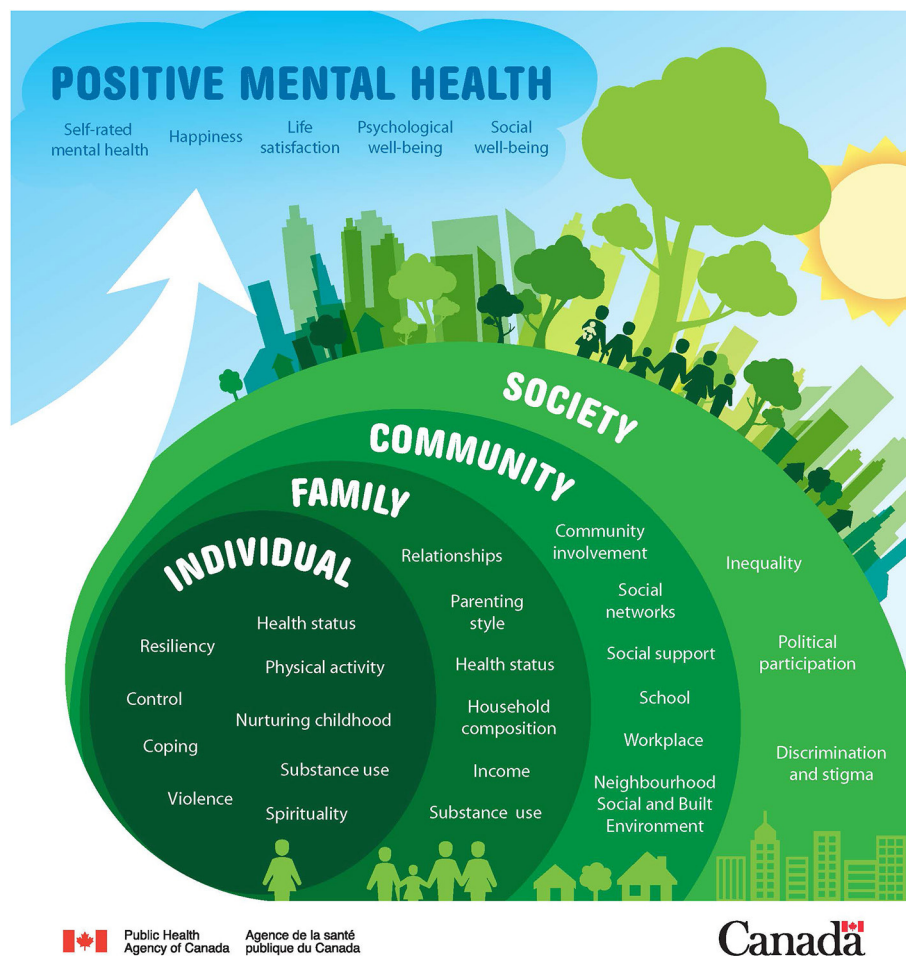


FIGURE 1
Positive mental health conceptual framework for surveillance. Developed by Orpana et al. (21).

positive mental health, as guided by our intervention theories (see Table 1 for overview of intervention theories mapped to corresponding socioecological domains and measures). Their use in this study also served as an opportunity to determine their utility for subsequent phases of research, including program evaluation. A knowledge assessment was also constructed by our research team to measure changes in what we conceptualize as mental health promotion literacy, or individuals' knowledge and beliefs about the determinants of positive mental health and wellbeing. Surveys were administered to participants *via* Qualtrics.

Knowledge

A series of 10 questions were developed by our research team to assess participant knowledge across intervention time points. Questions reflect key concepts related to positive mental health, including mental health promotion, youth rights, and the relationship between mental health and policy.

General self-efficacy scale

The 10-item General Self-Efficacy Scale (25) was adopted for this study. This scale measures participants' perceived competence in responding to stressful circumstances. Responses to the items comprising this scale were measured on a 4-point Likert scale ranging from 1 (Not at all true) to 4 (Exactly true). A sample item is, "I can usually handle whatever comes my way." In a multicultural validation study, this measure was found to have acceptable reliability levels in community-based samples, including among students ($\alpha = 0.86$ to 0.90) (26).

CYRM-12: A brief measure of resilience

The 12-item Child and Youth Resilience Measure (CYRM) (25) was used as a brief, multidimensional measure of resilience in young people. Participants' responses to the items comprising this scale were measured on a 7-point Likert scale from 1 (Does not describe me at all) to 7 (Describes me a lot). A sample item is, "I know where to go in my community to get help" and the original validation of the scale showed acceptable reliability ($\alpha = 0.84$) (27).

TABLE 1 Intervention theories mapped to corresponding socioecological domains and measures.

Theory	Measures	Socioecological domains represented
Mental Health Promotion Socio-ecological orientation to positive mental health, actions to alter the social and structural determinants of mental health, including through policy advocacy	CYRM-12: A Brief Measure of Resilience	Individual, Family, Community
	Peer and Adult Relationships	Individual, Family, Community
	Knowledge assessment – mental health promotion literacy	Individual, Family, Community, Society
Positive Youth Development (PYD) Growth in developmental competencies	General Self-Efficacy Scale (GSE)	Individual
Community Youth Development (CYD) Capacity to identify and redress social inequities Liberation psychology Empowerment, and the capacity to identify, analyze, and act on issues relevant to youth	Individual, Family, Community, Society	Critical Consciousness Scale Civic Participation

Critical consciousness scale

The Critical Consciousness Scale (CCS) is a 22-item scale comprised of three subscales: Critical Reflection: Perceived Inequality (items 1–8); Critical Reflection: Egalitarianism (items 9–13); and Critical Action: Sociopolitical Participation (items 14–22). The scale was developed and tested among diverse youth populations to quantify critical consciousness, conceptualized as the capacity of marginalized peoples to critically analyze “their social conditions and individual or collective action taken to change perceived inequities” (28). In this study, we utilized the Perceived Inequality and Egalitarianism subscales (items 1–13). Participants’ responses to the items comprising this scale were measured on a 6-point Likert scale ranging from 1 (Strongly Disagree) to 6 (Strongly Agree). For the eight-item Perceived Inequality subscale, a sample item is, “Certain racial or ethnic groups have fewer chances to get ahead”. This subscale showed moderate internal consistency in the original validation ($\alpha = 0.84$). For the five-item Egalitarianism subscale, a sample item is, “It would be good if groups could be equal”. This subscale also demonstrated acceptable internal consistency in the original validation ($\alpha = 0.82$) (29).

Peer and adult attachment

Both peer and adult attachment were assessed through measures adapted from various sources by the Students Commission of Canada for their Youth and Community Survey (30). Specifically, the peer attachment questions draw from the research of Armsden and Greenberg (31), which utilized attachment theory principles to develop a measure of youth’s feelings about their significant attachment relationships, including with peers. Similarly, the questions assessing adult attachment were adapted by the Students Commission of Canada from the work of Whitlock (32), which

focused on community connectedness, including relationships between youth and adults. Peer attachment was measured through three-items, including: “My friends are there when I need them” on a 5-point scale ranging from 1 (Never true) to 5 (Always true). Adult attachment was measured through five-items, including “There are adults I can ask for help when I need it” on a 5-point scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). While there is no published literature exploring the validity of these measures, they hold strong face validity and were considered well aligned with our guiding intervention theories.

Civic participation

The 10-item Civic Participation Scale was adopted from the Youth and Community Survey developed by the Students Commission of Canada (30). The Civic Participation Scale draws on the theoretical and research-based contributions of Pancer et al. (33), Speers and Peterson (34), and Flanagan et al. (35), all of which center the developmental importance of youth involvement in social and political aspects of life. Participants were asked about the frequency of their behaviors, such as involvement in community activities, including volunteering, as well as political activities such as taking part in discussions about social or political issues over the past year. Participants answered on a 5-point Likert scale ranging from 1 (Never) to 5 (A lot), reflecting how often they participated in each activity. While there is no published literature exploring the validity of this measure, it also has strong face validity and was considered well aligned with our guiding intervention theories.

Qualitative interviews

Qualitative interviews were guided by a semi-structured interview guide. This supported detailed accounts of participant experiences and perspectives related to the intervention and its effects. Questions included a focus on perceived intervention impacts for participants (e.g., *We expect that the Agenda Gap program will improve policies for youth mental health. That’s one outcome, but we are also interested in the immediate positive or negative effects of being involved. Can you describe any positive impacts to you personally? Can you describe any negative impacts to you personally?*), as well as impacts within participants’ broader communities (e.g., *Now that you have participated in Agenda Gap, in what ways have you seen things shift (outlook, relationships) among your peers because of your participation? What shifts have you noticed in your school, at home or in your community, if any?*). To enhance participant comfort in sharing all aspects of their intervention experience, interviews were conducted *via* Zoom and audio recorded by two members of the study team who were not involved in intervention implementation. Recordings were uploaded to Temi, an automated transcription service, and then checked for accuracy.

Data analysis

All pre- and post-intervention survey data were analyzed using SPSS 26 to produce descriptive statistics to characterize demographics, knowledge, and measures of positive mental health pre- and post-intervention. Paired sample *t*-tests were conducted to

assess change over time on positive mental health assessments. This process facilitates the trialing of selected measures for consideration of their fit with Agenda Gap constructs for use in Phase 2.

All qualitative interview transcripts were de-identified and uploaded to NVivo 12 to facilitate coding. Reflexive thematic analysis techniques were used as an initial analytic tool to examine and interpret the qualitative interview data and construct key intervention impacts from the perspectives of youth and adult allies (realist analyses detailing causal mechanisms will be presented in forthcoming papers). Guided by Braun and Clarke's (36) reflexive thematic analysis approach, our process included: (1) data familiarization through reading and re-reading of transcripts; (2) inductively identifying key patterns and generating six initial codes (*conceptual and behavioral changes, mental health, peer and adult relationships, capacity, agency, and ripple effects*); (3) assigning data excerpts to the codes; (4) combining codes to construct potential themes informed our conceptual framework; (5) reviewing themes in relation to data; and (6) refining and finalizing theme names. In keeping with our convergent mixed-methods study design (19), qualitative and quantitative data were analyzed separately but in parallel as we interpreted the findings, presented below.

Results

A total of 18 youth aged 15–17 participated in the Phase 1 Agenda Gap intervention across the two British Columbia cohorts. Of these participants, all 18 contributed to pre- and post-intervention surveys and post-intervention qualitative interviews. Youth participants predominantly identified being of non-white ethno-racial background ($n = 17$), while one youth identified as mixed descent (Indigenous and white). All the youth were currently attending high school (see Table 2 for additional demographic characteristics of youth participants). In addition to the demographic data collected through the survey, many of the youth self-identified as belonging to an equity-deserving group due to lived and living experience with mental ill health and associated health systems and services, being a recent immigrant or refugee, or being LGBTQ2+.

Four adult allies participated in a post-intervention qualitative interview. These participants had all engaged with Agenda Gap through their professional roles in the health ($n = 1$) and education sectors ($n = 3$) as policy and/or other decision makers. These results are visible in the theme area of community-level impacts.

Pre- and post-intervention survey findings

Pre- and post-intervention knowledge assessments are presented to characterize understanding of core positive mental health concepts (mental health promotion literacy) pre- and post-intervention – (see Table 3). For most of the items (60%), a greater proportion of participants answered correctly at the post-intervention time point. However, for Mental Health Promotion there was no change in the proportion of participants answering the item correctly. With respect to Youth Policy Engagement, Youth Policy Strategies, and Intersecting Vulnerabilities, there was a 5.6% reduction in the proportion of participants answering correctly post-intervention. Overall, the average number of correct responses increased from 5.7 (SD 1.7) pre-intervention to 6.4 (SD 1.6) in the post-intervention

TABLE 2 Demographic characteristics of Agenda Gap youth participants.

Youth participants	$n = 18$	%*
Gender		
Girl/Woman	17	94
Boy/Man	1	6
Non-binary	0	0
Age		
15	5	28
16	8	44
17	5	28
Educational level		
Grade 9	5	28
Grade 10	4	22
Grade 11	9	50
Ethno-racial background		
Black (African, Afro-Caribbean, African Canadian descent)	1	5
Southeast Asian (Vietnamese, Cambodian, Thai, Filipino, Indonesian, other Southeast Asian descent)	8	44
East Asian (Chinese, Korean, Japanese, Taiwanese descent)	6	33
Middle Eastern (Arab, Persian, West Asian descent (e.g., Afghan, Egyptian, Iranian, Lebanese, Turkish, Kurdish)	2	11
Mixed descent	1	5

*% totals may not equal 100% due to rounding.

TABLE 3 Description of pre- and post-intervention knowledge assessments.

	Pre-test, $n = 18$, no. correct (%)	Post-test, $n = 18$, no. correct (%)	Improvement? Yes or no
Mental health concept			
Resilience	2 (11.1)	8 (44.4)	Yes
Mental health	7 (38.9)	9 (50.0)	Yes
Contributors to mental health	15 (83.3)	16 (88.9)	Yes
Mental health promotion	2 (11.1)	2 (11.1)	No
Policy	10 (55.6)	12 (66.7)	Yes
Youth policy engagement	17 (94.4)	16 (88.9)	No
Youth policy strategies	13 (72.2)	12 (66.7)	No
Youth rights	9 (50.0)	11 (61.1)	Yes
Youth influence	16 (88.9)	18 (100)	Yes
Intersecting vulnerabilities	12 (66.7)	11 (61.1)	No
Total number correct Mean (SD)	5.7 (1.7)	6.4 (1.6)	Yes

assessment, however this difference was not statistically significant according to a paired samples t -test: $t(16) = 1.04$, $p = 0.31$.

Pre- and post-intervention group means and standard deviations are presented in Table 4 to characterize constructs of youth participants' positive mental health (i.e., self-efficacy, civic

participation, resiliency, attachment, and critical consciousness). Reliability of the scales, assessed *via* Cronbach's alpha, ranged from 0.58–0.97. In general, there was a trend toward improved positive mental health from pre- to post-intervention assessment, apart from self-efficacy, resilience, and egalitarianism, which had similar average scores in pre- and post-intervention assessment. Paired samples t-tests using cases with complete data indicated a similar trend toward improvement over time. However, only scores on the Perceived Inequality scale were significantly different [General Self-Efficacy: $t_{(12)} = -0.22$, $p = 0.83$; Civic Participation: $t_{(13)} = -1.67$, $p = 0.12$; Resilience: $t_{(12)} = -2.11$, $p = 0.06$; Peer Support: $t_{(14)} = -1.52$, $p = 0.15$; Adult Support: $t_{(13)} = -1.66$, $p = 0.12$; Perceived Inequality: $t_{(14)} = -2.26$, $p = 0.04$; and Egalitarianism: $t_{(11)} = 1.06$, $p = 0.31$].

Post-intervention qualitative interview findings

While the survey data provide indications of the impacts of Agenda Gap related to youth participants' knowledge and constructs of positive mental health, the interview data articulate the ways in which the intervention contributes to mental health promoting outcomes for youth and adult ally participants. These data also suggest 'ripple effects' that hold the potential to address the determinants of mental health and equity across socioecological domains. Findings are organized thematically to illustrate perceived impacts at the individual through community levels, though, as described by participants, these impacts often span multiple domains. In presenting these themes below, illustrative participant quotes are used throughout to foreground youths' voices and expertise.

Individual-level impacts: Personal transformation

Re-conceptualizing mental health

Across interviews, youth participants shared that Agenda Gap contributed to new and expanded understandings of mental health, as they were encouraged to connect program concepts and apply them to their everyday contexts. Specifically, youth identified the importance of recognizing mental health as a positive concept, distinct from mental illness. One youth related, *"This program helped me and a lot of others understand that mental health isn't mental illness."* She went on to say, *"I understood how good mental health can look different for people... good mental health isn't just exercising or meditating, it can be the daily things in your life."*

While this shift in understanding mental health was not well reflected in the knowledge assessment survey data, the qualitative data underscore substantial gains in youths' understanding and application of this new knowledge. Indeed, these new understandings extended youth participants' conceptualizations of mental health as an outcome of individual characteristics to also include the role of social and structural conditions, including positionality and inequities. One participant said she came to understand, *"how deep-rooted racism can affect mental health and how it's not just about personal change, it's more about community-based support."* This new knowledge also extended their ideas about how mental health could

be strengthened or promoted, including through policy change. One participant shared, *"I have a much better understanding of how policy affects me and how it can affect youth mental health."* Even youth who came to the program with lived experience of the ways that mental health is impacted by social and structural determinants gained this understanding. One youth said, *"I knew beforehand how systems of oppression can impact mental health, that's something my family's experienced. But that policy change can help – that is not something I really considered much..."* This participant continued that Agenda Gap helped them to appreciate that *"... mental health isn't just dealt with in a therapist's office, but it can be dealt with through legislature as well."*

As these youth participants' words so powerfully convey, and as is echoed in the quantitative results, there were pronounced shifts in mental health-related knowledge and critical consciousness as a result of Agenda Gap – providing new understandings that are informing how these youth think about and consider possible action to strengthen mental health.

Expanded social awareness and agency

Many participants expressed that their participation in Agenda Gap expanded their social awareness, increasing their sense of empathy and sensitivity to equity issues. According to one youth:

It made me open minded in the sense that when I talk to other people or interact with others in my life, whether in school or with other youth, it makes me more like thinking in their shoes. To remember that not everyone thinks the way you do, not everyone has the same experiences or the same support systems that you do.

This broadened awareness also extended to the social and structural determinants of mental health. As one youth described, Agenda Gap helped her to understand and respond to family dynamics impacting her mental health in new ways:

No one talks about intergenerational mental health. And so, if my forefathers or foremothers went through something, now I'm going through and I can approach it differently. Agenda Gap taught me to use that upstream approach... It gave me that proactive way of looking at my mental health, which really helped me break some toxic cycles.

This new way of looking at mental health was further described by other participants who explained that in addition to gaining awareness of the social and structural origins of mental health and illness, their participation in Agenda Gap contributed to a shift from feeling powerless to empowered and more equipped to take action:

... How we could impact as youth, 'cause a lot of youth, myself included, feel like nothing I say really matters cause it's all adults in charge. But actually realizing that we can change things and being able to present to [decision maker in the education system] was very empowering...

This personal growth and desire to become engaged in social and political activities – or civic participation – was shared by other participants, who also described gains in self-efficacy that would help position them for success in this sphere. As one youth shared:

TABLE 4 Constructs of youth participants' positive mental health pre- and post-intervention.

Construct	Pre-intervention			Post-intervention	
	Reliability*	M (SD)	n	M (SD)	n
General self-efficacy	0.65	3.28 (0.28)	17	3.28 (0.25)	15
Civic participation	0.88	3.29 (0.92)	17	3.57 (0.90)	16
Resilience	0.69	2.83 (0.21)	15	2.83 (0.19)	16
Peer attachment	0.58	4.55 (0.50)	17	4.63 (0.44)	17
Adult attachment	0.79	4.00 (0.90)	17	4.43 (0.44)	16
Critical consciousness					
Perceived inequality**	0.97	4.63 (1.27)	17	5.19 (0.92)	17
Egalitarianism	0.77	5.73 (0.42)	17	5.73 (0.47)	14

*Cronbach's Alpha assessed in pre-intervention survey; ** significant at $p < 0.05$.

Learning about all this shows that youth can do it. Like we're not just children that have to abide by the rules. We can be the rule makers or the rule changers. Learning about our rights, learning about our abilities, really boosted my confidence and I'm sure it boosted my group's confidence because we were instantly, like shaped into these leaders... You don't have to be old to be a leader or to create change. You can just voice your opinion and bring forward movements from here.

Overall, there was a strong emphasis and enthusiasm among the youth participants about improvements in their sense of capacity for leading change to strengthen mental health and advance equity for themselves, their peers, and communities.

Implementing learnings in daily life

Many of the participants shared they incorporated the various skills learned and practiced during the Agenda Gap intervention into their everyday lives, with myriad benefits. For example, a number of youth said they developed communication and public speaking skills as a consequence of the interactive and youth-led design of the program. A participant who struggled with confidence in public speaking and asserting their voice before joining Agenda Gap observed, *"I definitely see a lot of changes in my peers. It's the same thing as me – we were all very quiet and then after our participation, we became more competent in speaking."* One youth who led a community dialogue during the program said, *"I didn't know anything about dialogue coming in [to Agenda Gap] and I left with this new perspective on how to lead or hold a conversation in general. I found myself putting those techniques into use in my general life."* She explained that as a result, *"Some pretty hard conversations [outside Agenda Gap] went better than they could have because I used those techniques."* Other youth shared that they experienced a growth in their confidence and communication skills, which in combination with their new and expanded conceptualization of mental health, motivated them to talk about the topic in settings where there had previously been stigma or other barriers, including amongst their friends, families, and sports teams.

Many participants also described adopting self-awareness and emotional regulation techniques that were presented and practiced

during Agenda Gap sessions. Some of the youth were aware of or had tried these strategies in the past, but were skeptical because of previous experiences, found them difficult to do alone, or were unconvinced of their effectiveness. As one youth recounted:

I always used to think like, oh, this [breathing exercise] is useless. Like, why do people do this? But then we actually did it properly. And we did it for multiple sessions. Eventually I got super used to it and I realized how helpful and how good it is...

Benefits of incorporating these strategies were described as including stress reduction, better quality sleep and improved mental health. One youth said:

These activities were like a cherry on top, just to like help me with my personal mental health, especially with those meditation tactics and ways to boost self-confidence and being kind to yourself when you're going through a hard time and [to] not be so harsh with yourself.

Similar to this participant, others also expressed growth in self-compassion as well as expanded personal coping strategies, which they articulated as a key benefit of participation in Agenda Gap.

Experiencing supportive community connections

Mirroring findings from the survey data capturing improvements in peer and adult attachment, youth participants shared that Agenda Gap contributed powerfully protective effects for mental health by engendering a sense of community connection that expanded their networks of social support and inspired further engagement. According to the youth, these community connections were derived from a sense of inclusion, safety, and ownership of the Agenda Gap process. Many participants described the role of safety and non-judgement in supporting them to be open and honest about what they were experiencing. As one participant shared, *"The most important aspect was for me the community that we created, because it was an extremely safe space and everyone could get as honest and just share as much as they wanted to."*

For many participants, it was the first time they had experienced a validating, non-judgmental and empowering space, which inspired

them to share the approach in other contexts. One participant expressed, “there aren’t many spaces where youth voices are valued or, even if they are there, they aren’t accessible for all youth. Not all of us get to participate.... It’s like [typically] reserved to the ‘special youth.’” This sense of safety and validation within the context of strong adult and peer attachment was further attributed by some participants as having a positive impact on their mental health:

It’s the first place where I have adults or other students that I can openly talk to about my experiences or what is happening around us and not have to walk on eggshells, making sure what I said didn’t offend anyone. Because all the time in this group, I felt supported. I felt validated... I didn’t have people who would say these things before.

She went on to say, “having these people, having this space where I can openly talk about it was enough for me. And once I had this, I felt that I was generally becoming happier.”

This sense of being “happier” – a key characteristic of positive mental health – was echoed by several other participants, who articulated the mental health promoting benefits of Agenda Gap participation. Youth participants also shared that their growing sense of connectedness had become a resource that created opportunities to expand their engagement with and support for their community:

I have so many new contacts to talk to about this ‘cause before, it was just me, my therapist, and a few other friends that know a little more about mental health than the rest of the school. Now it’s an entire network of allies. I can literally reach out to any single person I was working with at Agenda Gap and ask them for an idea if I’m doing a fundraiser or I can reach out to one of the school trustees who seemed really eager to help me.

Opportunities for youth and adult allies to engage with one another supported youth to develop and use their voices to advocate for pathways for continued collaboration. According to youth participants, positive experiences with adult allies built trust that their efforts were worthwhile, and along with the confidence generated in the safety of the group, increased their motivation to engage and take action at a variety of levels. One participant articulated this sentiment in sharing:

Because of my participation in Agenda Gap, I felt more motivated to actually go and comment and write stuff down and help out [in school initiatives]. I felt more competent in my knowledge of mental health and confident in my voice and knowing that what I’m sharing will probably get to someone...

These strengthened relationships, and their related impacts, were a central feature of the youth participant interviews and provide nuanced insights into the role that peer and adult attachment plays in positive mental health through pathways of connectedness and belonging.

Family-level impacts: Breaking down barriers to mental health through knowledge sharing

While the youth participants noted a variety of individual-level impacts because of their direct engagement with the intervention,

they also described how their learnings were translating to shifts in their family’s understandings of mental health and related dynamics and were also effective at disrupting entrenched and stigmatized beliefs. For example, one participant who described new confidence in her knowledge and right to voice her perspectives, shared how she was working to change conversations about mental health within her family. She explained, “I feel like I’ve got a lot from Agenda Gap and I guess for me, my parents say, ‘oh, you have good ideas, I like what you shared with us, this really new and interesting!’”

Similarly, another participant demonstrated her growing mental health promotion knowledge and described how she used this to broaden her mother’s understandings of mental health to include an application of the impacts of social and structural determinants:

I tried to explain the idea of intergenerational trauma to [my mom]. And I think she had questions. She didn’t fully understand it. So, I tried my best to answer and she was “oh, that kind of made sense.” Not just that, but she, in fact, made a connection to our country back home. I had never heard a single adult in my life talk about the cycle of poverty. If I can explain this concept and my mom was able to understand it well enough to apply it to another situation that is definitely similar to this one, it’s just, like, whoa! That’s great because it was Agenda Gap. They gave me the tools to articulate my words and helped me explain what I meant.

For other participants, generational norms and stigmatized beliefs about mental ill-health within their family contexts were described as a barrier to their own mental health. Agenda Gap was described as generating new understandings and language to talk about mental health in ways that impacted their family’s knowledge. As one participant explained:

My parents are, I wouldn’t say they’re old, but there’s a generational gap obviously, and they don’t understand [mental health] the way that I do. I don’t expect them to fully understand it because there’s kind of lack of education in their generation. So, I would talk about it... and they’re starting to understand how it really is and how it really isn’t. It’s more than just mental illness, it’s mental wellbeing. I would say they kind of understand it more now than they did before I joined.

Indeed, the positive mental health orientation of mental health promotion was noted by some participants as providing an antidote to pervasive cultural stigma about mental health and illness – creating an entry point and the conditions for productive dialogue that is mental health supporting.

Community-level impacts: De-problematizing youth and strengthening pathways to meaningful engagement

Beyond the individual- and family-level impacts, participation in Agenda Gap also created venues for youth to engage with allied adults and their broader social contexts. In doing so, it provided opportunities for community to observe youth expertise and gain insights about meaningful youth engagement and partnership. Both youth and adult participants indicated that this process shifted, and sometimes overturned, adult assumptions about youths’ capacity to self-determine, voice their experiences, and meaningfully contribute

to initiatives that improve conditions at a community level – a step toward changing the structures that create and maintain health and social inequities. For one healthcare decision maker participant, the experience motivated them to advocate for the meaningful engagement of youth, using a strengths-based approach, in their professional context:

It really turned up the volume on my intention [to be] curious about the youth's experience and being curious about their strengths and really advocating strongly in meetings. I have really kind of recommitted to talking about the youth as doing the very best they can with the tools and structures that they have. How can we change the environment? How can we change their care team?... So that there's more accountability on the adults and less accountability, or not less accountability, but just different accountability, for the youth. [Engaging with Agenda Gap] was just such a good reminder of all the strengths and wisdom that youth bring.

The words of this adult decision maker participant reflect deepened understandings of the critical nature of youth-adult attachment relationships to young peoples' wellbeing and the role that adult allies can play in facilitating meaningful, mental health promoting opportunities. This participant went on to share that their advocacy for youth expertise and engagement extended to the healthcare policy tables they attended:

We've been talking a lot about policy level and program development and starting new teams in my area of practice. And this way of thinking I'd say, has been embedded in all of those. So, in some ways that's a tangible outcome or difference that like, as we're structuring who are we going to hire to build out new teams and how are we going to structure the policies and expectations of how those teams are going to function... I'd say my experience at the Agenda Gap workshop has tangibly informed my approach to those conversations.

A teacher who joined Agenda Gap as an ally relayed that she was approached by a group of youth participants who came equipped to self-direct and advocate for themselves in their initiation of a mental health club at their school. Drawing on their Agenda Gap experience, the youth were able to maintain a strengths-based approach to mental health that ensured the sustainability and positive impact of the club and her involvement:

I was a little bit worried about starting a club. I also didn't want it to be like group therapy. So, I think in seeing these students advocate for themselves... it's allowed me to kind of step back and say, 'okay, you do you, and just kind of ask me what you want from me and I will provide that'. Whereas, I think at the beginning, I was really afraid that it would become – and it has happened in schools and I think this is why the other school had banned it – it can become kind of a negative space where people are reinforcing their own kind of mental health issues. So, I was really happy to see it didn't happen like that.

In this way, the upstream and strengths-based understandings of mental health that youth participants gained through Agenda Gap were being translated to effect change within their broader

social contexts and through their allyships. Youth participants also shared that they observed several other ripple effects – or community impacts. For example, one cohort worked with their teachers to create a presentation to the school district on strengthening its anti-racism policy. News of their efforts broadened support for their initiative and the school supported their request to start a Black, Indigenous, and People of Color (BIPOC) club. One youth related that she received more opportunities to lead events, while another shared that their teachers were more open to changing their instruction processes to support anti-racism objectives:

After our presentations, a lot of our BIPOC teachers talked to other teachers and we also presented to them talking about the curriculum, the removal of the SLO (School Liaison Officer) [role], and how it affected a lot of students at [school]... We talked to the teachers about [engagement with the topic of slavery] and they changed their curriculum and changed their wording on the assignment.

Another cohort directed their advocacy toward the need for spaces to support intergenerational dialogue about mental health to address ongoing stigma in their family and community contexts. These youth hosted a dialogue event by school and health authority decision makers and reported several positive impacts at various levels and across systems. Within the school setting, youth participants shared that teachers were more willing to directly address the topic of mental health. One youth said, “I have teachers talk about mental health a lot. So, I think that's an outcome. They talk about it now in the lesson. They're like, 'If you're struggling, I'm here for you, everyone has this, is struggling with this.'” In one high school, the youth were also invited to provide a series of follow-up dialogues on an ongoing basis. One youth recounted, “One of the district [leaders] who came to our dialogue, he actually proposed the idea of having a dialogue on one of our pro-D (professional development) days.” At the school district level, a youth mental health advisory committee was approved and implemented, led by Agenda Gap youth alumni. Finally, at the broader community level, Agenda Gap youth were invited to deliver a dialogue for professionals involved with youth and youth mental health in their community.

Interest in continuing the Agenda Gap approach was referenced by youth and adult participants within and beyond the school setting, with a youth-serving health agency indicating their intention to continue with the dialogue model initiated by the youth. According to one youth participant:

People are planning to make this not a one-term thing, but to continue implementing this kind of Agenda Gap in school and in the school community, as well. And more teachers are more aware of what the students are doing and they are more inspired of what we do, especially for health workers and social teachers. They are inspired to take this on as a next level.

As this youth participant's words illustrate, there was great interest expressed by both youth and adult ally participants to continue to support and extend the initiatives that began as part of the Agenda Gap process. This bodes well for generating sustainable policy advocacy and change to continue the positive shifts that were initiated by the youth participants. In this way, the Agenda Gap is effectively positioned to continue to facilitate program impacts that

span socioecological domains to strengthen the mental health and wellbeing of other youth and members of their broader communities.

Discussion

Efforts to address and prevent mental ill health among youth have garnered widespread attention and growing investment in recent years, while a focus on strengthening positive mental health and wellbeing – the purview of mental health promotion – has remained more limited. Resultantly, there is a paucity of empirical evidence detailing the potential impacts achieved through adopting and implementing strengths-based and upstream mental health promotion initiatives. Drawing on mixed-methods data, this study offers important insights. Our findings, grounded in youth and adult ally perspectives, illustrate the promise and utility of mental health promotion *via* policy engagement and advocacy for generating positive mental health impacts across socioecological domains.

While further evaluation will be conducted in Phase 2, these Phase 1 findings emphasize the need for expanded investment in mental health programming explicitly guided by mental health promotion theory and principles. Many youth and adult ally participants articulated profound shifts in their understandings of mental health, moving from an illness-oriented, biomedical framing to one that now also includes an appreciation for, and application of, the social and structural determinants. Indeed, it is well recognized that the “drivers” of mental health and illness comprise the “complex interplay between neurobiological and psychosocial systems, risk and protective factors, and mental health systems and service utilization” (37). And yet, there continues to be limited investment in mental health promotion research, practice, and policy (3), effectively perpetuating narrow conceptualizations of mental health and, relatedly, intervention. With Agenda Gap, our study’s qualitative findings suggest that the program’s mental health promotion orientation supported youth to broaden their understandings of mental health and equity, while also contributing to gains in positive mental health for program participants. These expanded understandings of mental health were further accompanied by an appreciation for new opportunities and channels to strengthen mental health outcomes, particularly through policy advocacy. Policy advocacy as mental health intervention is responsive to the social and political nature of mental health and mental health inequities (6). While we are not suggesting that it is the sole means for promoting mental health, policy advocacy is positioned to influence beyond the health sector, to include other spheres shaping mental health and wellbeing, such as education, the environment, housing, justice and welfare (38). In this way, it provides a mechanism through which to create the social and structural conditions conducive to positive mental health. However, as we demonstrate in this study and as Knibbe et al. (39) also note, such policy advocacy ought to reflect diverse voices and expertise and acknowledge “issues of power and responsibility are at play” (p. 437). This is a salient consideration in the context of youth intervention, where power dynamics related to age, along with other social factors, have historically operated to exclude youth from policy and other decision-making processes (40), and where efforts to build skills and capacity remain limited (20).

Relevant in considering the potential impacts of our intervention, youth engagement in social and political life is associated with a number of positive mental health outcomes, including greater peer and adult attachment, higher self-esteem, and stronger sense of identity (33).

Another key finding of this study centered on the opportunities that Agenda Gap created to demonstrate youth citizenship or capacity for “belonging, independence and equality, responsibility and participation, and shared existence and identity” (32). Youth have long been constructed within public discourses as a threat, in need of discipline and maturation before *earning* the right to have their needs heard and valued. As Hart (41) suggests, “This has led to a situation where young people are positioned as the passive recipients of citizenship policy rather than as active citizens in their own right. Indeed, in defining young people as not-yet-citizens they are, in effect, excluded not just from the formal rights of citizenship, but also from being treated with equality in terms of membership in society.” Supporting conditions for youth to voice their needs and influence the contexts and structures that impact their health and wellbeing is an area of growing interest, globally, and one that is enshrined as a basic human right within the Convention on the Rights of the Child (42), to which Canada, the setting for the Agenda Gap intervention, is a signatory (43). Importantly, youth and adult ally participants expressed that Agenda Gap shifted adult perceptions about youths’ capacity for self-determination and citizenship and led to plans for continued engagement in social and political life.

Additionally, our study provides much-needed evidence on the processes and impacts of adopting a socioecological approach to mental health promotion intervention. Much of the mental health promotion literature describes programming targeted at changing intrapersonal behavior (14), though the full potential of this orientation is best achieved by leveraging its socioecological emphasis (44). As youth in our study emphasized, such intervention can benefit when it is responsive to the multi-level social and structural factors shaping access to determinants of good mental health and wellbeing as well as equity. Indeed, without the consistent adoption of a socioecological model, mental health promotion intervention risks operating to maintain the dominant, yet insufficient, conceptualization of wellbeing as an individual-level experience or state of mind, rather than as a collective or socially mediated phenomena (45). This narrower view has fit conveniently within the neoliberal political landscape that has characterized much of North America and Europe for the past several decades, responsibilizing the public for their mental health outcomes, while ignoring issues of inequity and injustice. As Knifton (45) aptly questions, “Why are we getting people to reframe their social situation without changing peoples’ social situations?” Socioecologically oriented mental health promotion holds great promise for disrupting the status quo. We argue that this disruption is overdue and required to advance intervention that is intentionally designed to address the broad spectrum of factors that shape mental health, from individual behaviors and practices through to societal conditions and issues of (in)justice.

While socioecological mental health intervention represents an important path to pursue, it is not without its challenges. It is a complex undertaking and requires thoughtful development of

aligned measures and metrics to monitor effect. This challenge is not unique to mental health promotion. It is a struggle shared by scholars within the broader public and population health field, where demonstrating the impact of community-based, multi-level (particularly structural) intervention is a priority methodological pursuit (46). Moreover, and specific to mental health promotion, many measures of positive mental health and wellbeing remain underdeveloped or un-validated, as was the case with several of the measures adopted for the present study (e.g., peer and adult attachment, civic engagement). An additional challenge with currently available measures of positive mental health is that many do not have sufficient item discrimination, that is, the items are framed in a way that produces little variability in scores across participants (47). This was an issue in our study alongside ceiling effects, wherein the overall group of participants scored high on measures of positive mental health at baseline, leaving little room to demonstrate improvement over time. Despite this, the quantitative results remain useful in providing information on the utility of various scales for future use in Agenda Gap research and evaluation in Phase 2 and beyond, as well as in research on positive mental health more broadly. Indeed, in light of our data, we argue there is a need for further identification, development and validation of scales that exhibit sensitivity and responsiveness to change (48) and can distinguish reliably between higher and lower levels of the underlying positive mental health constructs. Guided by these Phase 1 findings, careful consideration of additional or alternative mental health measures will be trialed alongside future iterations of Agenda Gap.

While this study makes important contributions to guide the science and practice of mental health promotion intervention, there are limitations to acknowledge. The data presented represent the perspectives and experiences of youth from one provincial region of Canada. While these participants were intentionally diverse in their social positions, identities, and lived experiences, future research will benefit from the inclusion of youth from other geographical contexts to confirm the transferability of findings. Furthermore, while we argue that previous research, and our results here, support the notion that youth-led policy engagement and advocacy can yield mental health benefits, we acknowledge that such efforts could take multiple forms. More broadly, while a focus on social justice and addressing health and social inequities through the social determinants of mental health has deep roots in Canadian public health (49), mental health promotion intervention could be informed by theoretical perspectives beyond those adopted and utilized in our intervention. As such, youth cohorts are encouraged to steer each iteration of the intervention and policy foci identified. Furthermore, while efforts were made to involve youth who have previously been excluded from opportunity, including through partnered recruitment methods and the provision of honoraria, barriers to participation likely remain; in some global contexts, for example, there may be risks to youth who engage in policy advocacy. However, we would suggest that such realities ultimately serve as an argument for bringing *greater* focus to interventions that address wider social and structural determinants of mental health.

Additionally, while the mixed methods design of this study provides rich and nuanced insights into participants' perceptions of Agenda Gap impacts, this was a Phase 1, exploratory study and was underpowered to support quantitative analyses beyond those

presented. This was compounded by the presence of ceiling effects for many of the measures used. As Agenda Gap is refined and tested with additional groups of youth in Phase 2 activities, the sample sizes will grow and it is anticipated that this will permit realist analyses to explore the causal mechanisms of program effects, including how these may vary by participant characteristics and context (23).

Mental health promotion – particularly that which adopts a socioecological orientation – holds untapped potential for strengthening positive mental health and wellbeing for youth, as well as their families, communities and society at large. Yet research, policy and practice in this field remains under resourced, with the burden for this work largely falling to individual schools and community organizations. To leverage the full potential of this approach, there is a need for a radical shift in the ways in which mental health is conceptualized (i.e., acknowledging the social and structural origins of mental health and illness, individually and collectively). This must be accompanied by bold actions by government and other decision makers to commit to realizing a population approach to mental health, inclusive of promotion, alongside prevention, treatment and recovery. It will also require ongoing efforts to challenge prominent (problematic) beliefs about youth capacity and to create spaces where their voices and perspectives are actively sought, valued and actioned. Without such efforts, solutions to youth mental health will remain illness-centric and reactionary, failing to progress in attending to the upstream determinants of good mental health and equity.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by the University of British Columbia Behavioural Research Ethics Board (H17-001602). Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

EJ and RH-S led conceptualization of the study. EJ directed project administration, formal analysis, and writing – original draft. LM, ZD, and CR contributed to analysis and writing – original draft. CM, TH, TG, CL, SB, RR, and RH-S contributed to analysis and writing – review and editing of manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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Impact of #PsychTwitter in promoting global psychiatry: A hashtag analysis study

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Introduction: Multiple studies have shown how valuable Twitter hashtags can be for promoting content related to different themes in the online community. This arena has grown into a rich data source for public health observation and understanding key trends in healthcare on a global scale. In the field of mental health in particular, it would be of benefit to understand and report the key stakeholders' (individual mental health professionals, academic organizations and their countries) trends and patterns of psychiatric knowledge and information dissemination using #PsychTwitter.

Objective: In this study, we aim to evaluate the achieved outreach of psychiatry-related tweets using the hashtag #PsychTwitter.

Methods: We utilized the Symplur Signals research analytics tool to characterize tweets containing #PsychTwitter from the 20th of August, 2019, to the 20th of August, 2022.

Results: The #PsychTwitter movement resulted in 125,297 tweets that were shared by 40,058 Twitter users and generated a total of 492,565,230 impressions (views). The three largest identified groups of contributors were Doctors (13.8% of all tweets), Org. Advocacy (6.2% of all tweets), and Researcher/Academic (4% of all tweets) stakeholders. The top influential accounts consisted of 55 psychiatrists and 16 institutional or organizational accounts. The top 5 countries from where most of the tweets containing #PsychTwitter were shared include the United States (54.3% of all users), the United Kingdom (10.4% of all users), Canada (4.9% of all users), India (2% of all users), and Australia (1.8% of all users).

Conclusion: This is the first of its kind study featuring the influence and usage of #PsychTwitter and covering its global impact in the field of psychiatry using the Twitter platform. Our results indicate that Twitter represents a broadly used platform for mental health-related discussions.

KEYWORDS

social media, psychiatry, Twitter, PsychTwitter, hashtag

Introduction

In the past decade, social media has greatly influenced both personal and professional lives (1). Social media apps help doctors to stay updated with the advances in medical science by facilitating easy consultation, collaboration, and communication with et al. from different parts of the world (2, 3). Various social networking sites, such as Facebook, LinkedIn, Twitter, and YouTube, cater to different audiences *via* different approaches, functions, and utilities. The majority of Twitter data is in the public domain. This arena has grown into a rich data source for public health observation and understanding key trends in healthcare communications on a global scale.

Twitter is a free-to-use, open-access social networking and micro-blogging site that allows registered users to post, read and share short messages called tweets. Users can post images, short videos, or website URLs with their followers, while there is 280-character restriction on tweets (up from 140) (4). Twitter utilizes a feature called “hashtag” which enables users to easily connect posts of a specific topic under an “umbrella” designated by a name, such as #PsychTwitter. This hashtag enables users to easily search and filter tweets pertaining to psychiatry on Twitter (5).

Multiple studies have shown how valuable hashtags can be for promoting material related to different themes and events such as disease-specific tweets (6–8), meeting or conference-related content (9–11), and Twitter-based chats and journal clubs (12). Moreover, it is pertinent to mention that academia has widely reported the social media usage trends, the effects of social media use on mental health and well-being, and the possibility to exploit social media’s accessibility and interactive content to improve the delivery of interventions for health and mental healthcare (13). For example, one of the relevant scholarly articles incorporated the use of the keywords “mental health”, “mental illness” and “social media” to evaluate the potential role of social media as an intervention platform for providing support to people with mental disorders and strengthening current mental health services (13). Another study reported the trends of social media usage among physicians, whereby 65% of the physicians reported using the space for personal and professional purposes (14). However, both of the mentioned important studies did not study the role or usage trends of Twitter by mental health professionals using global psychiatric discussion spaces on Twitter using #PsychTwitter, and up to know the usage of this hashtag has not been a subject to detailed longitudinal analysis.

As evident from the COVID-19 infodemic parallel pandemic, it is an established that social media can greatly influence the decision-making power of the general population when it comes to scientific information dissemination (15). In this context, it is especially important to analyze and report this area of the global psychiatry-related discussions. Furthermore, there is a knowledge gap who uses that kind of social media space, especially in regard of Twitter users disseminating information using #PsychTwitter. In this study, we aim to evaluate the achieved outreach (defined as the act of engaging of the Twitter community, measured by engagement metrics like the number of impressions and tweets, which were used as the key performance indicators) of psychiatry-related tweets using the hashtag #PsychTwitter.

Methods

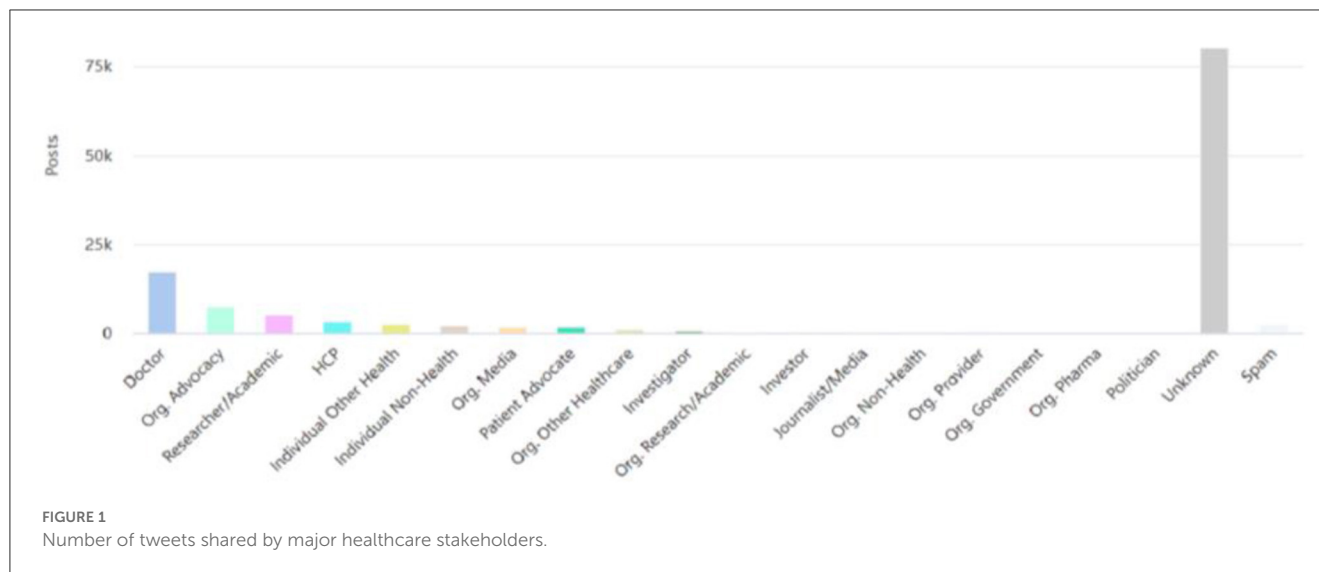
Hashtag development and outreach

This study observed the growth of #PsychTwitter over a 3-year period, ranging from the 20th of August, 2019, to the 20th of August, 2022. The initial registration of #PsychTwitter was established as part of the Symplur healthcare hashtag project (16). The nature of this hashtag was predominantly aimed at connecting psychiatry and the wider mental health community through posts in the form of “tweets” on topics of education, research, resources, events, or opportunities associated with advancing mental healthcare. Other forms of hashtag engagement included retweeting content, commenting on tweets, and community participation in live discussions. A Twitter list was also identified as part of promoting #PsychTwitter, which included 46 members and 550 follower accounts of individuals and organizations which were focused on actively sharing content related to psychiatry and mental health, thus amplifying the hashtag visibility (17).

Data extraction and analysis

We utilized the Symplur Signals research analytics tool to characterize of tweets containing #PsychTwitter from the 20th of August, 2019, to the 20th of August, 2022.

Symplur Signals is a comprehensive hashtag analysis tool that enables long-term tracking of tweets that contain focused hashtags pre-registered with the Symplur healthcare hashtag project (16). The analysis conducted with Symplur Signals evaluated the total number of tweets (including retweets), impressions (i.e., views of tweets), and unique users disseminating tweets containing #PsychTwitter (including user categorization to specific healthcare stakeholder groups). All tweets containing the hashtag #PsychTwitter were analyzed with Symplur Signals, without any restrictions on language, location of users, or other parameters. The most shared tweet, article, poll, image, and video clip were also identified. The collective data was then extracted to Microsoft Excel for final interpretation. Primary outcome measures for the achieved outreach (defined as the act of reaching out to the Twitter community) and awareness (defined as bringing relevant information and knowledge to the Twitter community) were the number of tweets and impressions. Furthermore, this analysis also included parameters such as the content of these tweets (e.g., links, mentions of other accounts, images), major influencers, tweet languages, sentiment analysis, and geolocation trends. The Healthcare Social Graph Score is determined by tracking over 35,000 healthcare topics in real-time on Twitter. Based on the tracking, a top impact profile list for the past year for each of the 35,000 topics is generated. The rankings are created using the impact algorithm SymplurRank. In addition to these rankings, Symplur also measures the quality of the conversations for every topic each week. This conversation quality score is then factored with conversation volume to provide a weighted measure for the impact scores. Finally, the 52 weekly rankings and quality scores are combined into a single number for each social media profile



and then normalized on a scale of 0 to 100. This final number is known as the Healthcare Social Graph Score (18, 19).

Additionally, the SymplurRank algorithm was used to measure the influence of specific accounts and the importance of the content that they share for selected datasets and parameters. The algorithm ranks influential accounts by measuring the number of quality mentions received, whereby the quality of a mention is determined by the account that gave the mention, and the influencer account's individual impact on the topic along with its healthcare stakeholder status (20). In order to retrieve the individual characteristics of these influential accounts, we evaluated their Twitter biographies and practice or institutional websites. This was accomplished by manually reviewing the list of influencers by visiting their Twitter profile and extracting details on gender, profession, and type of account created (institutional account/personal account) for further analysis.

Since commercial software (Symplur Signals) was used to perform the analysis, further details about the specific statistical techniques used by Symplur to generate several of the variables quantified (e.g., influencers, sentiment scores, user categories etc.) are not available.

Ethical approval and informed consent

This study is exempted from research ethics review since it is based on pre-existing publicly available data and did not involve the prospective collection of data from human participants. All presented data are anonymized and the study does not state any information related to specific Twitter user accounts.

Results

Across a 3-year period of hashtag analysis, the #PsychTwitter movement resulted in 125,297 tweets (including 75,548 retweets) that were shared by 40,058 Twitter users and generated a total of 492,565,230 impressions (views). Accounting for the percentage

TABLE 1 Regional popularity of #PsychTwitter.

Sr No.	Country	Users	Percentage (%)
1	United States of America	21,735	54.3
2	United Kingdom	4,158	10.4
3	Canada	1,961	4.9
4	India	796	2
5	Australia	741	1.8

distribution of #PsychTwitter-posting users in various healthcare stakeholders categories (data derived from Symplur Signals, with the classification being based on information provided in the Twitter biographies of the users), the three largest identified groups of contributors were Doctors (13.8% of all tweets), Org. Advocacy (6.2% of all tweets), and Researcher/Academic (4% of all tweets) stakeholders. The complete distribution of the 20 identified categories is depicted in Figure 1 (note: 65.1% of the tweets were from accounts that did not provide sufficient information to be categorized, and were labeled as "Unknown").

The top 5 countries from where most of the tweets containing #PsychTwitter were shared (based on the locations at which the posting accounts were registered) include the United States (54.3% of all users), the United Kingdom (10.4% of all users), Canada (4.9% of all users), India (2% of all users), and Australia (1.8% of all users). Table 1 represents the regional ranking of users that tweeted using #PsychTwitter.

The most commonly co-occurring hashtags with #PsychTwitter include #MedTwitter, #MentalHealth, #Psychiatry, and #MedEd. The top 100 influencer accounts were analyzed according to the SymplurRank algorithm in relation to their impact using #PsychTwitter. According to the algorithm, the top #PsychTwitter influencer accounts consisted of 55 psychiatrists and 16 institutional or organizational accounts. The remaining accounts included those of psychologists, psychiatry educational

communities, journals, and trainees in psychiatry. Among the top 100 accounts, 31 consisted of female psychiatrists and 24 were male psychiatrists. Interestingly, all of the top 20 psychiatrists (with Symplur Rank ranging from 100 to 43.69) using #PsychTwitter were based in the USA, with one single exception (one was based in Canada instead).

Sentiment analysis of the relevant tweets shared in the study period was also performed with Symplur Signals and revealed an average of 53.9% positive and 46.1% negative sentiment. Qualitative evaluation of the positive-sentiment tweets revealed that they often expressed gratitude (“thank you”, “gratitude”, “thanks to some great mentors”, “many thanks”, “gracias”, etc.), wishing all best (“my best to you all”, “wish you a joyful day”, “wish you all a blessed day”, “wish you all a wonderful weekend”, “wish you all a beautiful day”, etc.), and appreciation (“so awesome”, “amazing”, “so welcoming”, “source of joy”, “really amazed”, etc.) while negative-sentiment tweets often referred to diseases or health conditions (“mental illness”, “severe depression”, “pandemic”, “mental health problems”, “depression”, etc.), harmful actions (“self-harm”, “abused”, “abandoned”, “harm”, “stigmatized”, etc.), negative mental states (“grief”, “psychological pain”, “mourning”, “shame”, “pain”, etc.), and end of life (“suicide”, “death”, “American suicides”, “suicide attempts”, “risk of suicide”, etc.).

The tweet that induced most engagements (371 engagements) was a call from a medical doctor encouraging physicians to invest more efforts to understand specific patients illnesses in order to achieve superior treatments. The most shared article (posted 163 times) was a 2020 study published in *Pediatrics* entitled “Pubertal Suppression for Transgender Youth and Risk of Suicidal Ideation” (21). Meanwhile, the Twitter poll that received most votes (219 votes) was posted by psychiatrist who asked the users if they have ever heard someone to equate diverse representation with lack of merit. The most shared visual (image; 522 shares) was the cover-page of the “Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-5-TR)”, by American Psychiatric Association Publishing (22). Concerning the most shared video clip (200 shares), it represented a call by German and Austrian physicians and patients for more research to be conducted on myalgic encephalomyelitis/chronic fatigue syndrome.

The top 3 institutional or organizational accounts included the American Psychiatric Association, the American Academy of Child and Adolescent Psychiatry, and the Association of Directors of Medical Student Education in Psychiatry.

Discussion

We carried out a three-year longitudinal examination of the activity, users, and content associated with #PsychTwitter from the 20th of August 2019 to the 20th of August 2022; using the Symplur Signals hashtag analytics tool. The cumulative use of #PsychTwitter yielded 125,297 tweets that were shared by 40,058 Twitter users and generated a total of 492,565,230 impressions (views) from different geographical locations. The majority of users only sent one English-language tweet throughout this time. To make tweets easier to comprehend, links, mentions of other accounts, and graphics were frequently added. The vast majority of assembled content that includes references to other accounts and connections to external

sources served as proof of the knowledge-sharing that occurred during this campaign. Current techniques for social media analysis such as data mining and sentiment analysis have shown promising use-cases for research. Despite the early stage of positive outcomes, a number of challenges remain unaddressed in this context. Common issues with data mining include extracting and filtering through large quantities for data, which is often dynamic and complex in nature. The dynamic nature of data mining on social media includes both structured (texts) and unstructured (images, videos, live events) forms of communication across a variety of social media platforms (23). Furthermore, sentimental analysis relies on emotion detection between overlapping content shared online, which can be challenging due to difficulty in detection of sarcastic terms, negation handling, spam accounts postings, and lack of training data sets for machine learning algorithms analyzing non-English content (24). Healthcare data on social media adds to an additional layer of specificity which was seen for example in a study by Salud et al. that found challenges with supervised learning and lexicon-based sentimental analysis in analyzing content on drug-based reviews by patient communities that often incorporate complex medical terminologies, as compared to analyzing physician-reviews online that used relatively simpler terms online (25). This highlights the need for developing specialized sentiment analysis tools that are focused on detecting medical terminologies on social media in order to avoid gaps in data consistency and completeness of research. The top twenty influencers were analyzed according to SymplurRank, Healthcare Social Graph Score, number of mentions, number of shared tweets containing #PsychTwitter, and a total number of generated impressions (views) of the respective tweets. As depicted in Figure 1 majority of the tweets using #PsychTwitter were posted by doctors followed by advocacy organizations and researchers. There has been an increase in the trend of using Twitter as an active platform to create awareness and disseminate information about various conditions in the psychiatric field. Notably, “Patient Advocate” was the eight most prevalent stakeholder-group that shared #PsychTwitter containing tweets, and it is a reasonable assumption that this group might contain some users who are current or former patients or patient relatives who are qualified to bring into the discussion unique patient-derived perspectives.

There has been active evidencereporting since 2014, that examines the discourse of psychiatry on Twitter (26). Literature shows social media microblogging sites like Twitter have played an important role in highlighting mental health conditions. The general Twitter users concentrated on a small number of phrases related to psychiatric disorders like autism, schizophrenia, and depression. The hashtag #MDLL (#mydepressionlookslike) was created by Lachmar et al. that analyzed 3,225 tweets to highlight themes that come up frequently when people on Twitter discuss depression ranging from dysfunctional thoughts to the impact on social life and social support-seeking behaviors (27). Reavley et al. analyzed tweets posted in the English language that discussed the topics of schizophrenia and depression (28). Using the hashtags #schizophrenia and #depression, the studies explored patterns associated with the inclusion of these hashtags in research.

This project further explores the demographical variations associated with #PsychTwitter users in regard to various aspects, such as gender, an individual vs. an organization,

and psychiatric/academic background. United States (54.3% of all users)-based #PsychTwitter users were among the top accounts using the hashtag, followed by the United Kingdom (10.4% of all users), Canada (4.9% of all users), India (2% of all users), and Australia (1.8% of all users) to make the top five countries. It has been reported that physicians across the United States advocate actively on social media about various health promotion campaigns (29). During the course of the 5-year period, the number of physicians in the United States using Twitter has more than doubled (up by 112%) (29). The most popular topics included general health, medical education, and mental health during the examined period. It is noteworthy to mention that India is the only developing country in the top identified regions, possibly due to increased social media awareness and accessibility in the general population and psychiatrists. The past few years have seen an increase in the trend of internet access to social media usage by low and middle-income countries (30). Recent data shows that the United States tops the Twitter user number 76.9 million people followed by India at 23.6 million active Twitter users (31).

The data reports that top #PsychTwitter influencer accounts are dominated by psychiatrists because they are the core of the #PsychTwitter community. However, Udayakumar et al. analyzed previously the demographics of Twitter users in the field of psychology and reported that 31.4% of the accounts that used psychology terms belonged to the field of academia with only 16.5% having filed expert background (32). A recent study shows that 87.9% of the healthcare providers who participated in the study denoted that they use social media and encouraged their patients to research clinical conditions on social media (33). It is important to mention that the healthcare workers who advocated the use of social media were under 40 years of age. Furthermore, research indicates that 41% of American healthcare consumers used social media to select their healthcare providers (34). Additionally, 26% of American hospitals presently use social media in some capacity (35). Healthcare providers reported that social networking has given healthcare professionals a tool to overcome obstacles in patient care delivery.

If we analyze the #PsychTwitter algorithm through the gender lens among the top 100 accounts, 31 belonged to female psychiatrists as compared to the 24 male psychiatrists' accounts. The observed gender ratio is different compare with the data of Udayakumar et al. that showed 56% of males posted psychology-related tweets as compared to 37.5% of female users (32). When we looked into the types of the top 3 institutional or organizational accounts, the American Psychiatric Association, the American Academy of Child and Adolescent Psychiatry, and the Association of Directors of Medical Student Education in Psychiatry were among the #PsychTwitter most often posting accounts. Literature suggested that social media is one of the reliable methods to design, collect, implement and get feedback for advocacy works and physician-patient two-way communication (36). The above-mentioned analysis shows the influence of advocacy and mental health awareness that is bringing together different influencers engaging on Twitter between themselves and with organizational accounts in the psychiatry community by using #PsychTwitter. It brings together different influencers engaging on Twitter between themselves and with organizational accounts. In a similar line of

communication, Twitter public policy team launched a campaign in 2020 amid COVID-19 pandemic in collaboration with 60 mental health partners (37). The campaign tagline was quoted 170,000 times engaging more than half a million users and 70 global mental health organizations by using #MentalHealthAwareness, #LetsTalk, and #TogetherWeCan. However, this campaign did not report the specific mention and usage of #PsychTwitter.

Limitations and future research

This study is subject to a number of limitations regarding the methods and the extent of the analysis. The general challenge of detecting emotional contexts of social media content shared is pertinent to this study as well. Thus, despite the significance of emotion detection in the mental health field, the sentiment analysis performed within this study is limited in assessing the complete spectrum of emotional states, as well as might not well reflect the complex medical terminologies shared within the psychiatry community. Furthermore, tweets shared from spam accounts may have had some influence on quantified the impacts (likes, comments, retweets) of this hashtag, despite the comparably small share of spam accounts identified (Figure 1). Envisaging the limited information provided in biographies of Twitter users, some important demographic data (e.g., gender and age) could not be analyzed. Previous studies have investigated different fields of biomedical science and practice on social media by analyzing the entire content of one or more social media platforms for a number of keywords associated with the topic under question. For instance, a study by Sahu et al. (38) explored the hashtag #Orthotwitter together with tweets including terms such as orthopedic surgery or orthopedics. Considering that tweets related to psychiatry and mental health did not necessarily use the hashtag #PsychTwitter, it is possible that content relevant to the subject of the search remained unidentified (10). This challenge also limits the identification of non-English content shared within the online mental health community, providing that respective tweets did not include #PsychTwitter.

At a broader level, a study by Kawchuk et al. (39) analyzed misinformation related to the effects of chiropractic manipulation on immunity by means of a social media searching software. Studies with a broader scope than a particular hashtag were, hence, more likely to capture the entire spectrum of content related to the field under investigation. Notwithstanding this limitation, the orientation of the present study toward the hashtag #PsychTwitter is in line with emerging knowledge about the role that Twitter hashtags can play in sharing resources and spreading awareness among healthcare professionals (40, 41). Similarly, the study examined Twitter only, although hashtags are also used on other popular social media platforms such as Facebook (Meta) and Instagram. Theoretically, this constitutes an additional limitation to the content that was subjected to further analysis, since Twitter users familiar with #PsychTwitter may reshare their tweets on other platforms. Nonetheless, the use of a hashtag containing the term "Twitter" is less likely to happen intentionally on social media platforms other than Twitter. Moreover, narrowing the present study down to Twitter enabled the authors to weigh

on previous studies describing the particular features of Twitter interactions in biomedical discourse. This includes the active representation of biomedical journals and publishers apart from individual researchers and physicians and the rising awareness of Twitter-specific metrics of awareness and activities among the biomedical community (42, 43). It is worth noting that, although Symplur Signals has been extensively used for analyzing the impact of hashtags among social media communities, to our knowledge, no peer-reviewed study has been conducted to assess the validity of Symplur Signals techniques for content analysis. This adds as a limitation to our study with regards to handling of missing data and relying on proprietary algorithms that are unvalidated externally. Future studies should explore the use of such platforms as standardized tools for hashtag analysis. The scope of this study was also limited by barriers with transparency in obtaining data through the Symplur Signals platform, which does not elaborate on the statistical techniques used for content analysis. Future studies should also take into account the limitation of social metrics such as tweets and impressions not entirely reflecting the discussions, level of understanding of participants and “readability” of tweets by users. This may lead to over-reporting of data results if not accounted.

Future research can contribute to tackling the aforementioned obstacles and strengthening the understanding of online discourse. Within Twitter, it would be interesting to position the analysis of #PsychTwitter in the broader image of psychiatry and mental health content in the same medium. Comparing the outreach and the awareness achieved by tweets containing the hashtag and tweets not containing it can provide more evidence regarding the influence of hashtags. If hashtags prove more influential than general, unlabeled content on the matter, health promoters in the field can be recommended to include the use of #PsychTwitter and its co-occurring hashtags in their outreach strategies. Furthermore, numerous entities and individuals maintain a presence on more than one social media platform. Therefore, it is important to examine whether the same or similar hashtags and subsequent communities have been established on different social media platforms. Comparing the audience and the outreach of each of them could determine which medium is more suitable for communication between peers and for raising awareness among the public.

Conclusion

This is the first of its kind study featuring the influence and usage of #PsychTwitter and covering its global impact in

the field of psychiatry that allowed the assessment of a large sample of tweets and views (impressions) over a 3-year period for longitudinal analysis. Our conclusions emphasize the importance of professional voices in the exchange of accurate healthcare information during the recent COVID-19 pandemic. Our results indicate that social media microblogging sites like Twitter are broadly used for mental health-related discussions. In addition, it is necessary for future research to develop knowledge with a focus on the deeper and wider context of psychiatric diagnosis, care plans, and pathways that could be collected through online data. Special attention should be given to the topic and content of hashtag exchange in order to evaluate the impact of misinformation related to mental health on social media platforms.

Data availability statement

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

Author contributions

FN, MR, CT, UF, and NK prepared the first draft of this manuscript. AA analyzed results. FN, MR, CT, UF, EK, MK-P, OK, HW, MS, NK, and AA reviewed, edited, and approved the final manuscript. All authors contributed to the article and approved the submitted version.

Conflict of interest

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

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The associations between body dissatisfaction, exercise intensity, sleep quality, and depression in university students in southern China

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Background: In recent years, depression in early adulthood has become an urgent global public health concern. The university years mark a transitional period from adolescence to adulthood. Young people are required to face academic and life pressures independently, which increases the risk of mental health problems in university.

Purpose: The main goal of the current study was to explore the sex differences in depression, body dissatisfaction, sleep quality, and exercise intensity among university students in southern China and to analyze the factors affecting the level of depression among university students.

Methods: In total, 1,258 university students aged 18–23 years were recruited for this study. All participants completed anthropometric measurements, the Self-rating Depression Scale, Physical Activity Rating Scale, and Pittsburgh Sleep Quality Index. Body dissatisfaction levels were measured using sex-appropriate silhouettes.

Results: Compared with young women, young men had higher exercise intensity and sleep quality, whereas young women's body dissatisfaction and depression levels were significantly higher than those of young men. Sleep quality score ($\beta=0.34$, $p<0.01$), sex ($\beta=0.15$, $p<0.01$), physical activity score ($\beta=-0.14$, $p<0.01$), and body dissatisfaction ($\beta=0.14$, $p<0.01$) were significant predictive factors of the Self-rating Depression Scale score.

Conclusion: Low levels of physical dissatisfaction have a positive effect on depression, and high levels of physical activity and quality sleep can also improve depressive symptoms. At the same time, increasing body satisfaction has the effect of increasing physical activity and improving sleep quality. Therefore, there is great potential to prevent and ameliorate depression by reducing body dissatisfaction.

KEYWORDS

depression, body dissatisfaction, exercise intensity, sleep quality, young people, southern China

1. Introduction

As of 2018, the number of people with depression worldwide had reached 322 million (1). By 2030, depression will become one of the world's most burdensome diseases (2). In China, 130 million adults suffer from mental illness each year on average (1). Depression is one of the most prevalent mental health disorders and can cause anxiety, sleep disturbances, and other adverse consequences. People with major depression sometimes show suicidal behavior (3).

Sleep disturbance is considered one of the most common symptoms of adolescent depression (4). Recent studies have found that sleep disturbance is also an important factor leading to the occurrence and existence of depression (5, 6). At present, the main methods for improving sleep are drugs and behavioral therapy. Because of the risk of dependence and tolerability, more patients are willing to choose non-drug therapy (7). Results of a meta-analysis of 49 ($n=5,908$ subjects) non-pharmacological sleep intervention trials showed that treatment of sleep problems significantly reduced depressive symptoms (8). However, methods of treating insomnia, such as cognitive behavioral therapy, cannot be widely used to prevent and improve insomnia because they require the assistance of trained practitioners (9). Therefore, it is important to explore how to further improve sleep quality.

In addition, some studies have shown that exercise can positively affect mental health by reducing stress hormone levels (10). However, insufficient physical activity among adults is a serious problem. Based on a pooled analysis of 1.9 million respondents worldwide, 25% of adults fail to achieve adequate levels of physical activity (11). Studies have shown that only 10% of Chinese adults regularly perform physical exercise (12). Low physical activity level may be an important reason for the high incidence of psychological problems among adults (13–15).

Body image is defined as an individual's perception of one's own appearance and is mapped in the brain (16). It is thought to be linked to self-knowledge, self-attitudes, beliefs, thoughts, emotions, and behaviors (17). Body image can be explained as one's mental image of the body and feeling of body shape (18). When there is a difference between the actual body and idealized body, people are dissatisfied with their body shape. Body dissatisfaction is widespread among children and adults; however, the widespread problem of body dissatisfaction has not received enough attention (19). Few studies have examined the relationship between body dissatisfaction and depression among university students.

The university years mark a transitional period from adolescence to adulthood. Young people are required to face academic and life pressures independently, which increases the risk of mental health problems in university (20). University students are more likely to develop mental disorders than other age groups (21). In a meta-analysis of 24 papers published between 1990 and 2010, which surveyed more than 10 countries and regions including the United States, Canada, China, and South Korea, the authors speculated that the average prevalence of mental disorders among university students worldwide reached 30.6% (22). In recent years, there have been many reports in different countries regarding the high incidence of depression among university students. A 3-year survey in a university in the United States showed that 29.6% of the university students suffered from mild depression and 6.6% suffered from major

depression (23). It has been reported that British university students suffer from a high rate of depression (24). In Northern Ireland, the reported incidence of major depressive disorder was 24% and that of general anxiety disorder was 23%; 31% of the participants had thoughts of suicide, and 1 in 5 had made suicide plans (3). It is estimated that the prevalence of depression among university students in China is 23.8% (25). Therefore, improving depression status in early adulthood has become an urgent global public health issue. The main goal of the current study is to investigate sex differences in depression, body dissatisfaction, sleep, and exercise among university students in southern China and to analyze the body dissatisfaction affecting the level of depression among university students.

2. Materials and methods

2.1. Participants

We selected a comprehensive university in Ganzhou, Jiangxi Province, China. Participant recruitment information was disseminated on campus through posters put up in front of the dormitory building and leaflets distributed in study rooms. We recruited a total of 1,258 university students aged 18–23 years (men: 630; women: 628), who voluntarily signed and submitted their consent to be research subjects. The investigation period was from September to December, 2021.

2.2. Measurements

A portable stadiometer (Seca 213) with an accuracy of 0.1 cm was used to measure height. Weight (0.1 kg precision), muscle mass (0.1 kg precision), and fat percentage were measured using a body composition meter (BC 601, Tanita). Body mass index (BMI) was calculated as $\text{weight}/\text{height}^2$ (kg/m^2).

2.3. Body image

Body dissatisfaction levels were measured using a Stunkard visual graph table (26). The scale is based on a 9-point scale, with 1–9 representing body types for each sex and values ranging from the lowest (1) indicating a “very thin” body type to the highest (9) indicating a “very fat” body type. University students were asked to choose between what they considered their “current body type” and their “ideal body type.” The body dissatisfaction level represents the difference between current and ideal bodies and does not pertain to the preference for fat or thin.

2.4. Self-rating depression scale

The Self-rating Depression Scale (SDS) was used to measure the depression levels of the university students (27). It contains 20 items and is divided into four grades. The standard score is obtained by multiplying the sum of each individual score by 1.25; the higher the standard score, the more severe the depressive symptoms.

2.5. Physical activity rating scale

We used the Physical Activity Rating Scale (PARS-3) to evaluate the athletic level of the university students (28). The scale examines exercise with regard to three items: intensity, time, and frequency of exercise, and points ranging from 1 to 5 are assigned for each item. The formula for calculating the total exercise score is $\text{intensity} \times (\text{time} - 1) \times \text{frequency}$, and the result ranges from 0 to 100 points; the higher the score, the higher is the exercise intensity.

2.6. Sleep status scale

We measured sleep quality using the Pittsburgh Sleep Quality Index (PSQI), a 19-item scale. This scale can be used to assess sleep quality in the past month and contains seven component scores: sleep latency, sleep duration, sleep disturbance, daytime dysfunction, habitual sleep efficiency, sleep medication, and overall sleep quality (29). The PSQI score is a combination of these seven components, with higher scores indicating poorer sleep quality.

2.7. Sociodemographic characteristics

Data on the age, sex, and monthly cost of living of the university students were collected through a questionnaire.

2.8. Statistical methods

We used the independent sample *t*-test to verify BMI, body fat percentage, muscle mass, depression score, sleep quality score, exercise intensity score, and sex differences in the level of body dissatisfaction. Multiple regression analysis was performed with depression scores and body dissatisfaction as dependent variables. When the depression score was used as the dependent variable, sex, age, muscle mass, BMI, monthly cost of living, exercise intensity score, sleep quality score, and body dissatisfaction level were used as predictor variables. When the level of body dissatisfaction was used as the dependent variable, sex, age, muscle mass, BMI, monthly living expenses, exercise intensity score, and sleep quality score were used as predictor variables. Variables were selected according to the stepwise increase and decrease method, and we used the likelihood ratio test method to calculate and set the threshold *p*-value as 0.20. $p < 0.05$ was considered statistically significant. We used JMP 20.0J (SAS Institute Inc., Cary, NC) for all statistical analyses and processing.

2.9. Ethics approval and consent to participate

Complete research objectives and survey contents were explained to the participants. All participants provided written informed consent, agreeing to the required measurement and survey completion procedures. Ethical approval for the study was granted by the Gannan Medical University, China, No: 2021110.

3. Results

Table 1 lists the characteristics of the research subjects. Men had higher BMI and muscle mass than women, while women's body fat percentage was significantly higher than that of men ($p < 0.05$). There were sex differences in depression, sleep, and exercise scores (Table 1). Women had significantly higher average depression and sleep scores than men (Table 1). Men scored significantly higher than women in terms of physical activity (Table 1). Simultaneously, the level of body dissatisfaction in women in each body type group was significantly higher than that in men (Figure 1).

Table 2 shows the results for multiple regression analysis of the factors contributing to the SDS score. Sleep quality score ($\beta = 0.34$, $p < 0.01$), sex ($\beta = 0.15$, $p < 0.01$), physical activity score ($\beta = -0.14$, $p < 0.01$), and body dissatisfaction ($\beta = 0.14$, $p < 0.01$) were significant predictive factors of the SDS score.

The influencing factors of body dissatisfaction obtained through multiple regression analysis are shown in Table 3. BMI ($\beta = 0.30$, $p < 0.01$), sex ($\beta = 0.21$, $p < 0.01$), sleep quality score ($\beta = 0.19$, $p < 0.01$), physical activity score ($\beta = 0.09$, $p < 0.05$), and muscle mass ($\beta = 0.09$, $p < 0.05$) were significant predictors of body dissatisfaction.

4. Discussion

In recent years, researchers have shown increasing interest in the effects of body image on depression in university students. A study of 160 Hispanic university students showed that the higher the level of body dissatisfaction, the higher was the degree of depression (30). A study in China on 13,046 university students from 17 universities in different regions across the country showed that self-body awareness in early adulthood has been linked to the development of depression (31). The results of our study showed that higher levels of body dissatisfaction were associated with higher levels of depression, supporting the findings of a previous study (Table 2). However, it is worth mentioning that the impact of body dissatisfaction on depression may have been underestimated. The results obtained from the preliminary analysis showed that body dissatisfaction had a less direct effect on depression than exercise and sleep (Table 2). However, an increased level of body dissatisfaction may simultaneously reduce the level of exercise, increase the sleep quality score, and indirectly affect the development of depression (Tables 2, 3).

TABLE 1 Sample characteristics ($n=1,258$).

	Mean \pm SD		<i>p</i>
	Male ($n=630$)	Female ($n=628$)	
BMI (kg/m ²)	22.1 \pm 3.7	21.2 \pm 3.1	<0.01
Fat%	16.1 \pm 7.2	27.3 \pm 6.6	<0.01
Muscle mass (g)	50.4 \pm 8.3	35.9 \pm 4.7	<0.01
SDS score	45.2 \pm 9.8	50.3 \pm 8.9	<0.01
Sleep quality score	16.6 \pm 2.5	17.0 \pm 2.4	<0.05
Physical activity score	21.5 \pm 20.5	12.5 \pm 15.4	<0.01
Body dissatisfaction	1.65 \pm 1.4	2.71 \pm 1.3	<0.01

BMI, body mass index; SDS, Self-rating Depression Scale. The significance of differences between male and female students was determined by *t*-test.

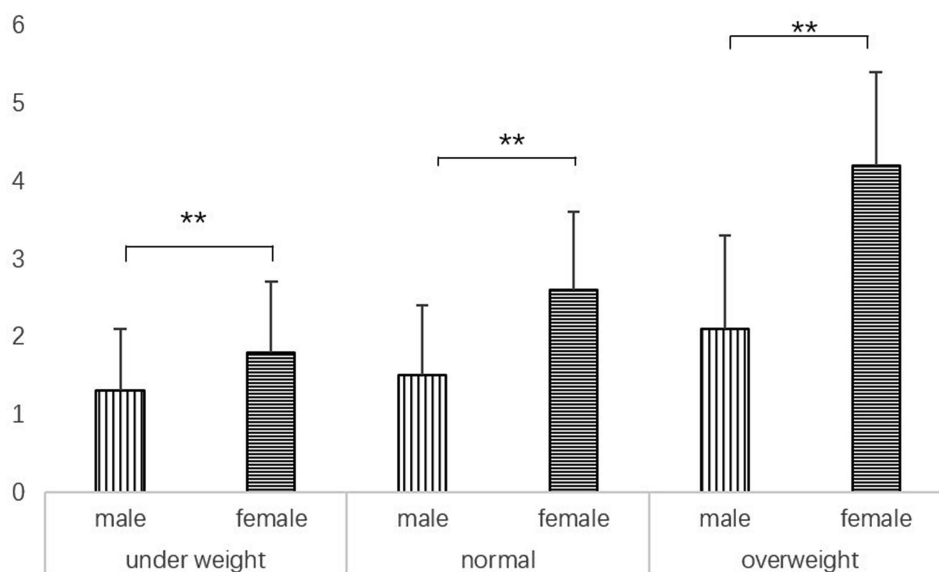


FIGURE 1

Sex difference of body satisfaction level in college students with different body shapes. ***t*-test, $p < 0.01$.

TABLE 2 Factors that contributed to depression level of university students.

	β	t	VIF	p
Sleep quality score	0.34	13.48	1.05	<0.01
Sex	0.15	5.59	1.22	<0.01
Physical activity score	-0.14	-5.41	1.11	<0.01
Body dissatisfaction	0.14	4.91	1.29	<0.01

R^2 : 0.25; $p < 0.01$; RMES: 6.74.

TABLE 3 Factors that contributed to body dissatisfaction of university students.

	β	t	VIF	p
BMI	0.41	15.45	1.41	<0.01
Sex	0.35	10.08	2.42	<0.01
Sleep quality score	0.16	6.99	1.01	<0.01
Physical activity score	-0.14	-6.17	1.08	<0.01
Muscle mass	-0.08	2.00	2.96	<0.05

R^2 : 0.37; $p < 0.01$; RMES: 1.05.

Prior studies have showed that, among university students, women have higher rates of depression than men. A survey of 286 university students in the United Kingdom revealed a greater risk of depression among women than among men (32). Another survey of 5,989 university students in China showed that the prevalence of depression was higher among women. Our findings are consistent with those of previous studies. The results of the preliminary analysis showed that women had significantly higher depression scores than men (Table 1). The results of this study also show that high body dissatisfaction, low exercise levels, and low sleep quality may lead to depression (Table 2). The low exercise level, sleep quality, and high

body dissatisfaction among young women may be important reasons for the high level of depression in women compared to that in men (Tables 1, 2). Body dissatisfaction may also adversely affect exercise level and sleep quality (Table 3). The results of this study highlight that body dissatisfaction may be an important reason for sex differences in depression levels (Tables 2, 3; Figure 1).

Previous studies have shown that regular and moderate physical activity has strong antidepressant effects (33, 34). Additionally, high-intensity exercise improves depression (35). Comparison of the present findings with those of other studies confirms that higher exercise scores among university students in southern China were associated with lower levels of depression (Table 2). Therefore, improving the sports skills of university students is particularly important. For a long time, some researchers tried to develop sports habits and improve participants' exercise level through exercise interventions, but the effect was limited or unsustainable (36, 37). A note of caution is due here because of the limitation of this simple intervention.

The results of our study indicate that the lower the level of body dissatisfaction among university students, the higher their exercise score (Table 3). Body dissatisfaction is considered an important factor affecting university students' sports levels. This is consistent with our earlier observations, which showed that if university students are dissatisfied with their body shape, they are less likely to participate in sports (38). University students with a higher degree of body dissatisfaction are more likely to feel embarrassed by outdoor sports (38). They try to reduce outdoor activities as much as possible to avoid being perceived as unattractive (38). Because high exercise levels are a preventative factor for depression (Table 2), improving the level of body satisfaction of university students can increase their exercise level and improve their depression state.

Sleep quality is thought to have an important impact on mental health. A study of 29,099 Chinese university students showed that insomnia is a major risk factor for depression in both sexes (21).

According to the results of the preliminary analysis, the lower the sleep quality of university students in southern China, the higher the depression level (Table 2), which supports the results of a previous study. Research has shown that sleep has a lasting negative effect on mental health (39). It is difficult to improve sleep quality with psychotherapy for depression. A study of 465 adolescents in the United Kingdom showed that psychotherapy improved depression but caused limited improvement in sleep quality (6). This may reveal a hidden danger to the recurrence of depression (40). Therefore, further improvement in the management of sleep problems is essential.

We found that the higher the level of body dissatisfaction, the lower the sleep quality of university students (Table 3). Negative or self-critical thinking can reduce sleep quality (6). University students' steep demands on their bodies and their dissatisfaction with their actual bodies are likely to be important reasons for poor sleep quality. The results of this study showed that body dissatisfaction is common among people of all body types (Figure 1). Therefore, improving body dissatisfaction among university students may have a positive effect on improving the sleep quality of university students. In conclusion, by concatenating the above points, improving university students' body satisfaction can improve their sleep quality and play a positive role in the prevention and treatment of depression.

4.1. Limitations

This study had some limitations. First, the number of participants in this study was small, and their ages ranged from 18 to 23 years. Second, this was a cross-sectional study, and although it showed that body satisfaction may play a positive role in improving depression, it could not clarify the causal relationship. Third, this study only included university students in southern China as the research subjects, and the research results may not be generalizable to university students from other regions. Finally, the survey period overlapped with the period of the COVID-19 pandemic, which may have influenced the study findings.

5. Conclusion

The results of this preliminary analysis showed that the depression levels of university students in southern China were significantly higher among females than among males. We found a positive correlation of low body dissatisfaction levels, high physical activity levels, and quality sleep on depression. The findings also emphasize that the role of body dissatisfaction in causing depression may be underestimated. Although improving body satisfaction may directly influence depression levels, it may improve the mood by increasing physical activity and improving sleep quality. Therefore, reducing body dissatisfaction has great potential for preventing and ameliorating depression.

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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 Gannan Medical University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

MH, XL, YW, QW, WY, and YH involved in the conception of the study and design of the work. YW, WY, and YH involved in the data collection, data analysis, and initial drafting of the manuscript. MH contributed to the interpretation of the analyzed data and critically reviewed the manuscript for important intellectual content. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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Family context as a double-edged sword for psychological distress amid the COVID-19 pandemic with the mediating effect of individual fear and the moderating effect of household income

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Background: The COVID-19 pandemic drives psychological distress. Previous studies have mostly focused on individual determinants but overlooked family factors. The present study aimed to examine the associations of individual and family factors with psychological distress, and the mediating effect of individual fear and the moderating role of household income on the above associations.

Methods: We conducted a population-based cross-sectional survey on Chinese adults in Hong Kong from February to March 2021 ($N=2,251$) to measure the independent variables of anti-epidemic fatigue, anti-epidemic confidence, individual and family members' fear of COVID-19, and family well-being (range 0–10), and the dependent variable of psychological distress (through four-item Patient Health Questionnaire, range 0–4).

Results: Hierarchical regression showed that anti-epidemic fatigue was positively ($\beta=0.23$, 95% CI [0.18, 0.28]) while anti-epidemic confidence was negatively ($\beta=-0.29$, 95% CI [-0.36, -0.22]) associated with psychological distress. Family members' fear of COVID-19 was positively ($\beta=0.11$, 95% CI [0.05, 0.16]) while family well-being was negatively ($\beta=-0.57$, 95% CI [-0.63, -0.51]) associated with psychological distress. Structural equation model showed that individual fear mediated the above associations except for family well-being. Multi-group analyses showed a non-significant direct effect of anti-epidemic confidence and a slightly stronger direct effect of family well-being on psychological distress among participants with lower incomes, compared to those with higher incomes.

Conclusion: We have first reported the double-edged effect of family context on psychological distress, with the positive association between family members' fear of COVID-19 and psychological distress fully mediated by individual fear and the negative association between family well-being and psychological distress moderated by income level. Future studies are warranted to investigate how the contagion of fear develops in the family and how the inequality of family resources impacts family members' mental health amid the pandemic.

KEYWORDS

COVID-19, family, fear, household income, psychological distress

Introduction

Psychological distress has surged amid the COVID-19 pandemic (1, 2), and it is important to identify its risk and protective factors. Precautionary measures and vaccination may protect against COVID-19 (3), but no one is immune from the psychological distress it causes. Three meta-analyses showed the general population reported higher prevalence of psychological distress, particularly anxiety and depressive symptoms, during the COVID-19 pandemic compared to before the pandemic (4–6). Our cross-sectional study “Family amid COVID-19 survey 1” (FamCov-1) in May 2020 showed that Hong Kong adults who perceived harms rather than benefits from the pandemic reported low levels of happiness (7). However, previous studies have mainly focused on factors at the individual level, overlooking the importance of family, which serves as the immediate setting for individuals to shape and develop their cognitions and emotions (8, 9), particularly when family members are confined at home during the pandemic (10). Moreover, it is unclear about the potential mediator and moderator underlying the associations between individual and family factors and psychological distress.

The individual factors of anti-epidemic fatigue and anti-epidemic confidence contribute to psychological distress. The COVID-19 pandemic has continued for over 2 years, requiring continuous and varying efforts to control and cope with it, and people may feel exhausted and develop anti-epidemic fatigue (11) or gain positive beliefs and build up anti-epidemic confidence (12). The conservation of resources theory suggests that anti-epidemic fatigue may cause psychological distress with depleted mental resources to cope with stressors of the pandemic, while anti-epidemic confidence may improve mental health with increasing cognitive resources, including enriched anti-epidemic experiences and enhanced knowledge (13). As Hong Kong follows the “dynamic-zero” policy to minimize COVID-19 cases as much as possible (14), the general population are highly subject to the pandemic fatigue (15). Emerging evidence in Hong Kong has shown consequences of anti-epidemic fatigue, including lower adherence to control measures and depressive and anxiety symptoms (16, 17). However, like two sides of the same coin, anti-epidemic fatigue impedes the mitigation of the pandemic (18) while anti-epidemic confidence promotes the compliance with control measures (19). Compared with increasing studies on anti-epidemic fatigue, only one cross-sectional study showed a positive association between anti-epidemic confidence and mental health in Taiwan adults (12), leaving the scarcity of studies examining the psychological impacts of anti-epidemic confidence. Moreover, the extent to which anti-epidemic fatigue and anti-epidemic confidence are associated with psychological distress relative to family factors is unclear, as are the potential mediators underlying these associations.

Like the individual factors, the family may have a double-edged sword effect on psychological distress, with the transmission of fear through the family heating up symptoms of distress, and family well-being cooling them down. Suggested by Bronfenbrenner's Ecological Systems Theory, family may influence an individual's outcomes as the proximal context (20). On the one hand, dense living conditions and close family ties make Hong Kong families vulnerable to virus transmission, posing a much higher infection risk in family settings than in social and work settings (21). Based on the theory of emotion contagion, a high rate of household infection in Hong Kong may cause fear to prevail within families *via* their daily interactions (22).

Although studies on SARS, H1N1, and COVID-19 support interdependent correlations of fear between parents and children and within couples (23–26), there is a lack of evidence on the mental health outcomes of family members' fear of COVID-19. Only one study in Israel showed a non-significant association between family members' fear of COVID-19 and psychological symptoms of stress, depression, and anxiety (27). Therefore, more evidence is needed to understand how family members' fear of COVID-19 affects psychological distress. On the other hand, the family is often considered a “safe haven” that provides comfort and support to family members (28), with family well-being buffering the social disruption caused by the pandemic and facilitating mental adjustment (29). However, while the beneficial role of family well-being has been investigated in vulnerable family such as people with prior mental health disorders (30), the effect of family well-being in the general population is underexplored. Furthermore, no report has examined the relationship between family well-being and psychological distress during the COVID-19 pandemic.

Furthermore, fear may serve as a cognitive mechanism to mediate the associations between individual and family factors and psychological distress, which may be moderated by socio-demographic characteristics. Based on the transactional theory of stress and coping, fear may serve as an essential link in transmitting stress perception into psychological outcomes as a primary appraisal assessing the level of threat (31, 32). Individuals with an intense fear of COVID-19 have reported higher psychological distress (33), misperceived physical symptoms as signs of COVID-19 infection, and practiced excessive precautionary behaviors (34, 35). Our previous papers on FamCov-1 survey have also shown that those with higher fear of COVID-19 delayed doctor consultations and reported increased family conflict (36, 37). While accumulating studies showing the detrimental impacts of fear, it is unknown regarding the potentially mediating role of individual fear as a cognitive process. Besides, females, older people, those with less education and lower income may be more vulnerable during the pandemic (4, 38–40), which may cause difference in the underlying mediating mechanism. But it is not clear how such mediation mechanism *via* individual fear may differ by socio-demographic strata.

The present study aimed to (1) examine the associations of individual and family factors with psychological distress; (2) test the mediating effect of individual fear of COVID-19 on the above associations; and (3) investigate whether the mediating results differed by socio-demographic characteristics.

Based on the above theoretical framework and previous studies, we proposed the following hypotheses:

Hypothesis 1a: Anti-epidemic fatigue is positively associated with psychological distress.

Hypothesis 1b: Anti-epidemic confidence is negatively associated with psychological distress.

Hypothesis 1c: After controlling for individual factors, family members' fear of COVID-19 is positively associated with psychological distress.

Hypothesis 1d: After controlling for individual factors, family well-being is negatively associated with psychological distress.

Hypothesis 2: Individual fear of COVID-19 mediates the above associations.

Hypothesis 3: The mediating results vary by socio-demographic characteristics.

Methods

Study design and participants

Under the Hong Kong Jockey Club Smart Family-Link Project, the current study was based on the population-based cross-sectional “Family amid COVID-19 survey 2” (FamCov-2) which was conducted using telephone interviews and online questionnaires from 22 February to 23 March 2021. We conducted the FamCov-1 in May 2020 when the second wave of COVID-19 outbreak was under control to assess individual attitudes, concerns, behaviors, and personal and family well-being, including fear (37), COVID-related information sharing (41), and delay in doctor consultation (36). Based on the FamCov-1, we conducted the second phase survey FamCov-2 in March 2021 when the fourth wave of COVID-19 outbreak was under control to assess the longer-term responses to the pandemic, including anti-epidemic fatigue and confidence (16), and adversity coping (42). The inclusion criteria of participants were those who (1) were Hong Kong residents aged 18 years or above, (2) could read or communicate using Cantonese, and (3) had landline or mobile telephone numbers or email accounts to contact. The Hong Kong Public Opinion Research Institute (HKPORI), a well-known local survey agency, was commissioned to conduct the survey.

The survey design and methods have been published (16, 42, 43). Specifically, this survey used a combination of probability and non-probability sampling methods. For the probability sampling, we adopted random telephone interview and probability-based online questionnaire survey. In both the landline and mobile telephone interviews, all telephone interviews were conducted by trained interviewers using random numbers generated by known prefixes assigned to telecommunication service providers. Invalid and working telephone numbers were identified by computers, and the remaining numbers were mixed in random to produce the number pool. A second-level sampling was only adopted in the landline telephone survey using the “next birthday rule” to select one eligible respondent among all those present in a household (i.e., select the qualified family member whose next birthday is nearest to the interview date). The online questionnaire survey invited HKPORI’s probability-panel, representative of the Hong Kong population, who were randomly selected in previous telephone surveys before this study. Totally 1,522 participants (62.9% out of the 2,420 valid telephone numbers) completed the telephone interview and 641 participants (14.9% out of the 4,311 probability-panel) completed the online survey, respectively. For the non-probability sampling, we adopted online questionnaire survey by inviting a convenience sample of HKPORI’s non-probability-panel (voluntarily registered members). Totally 5,372 participants out of the 44,514 non-probability-panel who opened the email invitations completed the online questionnaires.

The questionnaire comprises three subsets of questions on family communication, COVID-19 information, and COVID-19 influence. Each subset included core questions (which were present in all subsets) and subset-specific questions, and was randomly distributed

to a third of all participants. The present analysis is based on the subset of COVID-19 influence, which was answered by 2,251 participants. Ethics approval was granted by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (Reference number: UW 20-651). Oral consent for the telephone survey or written informed consent for the online survey was obtained from each participant before the survey commenced. To ensure confidentiality, we used anonymous questionnaire, stored data using a password, and restricted the use of data.

Measurements

As assessment tools were not available to measure anti-epidemic fatigue, anti-epidemic confidence, and individual and family members’ fear of COVID-19 during our survey time, our research team designed a single item to efficiently and effectively assess each of these variables for Hong Kong community adults. Anti-epidemic fatigue was measured using a single question, “Do you think you have anti-epidemic fatigue?” Anti-epidemic confidence was measured using a single question, “How much confidence do you have to cope with the COVID-19 pandemic?” Individual fear and family members’ fear of COVID-19 were measured using a single question, “Has COVID-19 caused you/your family member(s) fear?” as used in our previous studies (36, 37). Participants responded to each question using an 11-point scale ranging from 0 to 10, with higher scores indicating higher levels of the assessed variable.

Family well-being was measured using family health, harmony, and happiness (3Hs): three separate questions asked, “How healthy/harmonious/happy do you think your family is?” and were answered using an 11-point scale ranging from 0 to 10, which was developed and validated in our previous studies (44, 45). In addition to the three subscales of family 3Hs, we calculated a composite score of family well-being by dividing the sum of family 3Hs by three as in our previous studies, with higher scores indicating higher levels of family well-being (41, 42, 46). In the present study, the Cronbach’s α coefficient of the family 3Hs was 0.94.

Psychological distress was measured using the four-item Patient Health Questionnaire (PHQ-4), including 2 two-item subscales measuring anxiety and depressive symptoms (47). The Chinese version of PHQ-4 has shown good reliability and validity (48, 49). Participants indicated the frequency of the described symptoms over the previous 2 weeks using a 4-point Likert scale from 0 (not at all) to 3 (nearly every day). The total scores for PHQ-4 ranged from 0 to 12, with higher total scores indicating higher psychological distress. In the present study, Cronbach’s α coefficient was 0.88 for the PHQ-4, and 0.82 and 0.79 for the subscales measuring anxiety and depressive symptoms, respectively.

We collected information on socio-demographic characteristics, including sex, age, education level, monthly household income, and number of cohabitants. We recoded age as “18–44 years” or “ \geq 45 years” and education level as “secondary or below” or “tertiary.” Monthly household income per person (income divided by household size) was calculated and dichotomized as “lower” or “higher” with reference to the size-specific median monthly household income in Hong Kong’s census statistics (50). Except for the socio-demographic characteristics, each variable was treated as continuous variable without cut-off value.

Statistical analyses

Descriptive statistics of socio-demographic characteristics were computed and weighted by sex, age group, and education level based on data from the 2019 Hong Kong census (51). Hierarchical regression analysis was used to examine the associations of individual and family factors with psychological distress (Hypotheses 1a to 1d), using a regression coefficient (beta, β) with 95% confidence interval (CIs) to estimate the strength and direction of the associations. To be specific, in Step 1, socio-demographic characteristics were added to examine their associations with psychological distress. In Step 2, individual factors (i.e., anti-epidemic fatigue and confidence) were added to examine the associations between individual factors and psychological distress beyond the effects of socio-demographic characteristics. In Step 3, family factors (i.e., family members' fear of COVID-19 and family well-being) were added to examine the associations between family factors and psychological distress beyond the effects of individual factors and socio-demographic characteristics. Finally, in Step 4, individual fear was added to preliminarily examine its mediating effect on the associations aforementioned (52).

Structural equation model (SEM) was used to examine the mediating effect (i.e., indirect effect) of individual fear of COVID-19 by decomposing the aforementioned associations into direct and indirect effects (Hypothesis 2) (53). Missing values were handled using full information maximum likelihood estimation. Standardized coefficients and bias-corrected (BC) 95% CI of the direct and indirect effects were estimated by the maximum likelihood and bootstrap methods with 1,000 replications, respectively. We examined the fit indices of the SEM, including (1) root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR), with RMSEA < 0.06 and SRMR < 0.08 considered as good fit indices; and (2) comparative Fit Index (CFI) and Tucker-Lewis index (TLI), with CFI > 0.95 and TLI > 0.95 considered as good fit indices (54, 55).

Multi-group analysis was used to investigate whether the SEM results differed according to socio-demographic characteristics (Hypothesis 3). To be specific, we conducted four multi-group analyses to test whether the SEM results were equal across sex (male vs. female), age group (18–44 years vs. ≥ 45 years), education level (secondary or below vs. tertiary), and monthly household income per person (lower vs. higher), including three steps for each multi-group analysis (56, 57). First, an unconstrained model (all path coefficients were freely estimated across different groups) and a fully constrained model (all path coefficients were constrained to equality across different groups) were compared using likelihood-ratio tests. Second, if the result of the model comparison indicated a statistically significant difference, we released the constraint of the specific path coefficient with the largest modification index in the fully constrained model and obtained a partially constrained model. Third, we compared the partially constrained model with the unconstrained model. The last two steps were repeated until there was no statistically significant difference between the partially constrained and unconstrained models.

In hierarchical regression analysis, we used the total scores of PHQ-4 and the composite score of family 3Hs to indicate psychological distress and family well-being, respectively. In SEM and multi-group analysis, we used the two PHQ-4 subscales measuring anxiety and depressive symptoms to indicate the latent variable of psychological

distress, and the three family 3Hs subscales to indicate the latent variable of family well-being. We used STATA/SE 17.0 and the “lavaan” package in R 4.2.1 for these statistical analyses (58). Two-sided $p < 0.05$ was considered statistically significant.

Results

Socio-demographic characteristics of the participants

Table 1 shows that, after weighting, about half of the participants were female (52.6%). Most participants were 45 years old or above (58.7%), had secondary education level or below (61.2%) and lower monthly household income per person than the median level in Hong Kong's 2019 census statistics (56.0%). The mean number of cohabitants was 2.20 ± 1.35 . For socio-demographic characteristics, the differences between unweighted and weighted data in education level reached a medium level of effect size (Cramer's $V = 0.37$), and in monthly household income per person reached a small level of effect size (Cramer's $V = 0.13$). However, for individual and family factors, the weighted data showed little difference with the unweighted data.

Associations of individual and family factors with psychological distress

Supplementary Table 1 shows that all variables of individual and family factors and psychological distress had significant bivariate correlations, except for the association (1) between individual fear of COVID-19 and family well-being, and (2) between family member's fear of COVID-19 and family well-being.

Table 2 shows the results of hierarchical regression analyses. When adding socio-demographic characteristics in Step 1, age of 45 years or above ($\beta = -1.34$, 95% CI $[-1.60, -1.07]$, $p < 0.001$), tertiary education ($\beta = 0.37$, 95% CI $[0.04, 0.69]$, $p = 0.03$), and higher monthly household income per person ($\beta = -0.37$, 95% CI $[-0.64, -0.10]$, $p = 0.007$) were associated with higher psychological distress. Socio-demographic characteristics explained 7% of the variance of psychological distress. When adding individual factors in Step 2, anti-epidemic fatigue was positively associated with psychological distress ($\beta = 0.23$, 95% CI $[0.18, 0.28]$, $p < 0.001$), while anti-epidemic confidence was negatively associated with psychological distress ($\beta = -0.29$, 95% CI $[-0.36, -0.22]$, $p < 0.001$), supporting H1a and H1b, respectively.

When adding family factors in Step 3, family members' fear of COVID-19 was positively associated with psychological distress ($\beta = 0.11$, 95% CI $[0.05, 0.16]$, $p < 0.001$), while family well-being was negatively associated with psychological distress ($\beta = -0.57$, 95% CI $[-0.63, -0.51]$, $p < 0.001$), supporting H1c and H1d, respectively. Individual factors accounted for 8% of the variance of psychological distress, and family factors accounted for an additional 13%. Using the subscales of PHQ-4 measuring anxiety and depressive symptoms as two separate outcomes in regression analyses, we found that individual and family factors remained significant, although with smaller coefficients compared to those found when using the total scores of PHQ-4 scores (see Supplementary Tables 2, 3).

TABLE 1 Descriptive statistics of socio-demographic characteristics, individual and family factors.

	Unweighted	Weighted ^a	Effect size ^b
Sex, <i>n</i> (%, 95 CI)			
Male	1,078 (47.9, 45.8–50.0)	1,059 (47.4, 43.9–50.8)	0.01
Female	1,173 (52.1, 50.0–54.2)	1,177 (52.6, 49.2–56.1)	
Age group (years), <i>n</i> (%, 95 CI)			
18–44	1,105 (49.1, 47.1–51.2)	923 (41.3, 38.0–44.7)	0.08
≥45	1,144 (50.9, 48.8–52.9)	1,311 (58.7, 55.3–62.0)	
Education level, <i>n</i> (%, 95 CI)			
Secondary or below	552 (24.7, 22.9–26.5)	1,363 (61.2, 58.1–64.3)	0.37
Tertiary	1,686 (75.3, 73.5–77.1)	863 (38.8, 35.7–41.9)	
Monthly household income per person, <i>n</i> (%, 95 CI)			
Lower (<median)	834 (42.9, 40.7–45.1)	1,105 (56.0, 52.4–60.0)	0.13
Higher (≥median)	1,111 (57.1, 54.9–59.3)	867 (44.0, 40.4–47.6)	
Number of cohabitants, Mean (SD)	2.20 (1.38)	2.20 (1.35)	0.001
Anti-epidemic fatigue ^c , Mean (SD)	5.94 (2.61)	5.75 (2.62)	0.07
Anti-epidemic confidence ^c , Mean (SD)	6.83 (1.77)	6.76 (1.85)	0.04
Individual fear of COVID-19 ^c , Mean (SD)	5.00 (2.46)	5.01 (2.43)	0.001
Family members' fear of COVID-19 ^c , Mean (SD)	5.48 (2.22)	5.43 (2.16)	0.02
Family well-being ^d , Mean (SD)	6.45 (1.93)	6.47 (1.89)	0.01

^aWeighted by sex, age group, and education level based on data from the 2019 Hong Kong census.

^bEffect size: Cramer's V was used to calculate the effect size of differences between pairs of proportions for the categorical variable: 0.10–0.30, small; 0.30–0.50, medium; ≥0.50, large. Cohen's *d* for the continuous variable: 0.20–0.50, small; 0.50–0.80, medium; ≥0.80, large.

^cA single item ranges from 0 to 10, with higher scores indicating higher levels.

^dFamily well-being is indicated by the composite score calculated by dividing the sum of family health, family harmony, and family happiness by three, ranging from 0 to 10 with higher scores indicating higher levels of family well-being.

Participants with missing values were excluded.

Mediating effects of individual fear of COVID-19

When individual fear of COVID-19 was added in Step 4, the coefficient and *p*-value of anti-epidemic confidence both appeared to decrease slightly, suggesting that individual fear of COVID-19 might have a partial mediating effect; the association between family members' fear of COVID-19 and psychological distress became non-significant, suggesting that individual fear of COVID-19 might have a full mediating effect.

The hypothesized model with the mediating effect of individual fear of COVID-19 showed good fit indices: $\chi^2 = 157.51$, *df* = 29, RMSEA = 0.04, SRMR = 0.01, CFI = 0.99, TLI = 0.98. [Supplementary Figure 1](#) shows the path diagram with the standardized regression coefficients of the hypothesized model. We adjusted sex, age group, education level, monthly household income per person, and number of cohabitants in this model.

[Table 3](#) shows that, for individual factors, the mediating effect of individual fear of COVID-19 was statistically significant on the association between anti-epidemic fatigue and psychological distress (standardized $\beta = 0.010$, BC 95% CI [0.003, 0.020], *p* = 0.011), and the association between anti-epidemic confidence and psychological distress (standardized $\beta = -0.013$, BC 95% CI [−0.026, −0.005], *p* = 0.009), respectively. Given both direct effects were statistically significant, the mediating effect was partial (proportion mediated: 5.92% and 18.31%, respectively). For family factors, the mediating effect of individual fear of COVID-19 was statistically significant on the

association between family members' fear of COVID-19 and psychological distress (standardized $\beta = 0.046$, BC 95% CI [0.016, 0.082], *p* = 0.005), but not statistically significant on the association between family well-being and psychological distress (standardized $\beta = 0.004$, BC 95% CI [−0.001, 0.010], *p* = 0.089), partly supporting our H2. Given the direct effect of family members' fear of COVID-19 on psychological distress was not statistically significant, the mediating effect was full.

Multi-group analyses to examine socio-demographic differences

As [Supplementary Table 4](#) shows, the comparisons of multiple-group models stratified by sex [$\Delta\chi^2_{(17)} = 23.21$, *p* = 0.142], age group [$\Delta\chi^2_{(17)} = 24.45$, *p* = 0.108], and education level [$\Delta\chi^2_{(17)} = 17.73$, *p* = 0.406] indicated that the SEM results did not differ by these characteristics. However, when stratified by monthly household income per person, the model comparison showed that the fully constrained model fit worse than the unconstrained model, indicating significant differences in one or more path coefficients across the groups [$\Delta\chi^2_{(17)} = 29.72$, *p* = 0.028]. [Supplementary Table 5](#) shows that participants in the lower income group reported lower anti-epidemic fatigue, anti-epidemic confidence, and family well-being than those in the higher income group.

We repeated the iterative process to obtain a final partially constrained model ($\chi^2 = 464.04$, *df* = 88, RMSEA = 0.07, SRMR = 0.07, CFI = 0.96, TLI = 0.95), which was not statistically significantly different from the unconstrained model [$\Delta\chi^2_{(15)} = 24.39$, *p* = 0.059]. In the final model, we released the constraints on two path coefficients

TABLE 2 Results of hierarchical regression examining the associations between individual and family factors with psychological distress.

	Psychological distress ^a			
	β (95% CI)			
	Step 1	Step 2	Step 3	Step 4
Socio-demographic characteristics				
Sex				
Male	1	1	1	1
Female	0.07 (−0.18, 0.32)	−0.07 (−0.30, 0.17)	0.04 (−0.18, 0.27)	−0.01 (−0.23, 0.22)
Age group (years)				
18–44	1	1	1	1
≥45	−1.34 (−1.60, −1.07)***	−1.20 (−1.45, −0.94)***	−0.80 (−1.04, −0.56)***	−0.80 (−1.04, −0.56)***
Education level				
Secondary or below	1	1	1	1
Tertiary	0.37 (0.04, 0.69)*	0.24 (−0.08, 0.55)	0.07 (−0.22, 0.36)	0.07 (−0.22, 0.36)
Monthly household income per person				
Lower (<median)	1	1	1	1
Higher (≥median)	−0.37 (−0.64, −0.10)**	−0.29 (−0.55, −0.03)*	−0.09 (−0.33, 0.15)	−0.09 (−0.33, 0.15)
Number of cohabitants	−0.07 (−0.16, 0.03)	−0.08 (−0.17, 0.02)	−0.05 (−0.13, 0.03)	−0.05 (−0.13, 0.04)
Individual factors				
Anti-epidemic fatigue ^b		0.23 (0.18, 0.28)***	0.18 (0.14, 0.23)***	0.17 (0.13, 0.22)***
Anti-epidemic confidence ^b		−0.29 (−0.36, −0.22)***	−0.12 (−0.18, −0.05)***	−0.10 (−0.16, −0.03)**
Family factors				
Family members' fear of COVID-19 ^b			0.11 (0.05, 0.16)***	0.05 (−0.02, 0.11)
Family well-being ^c			−0.57 (−0.63, −0.51)***	−0.58 (−0.64, −0.51)***
Mediating factor				
Individual fear of COVID-19 ^b				0.10 (0.03, 0.16)**
R-square	0.07	0.15	0.28	0.29
R-square change		0.08***	0.13***	0.01**

^aPsychological distress is indicated by the total score of four-item Patient Health Questionnaire, ranging from 0 to 12 with higher scores indicating higher psychological distress.

^bA single item ranges from 0 to 10, with higher scores indicating higher levels.

^cFamily well-being is indicated by the composite score calculated by dividing the sum of family health, family harmony, and family happiness by three, ranging from 0 to 10 with higher scores indicating higher levels of family well-being.

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

in the fully constrained model: (1) the direct effect of anti-epidemic confidence on psychological distress, and (2) the direct effect of family well-being on psychological distress, indicating that these two path coefficients were significantly different across lower and higher income groups. [Supplementary Figure 2](#) shows that the direct effect of anti-epidemic confidence on psychological distress was not statistically significant in the lower income group (standardized $\beta = -0.03$, $p = 0.359$) but was statistically significant in the higher income group (standardized $\beta = -0.10$, $p = 0.001$). Besides, the direct effect of family well-being on psychological distress was slightly stronger in the lower income group (standardized $\beta = -0.49$, $p < 0.001$) than in the higher income group (standardized $\beta = -0.42$, $p < 0.001$).

Discussion

We have first shown, by extending beyond the individual factors and finding that anti-epidemic fatigue showed a positive association

with psychological distress while anti-epidemic confidence showed a negative association, that the family context appeared to be a double-edged sword, with psychological distress positively associated with family members' fear and negatively associated with family well-being. We have further shown that individual fear of COVID-19 mediated all the above associations except for family well-being. Disparities by different monthly household income per person were evident, with a non-significant direct effect of anti-epidemic confidence and a slightly stronger direct effect of family well-being on psychological distress among those with lower incomes, compared to those with higher incomes. Our study provides some new insight into how the family context can lead to psychological distress, with one for family members' fear of COVID-19 fully mediated by individual fear and the other for family well-being moderated by income level.

As expected, anti-epidemic fatigue was positively associated with psychological distress, with a mediating effect of individual fear of COVID-19. These two findings can be explained by the process of self-regulation (59), through which individuals take actions to cope

TABLE 3 Direct and indirect effects in the structural equation model.

	Standardized coefficients (β)	BC ^a 95% CI	p-values
Direct effects			
Anti-epidemic fatigue ^b → psychological distress ^c	0.159	(0.116, 0.201)	< 0.001
Anti-epidemic confidence ^b → psychological distress ^c	−0.058	(−0.103, −0.009)	0.017
Family members' fear of COVID-19 ^b → Psychological distress ^c	0.021	(−0.033, 0.075)	0.444
Family well-being ^d → psychological distress ^c	−0.460	(−0.505, −0.414)	< 0.001
Indirect effects (via individual fear of COVID-19)			
Anti-epidemic fatigue ^b → individual fear of COVID-19 ^b → psychological distress ^c	0.010	(0.003, 0.020)	0.011
Anti-epidemic confidence ^b → individual fear of COVID-19 ^b → psychological distress ^c	−0.013	(−0.026, −0.005)	0.009
Family members' fear of COVID-19 ^b → individual fear of COVID-19 ^b → psychological distress ^c	0.046	(0.016, 0.082)	0.005
Family well-being ^d → individual fear of COVID-19 ^b → psychological distress ^c	0.004	(−0.001, 0.010)	0.089

^aBC: Bias-corrected (BC 95% CI corrects for the bias and skewness in the distribution of bootstrap method).

^bA single item ranges from 0 to 10, with higher scores indicating higher levels.

^cPsychological distress is a latent variable indicated by anxiety and depressive symptoms (each ranging from 0 to 6, with higher scores indicating higher levels).

^dFamily well-being is a latent variable indicated by family health, family harmony, and family happiness (each ranging from 0 to 10, with higher scores indicating higher levels).

This model was adjusted by sex, age group, education level, monthly household income per person, and number of cohabitants.

with changing situations to achieve their goals (e.g., pandemic control), and evaluate whether their efforts have achieved their goals through external feedback. If people try to follow the government recommended measures to cope with the pandemic, but continuously receive negative feedback about fluctuating and rising infection cases and deaths, they may feel a sense of failure and helplessness, followed by psychological distress. The negative feedback of the unsolved pandemic may also evoke the emotion of fear, as individuals may feel that their abilities are limited and the measures they have adopted are ineffective in returning to normal life despite huge efforts and sacrifices.

Our study found that anti-epidemic confidence was negatively associated with psychological distress, mediated by individual fear of COVID-19, particularly among those with higher incomes. These findings can be explained by the extended parallel process model, which proposes that fear is determined by levels of perceived self-efficacy and response efficacy (60). Those who have more confidence in handling the pandemic have higher perceived efficacy, with greater belief in their abilities and the effectiveness of preventive behaviors; they thus feel less fear and lower psychological distress. As the prolonged pandemic has led to adverse impacts on the economy, including reduced salaries and increased unemployment (61), those with lower incomes not only reported lower anti-epidemic confidence, but also showed a non-significant direct effect of anti-epidemic confidence on psychological distress, compared with those with higher incomes. This is understandable, as those with financial hardship have great difficulties in acquiring adequate supplies for daily life, personal protective materials, and medical services to build up their confidence when handling the pandemic.

Our study showed that family members' fear of COVID-19 was positively associated with psychological distress *via* the full mediating effect of individual fear of COVID-19. Facing with uncertain situation at early wave of the outbreak, our FamCov-1 study showed that the general population reported a moderate level of fear and found that individuals with higher levels of fear reported lower happiness (37). Extending the FamCov-1's findings, the current study showed that perceived fear of family members strengthened one's own fear, and then worsened one's mental health problems. Future studies using

longitudinal designs are warranted to investigate how fear contagion develops within families and affects family members, especially among healthcare workers and public service providers with higher exposure to the virus. Interestingly, compared to participants in the higher income group, although those in the lower income group reported lower levels of family well-being, the direct negative effect of family well-being on psychological distress was slightly stronger among them. Based on studies showing the importance of family dynamics in managing COVID-19 stressors (62, 63), our findings support and extend previous findings by showing that family well-being nurtured in family dynamics could protect individuals from psychological distress. In addition to family well-being, further studies on the inequity of other family resources between people with lower and higher economic status are needed to understand the effects on mental health, as our findings suggest that a healthy, harmonious, and happy family may have a slightly stronger buffering effect on psychological distress among those with lower incomes. Besides, we also found that the mediating effect of individual fear of COVID-19 on the association between family well-being and psychological distress was non-significant. This may be explained by other potential mediators not identified and included in previous studies and our present study, such as uncertainty and coping strategies (64, 65).

Our study has some limitations. Firstly, the cross-sectional study design limits causal inference, as the temporal sequence of variables were unclear, and the potential confounding variables were unknown and not being controlled. Secondly, family factors, including family members' fear and family well-being, were perceived and self-reported, and may be subject to subjective bias. Thirdly, as valid and brief tools to assess anti-epidemic fatigue, anti-epidemic confidence, and family members' fear of COVID-19 were not available when we conducted the survey, the psychometric properties of our single-item measures need to be further investigated. Moreover, as our sample included more participants with higher education and household incomes, their understanding of our measurements may differ from the general population, which may cause information bias. However, giving responses to simple and direct questions may have allowed participants to reveal their genuine feelings and thoughts quickly. Finally, this study might have selection bias because only

telephone interviews and online questionnaires (*via* email invitations) were used for data collection. Therefore, our findings may have limited generalizability for not covering the significant volume of non-respondents (e.g., the older might have less access to or less preference for being contacted through telephone or email). Nevertheless, there was little difference in our study variables when we compared unweighted and weighted results by sex, age group, and education level based on data from the 2019 Hong Kong census (see Table 1).

Conclusion

Beyond investigating individual factors of anti-epidemic fatigue and anti-epidemic confidence, this study is the first to report the double-edged effect of family context on psychological distress. Specifically, the positive association between family members' fear and psychological distress was fully mediated by individual fear of COVID-19, and the negative association between family well-being and psychological distress was strengthened among those with lower incomes than those with higher incomes. Future studies are warranted to investigate how fear contagion develops in the family and how the inequality of family resources impacts family members' mental health amid the pandemic.

Data availability statement

The datasets presented in this article are not readily available because the sharing of data to third parties was not mentioned in the subjects' consent. The dataset supporting the current study is available on request from the corresponding authors. Requests to access the datasets should be directed to NY, nancy.yu@cityu.edu.hk; MW, mpwang@hku.hk.

Ethics statement

The studies involving human participants were reviewed and approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (Reference number: UW 20–651). The patients/participants provided their written informed consent to participate in this study.

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Author contributions

BC, WG, NY, and TL: conceptualization and methodology. BC: formal analysis and writing—original draft. WG: data curation. BC, WG, AL, SS, SH, NY, MW, and TL: writing—review and editing. SH, MW, and TL: resources, supervision, 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.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2023.1109446/full#supplementary-material>

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Cultural collectivism, intimate partner violence, and women's mental health: An analysis of data from 151 countries

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Culture, defined as the distinctive, learned beliefs and patterns of behavior that are particular to a given group or community, is a key determinant of mental health. The cultural dimension of individualism-collectivism, which measures the extent to which a given society accords importance to individuals as opposed to larger groups, has been associated with cross-national variations in mental health outcomes such as depression and suicide. However, this cultural dimension is also associated with variations in the frequency of intimate partner violence (IPV), which has a significant and sustained adverse impact on women's mental health. This study examines the relationships between individualism-collectivism, the frequency of IPV, and rates of depression and suicide in women, based on data from 151 countries. In this data set, IPV was significantly associated with age-standardized rates of depression and suicide in women, even after adjusting for demographic variables. Cultural collectivism was positively correlated with IPV, but this relationship was significantly influenced by national income and women's educational attainment. In multivariate analyses, IPV, but not cultural collectivism, remained significantly associated with depression in women. These results highlight the importance of screening for and addressing IPV in women seeking mental health care, particularly in low- and middle-income countries where cultural and economic factors may both increase the risk of IPV and delay or impede its reporting.

KEYWORDS

collectivism, intimate partner violence, depression, suicide, epidemiology

Introduction

Culture has been defined by Hofstede as “the programming of the human mind by which one group of people distinguishes itself from another group.” In other words, culture refers to shared values, symbolic meanings and patterns of behavior that are specific to a given community, and which are acquired through learning from one's social environment (Hofstede et al., 2010). Because of its pervasive influence on all aspects of human life, culture is an important determinant of mental health (Campo-Arias et al., 2021). A proper understanding of the link between different aspects of culture, mental health outcomes, and the variables mediating this association is essential when planning and implementing mental health services at the community level (Alegria et al., 2022).

Several schemata for the classification of cultural values into distinct dimensions have been proposed by researchers (Hsu et al., 2013). Regardless of the specific classificatory system adopted, there is agreement among researchers in this field that cultures can be meaningfully described in terms of the importance accorded to the individual as opposed to that accorded to the wider group or community. This cultural dimension is referred to as *individualism-collectivism*. In an individualistic culture, which is typical of North American and European countries, there is a greater emphasis on individual liberty and a more “loosely-knit” social framework. In a collectivist culture, which is more typical of Asian and African countries, there is a more “tightly-knit” social framework and a subordination of individual desires and freedoms to the wellbeing of a larger social group (Hofstede et al., 2010; Wagner, 2022).

It is often stated that collectivism is associated with a reduced risk of depression and suicide; however, the underlying reality is more complex (Abramov and Peixoto, 2022). Initial studies of the link between cultural collectivism and depression did show a negative correlation between these two variables at the cross-national level. However, the authors of these studies also highlighted the need to consider the “goodness of fit” between genotype and social environment when interpreting these results (Chiao and Blizinsky, 2010; Way and Lieberman, 2010). Subsequent research in individual subjects has confirmed the need for a nuanced interpretation of the link between individualism-collectivism and mental health, with both individualism and collectivism linked to specific adverse outcomes (Kasof, 2009; Chu, 2015; Liu et al., 2017). Cultural collectivism may promote mental health through both through its effects on individual psychological processes, such as improved self-regulation and cognitive fluency (Li et al., 2018; Medina et al., 2019) and its social concomitants, such as enhanced social support in the face of adversity (Fu et al., 2007; Moscardino et al., 2010; Ariapooran et al., 2018).

However, every cultural adaptation represents a “trade-off” between advantages and disadvantages, and there are aspects of collectivism that can be harmful to an individual’s mental health. Notions of family honor and shame, which are prevalent in collectivist cultures, can lead to a “culture of silence” surrounding traumatic situations such as sexual abuse (Haboush and Aylan, 2013), intimate partner violence (Ahmad et al., 2009), or violence within the family in general (Sawrikar, 2019). This leads to delayed or absent help-seeking and prolonged exposure to trauma. Such negative impacts may be specific to particular sub-groups within a population, such as women (Towns and Adams, 2009) and sexual minorities (Lowe et al., 2021), and are often passed over in discussions of the link between collectivism and mental health. There is also some evidence that in collectivistic societies, the impact of loneliness on physical and mental health may be greater than in individualistic cultures (Beller and Wagner, 2020). Finally, a special problem is posed by cultures in transition from a more collectivistic to a more individualistic set of values (Istiqbal et al., 2022). In these settings, the relationship between collectivism and mental health may be non-linear and difficult to predict (Berman et al., 2014). Adding to this complexity is the role played by economic factors such as poverty and income inequality, which are more common in collectivist cultures and are themselves risk factors for depression (Steptoe et al., 2007). It is clear that

any evaluation of the link between individualism-collectivism and depression should attempt to account for both “positive” and “negative” confounding factors.

From a public health perspective, the relationship between individualism-collectivism, intimate partner violence (IPV) and women’s mental health is of particular importance. Systematic reviews of the available evidence have found that exposure to IPV is associated with a nearly 2-fold increase in the risk of depression and suicide in women, even after adjusting for potential confounding factors (Devries et al., 2013; Bacchus et al., 2018). It is estimated that about 9–28% of depressive symptoms or disorders in women may be related to exposure to IPV (Beydoun et al., 2012). According to a recent World Health Organization Report, around 23–31% of women aged 15–49 who have ever been married or in a relationship have experienced IPV in their lifetime. Though no country or culture is free of IPV, there are marked variations across regions, ranging from a relative minimum of 10–15% in certain European countries to a maximum of over 40% in certain Asian, African and South American countries (World Health Organization, 2021a). This distribution approximates to a marked difference between individualistic and collectivistic societies; however, it is not possible to conclude from this that cultural collectivism is associated with higher rates of IPV *per se*. Nevertheless, an analysis of data from 52 countries found a significant positive association between IPV and more collectivistic cultural values (Archer, 2006).

Collectivistic societies are also associated with higher gender inequality and a lower social approval of divorce or separation (Pelham et al., 2022), both of which may lead to women remaining in abusive relationships. This relationship may be further moderated or mediated by individual demographic or environmental exposures. For example, a meta-analysis of factors associated with IPV across cultures, grouped using Hofstede’s index of individualism-collectivism, found that age and relationship satisfaction were stronger predictors of IPV in individualistic countries, while witnessing parental IPV was a stronger predictor of IPV in collectivistic countries (Mallory et al., 2016). Likewise, a meta-analysis of research from a collectivist country found that education and family income were both negatively associated with the risk of IPV (Nikparvar et al., 2021).

The aim of the current study was to examine cross-sectional associations between cultural collectivism, intimate partner violence, and two specific mental health outcomes (depression and suicide) across countries, while correcting for possible confounding factors.

Materials and methods

As data on IPV across countries was available only for a single time point, a cross-sectional ecological analysis was undertaken for the current study, keeping in mind the limitations associated with this approach. In this study, correlations between estimated cultural collectivism, lifetime risk of IPV, and the prevalence of depression as well as the suicide rate for women were examined across 115 countries. These analyses were adjusted for the possible confounding effects of women’s education, per capita income, and a composite measure of gender inequality, as these factors were

independently associated with a reduced risk of IPV in an earlier meta-analysis. Though there are certain limitations inherent in this form of cross-national analysis, they are valuable in identifying “macro”-level social, cultural and economic factors that can affect mental health in diverse populations (Meda et al., 2022).

Data sources

Data on IPV was obtained from the World Health Organization’s publication entitled “Violence against women prevalence estimates, 2018” (World Health Organization, 2021a). This monograph provides estimates of the lifetime prevalence of IPV in women for a total of 151 countries, provided as a percentage, based on data reported by United Nations member countries and multilevel statistical modeling. This process involved the collection of all representative published studies on the prevalence of IPV from WHO member countries, amounting to a total of 307 national and sub-national studies from 154 countries and regions (Maheu-Giroux et al., 2022).

The Global Collectivism Index (GCI) was used to estimate the position of each country on the individualism-collectivism continuum. This measure, published in 2022, is the first estimate of individualism-collectivism that covers the majority of the Earth’s population, providing data on 188 countries and territories (Pelham et al., 2022). The GCI was constructed based on six indicators that have been found to predict individualism-collectivism: total fertility rate, living arrangements, stability of marriage, religiosity, collective transportation and in-group bias. Positive GCI scores indicate collectivistic cultural values, while negative scores indicate individualistic values.

Though the GCI was developed with the stated aim of providing a measure of individualism-collectivism that reduces Western cultural biases, it is partly based on a measure of motor vehicle sharing, which is inconsistent across low- and middle-income countries (Ingram and Liu, 1999). Therefore, as an independent measure of cultural individualism-collectivism, data on the Hofstede index of individualism-collectivism (HOF-IC) was retrieved from the Hofstede Institute’s database (Hofstede, Insights, 2022). This measure is based on survey data from 115 countries, and has been used in studies examining the relationship between individualism-collectivism and mental health-related outcomes (Bailey and Kind, 2010; Gonda et al., 2011). The HOF-IC is scored from 0 to 100, with higher scores indicating cultural individualism and lower scores indicating cultural collectivism. Associations between the HOF-IC, IPV and mental health were not the primary outcome measures of this study, but were included as an additional measure of convergent validity.

Depression and suicide were selected mental health outcomes in this study due to their consistent association with IPV in earlier meta-analyses. The estimated prevalence of depression in women for each country was obtained *via* a database query from the Institute for Health Metrics and Evaluation (IHME), which provides estimates of the prevalence of depression by age and gender for each country and region based on Global Burden of Disease 2019 estimates (Global Burden of Disease Collaborative Network, 2020).

Suicide rates for women in each country were obtained from the World Health Organization’s publication “Suicide worldwide in 2019: Global Health Estimates” (World Health Organization, 2021b), which provides crude and age-standardized estimates of the suicide rate per 100,000 population for 183 countries and territories. For 60 of these countries, data on suicides was obtained from direct reports and was considered to be of good quality. For the remaining 123 countries, which were largely low- and middle-income countries, statistical models were used to supplement available data, and estimated suicide rates were generated. To minimize the confounding effect of age on both the risk of IPV and mental health outcomes, age-standard estimates were used for both the prevalence of depression and the suicide rate in women.

Data on the educational status of women in each country was obtained from the United Nations’ Human Development Report for the year 2019 (United Nations Development Programme, 2020), which provides data on average years of schooling for men and women for all member countries. From the same source, data was obtained on the Gender Inequality Index (GII), a composite measure of women’s health, higher education, workforce participation and representation in government. The GII is scored from 0 to 1, with lower scores indicating higher equality and vice versa. Information on income, operationalized as the gross national income (GNI) per capita, was obtained for the year 2018 from the World Bank’s database (The World Bank, 2022).

Data analysis

All variables included in this study were tested for normality prior to further analysis. As none of the variables conformed to a Gaussian distribution, non-parametric correlations were used for bivariate analyses.

In the first stage of the data analysis, non-parametric correlations (Spearman’s rho and Kendall’s tau) were used to examine the associations between the GCI, the prevalence of IPV, and rates of depression and suicide in women. As each of these methods has certain advantages as well as limitations (Puth et al., 2015), both were used in the current study.

In the second stage, partial bivariate correlations were computed to examine (a) whether the associations between the GCI, the prevalence of IPV, and mental health outcomes were significant after adjusting for income, education and gender inequality, and (b) whether the association between IPV and mental health was moderated by the GCI, and (c) whether the association between the GCI and mental health was altered when IPV was taken into consideration. Both unadjusted and bivariate correlations were two-tailed, with the significance level set at $p < 0.05$. The strengths of the observed correlations were quantified based on Spearman’s rho, using standard guidelines for psychology and the social sciences, as follows: 0.1–0.39, weak; 0.4–0.69, moderate; 0.7 and above, strong (Akoglu, 2018).

Following these steps, a multivariate linear regression analysis was carried out to examine whether any associations identified in the bivariate analyses remained significant, taking the prevalence of depression and the suicide rate in women as the dependent variables. Independent variables were selected for inclusion in the

TABLE 1 Descriptive statistics for all variables analyzed in the current study.

Variable	Number of countries for which data was available	Shapiro-Wilk test statistic	Median (inter-quartile range)	Maximum	Minimum
Intimate partner violence, lifetime prevalence (%)	151	0.943*	24.00 (13.50)	53.00 (Kiribati)	10.00 (Armenia)
Global collectivism index	143	0.966*	0.20 (1.29)	1.61 (Senegal)	−1.43 (Sweden)
Hofstede index of individualism-collectivism	101	0.907*	30.00 (32.00)	91 (United States)	6 (Guatemala)
Depression in women, age-standardized prevalence (%)	151	0.983	4.64 (1.58)	7.90 (Gambia)	2.45 (Colombia)
Female suicide rate, age-standardized (per 100,000 population)	145	0.715*	3.90 (3.70)	34.60 (Lesotho)	0.70 (Grenada)
Average years of education per adult woman	141	0.939*	8.90 (5.80)	13.50 (United States)	1.00 (Burkina Faso)
Gross national income per capita, standard \$	123	0.840*	12398.10 (23486.50)	80522.20 (Luxembourg)	724.40 (Burundi)
Gender inequality index	134	0.950*	0.381 (0.334)	0.740 (Papua New Guinea)	0.037 (Switzerland)

* indicates a significant deviation from a Gaussian distribution (Shapiro-Wilk $p < 0.05$).

regression analyses if they were correlated with the outcomes at $p < 0.1$ or less. In view of the significant multicollinearity observed between certain predictor variables, the backward method of linear regression was adopted.

As a secondary measure, bivariate and partial correlations were repeated using the HOF-IC instead of the GCI, as described above, to examine whether the results obtained in each case would be similar in magnitude and direction.

Results

Data from a total of 151 countries was included in the current study. Descriptive statistics for all study variables of interest are presented in Table 1.

Bivariate correlations between collectivism, IPV, and mental health outcomes

A complete correlation matrix for all unadjusted bivariate correlation analyses is presented in Table 2. It can be seen that the prevalence of IPV is positively correlated with both the prevalence of depression in women ($\rho = 0.25$, $p = 0.002$) and the female suicide rate ($\rho = 0.27$, $p < 0.001$), though the strength of these associations is modest. The GCI was positively correlated with the prevalence of depression in women ($\rho = 0.20$, $p = 0.018$), but not with the female suicide rate. A stronger, “moderate” correlation was observed between the GCI and the prevalence of IPV ($\rho = 0.55$, $p < 0.001$).

When examining potential confounding variables, the level of education among adult women was negatively correlated with the prevalence of depression ($\rho = -0.33$, $p < 0.001$), but not with the suicide rate. GNI per capita was marginally correlated with the

prevalence of depression, though there was inconsistency between the results obtained using Spearman's ($p = 0.049$) and Kendall's ($p = 0.069$) methods. IPV was negatively correlated with both women's education ($\rho = -0.51$, $p < 0.001$) and GNI per capita ($\rho = -0.56$, $p < 0.001$), and positively correlated with the GII ($\rho = 0.62$, $p < 0.001$). The GII was positively correlated with the prevalence of depression ($\rho = 0.31$, $p < 0.001$) but not the suicide rate. Cultural collectivism was strongly and negatively correlated with women's education, GNI and the GII to the point of multicollinearity (absolute value of $\rho > 0.8$ for all three correlations).

When using the HOF-IC as a measure of individualism-collectivism (Supplementary Table 1), this variable was negatively but non-significantly correlated with IPV ($\rho = -0.13$, $p = 0.181$) and positively and significantly correlated with both the prevalence of depression ($\rho = 0.20$, $p = 0.044$) and the suicide rate ($\rho = 0.27$, $p = 0.007$) in women, though the strength of these associations was weak. The differences in the directions of the observed correlations between the GCI and HOF-IC are due to the opposite scoring schemes used by each measure; higher GCI scores indicate a collectivistic cultural orientation, while higher HOF-IC scores indicate an individualistic orientation. There was a moderate-to-strong correlation between both measures of individualism-collectivism ($\rho = 0.65$, $p < 0.001$), though this did not reach the level of multicollinearity, indicating an acceptable level of convergence between these estimates of cultural orientation. The HOF-IC was positively correlated with women's education and GNI, but negatively correlated with the GII.

Partial correlation analyses

In the first partial correlation analysis (Table 3), the associations between the GCI, the prevalence of IPV, and the frequency of

TABLE 2 Correlation matrix of unadjusted bivariate correlations between individualism-collectivism, intimate partner violence, mental health outcomes, and possible confounding factors.

Variable	1 Dep-W	2 Suicide-W	3 IPV	4 GCI	5 Education	6 GNI	7 GII
1	-	0.28 (<0.001)** 0.20 (<0.001)**	0.25 (0.002)** 0.20 (<0.001)**	0.20 (0.018)* 0.12 (0.032)*	−0.33 (<0.001)** −0.21 (<0.001)**	−0.18 (0.049)* −0.11 (0.069)	0.31 (<0.001)** 0.20 (<0.001)**
2		-	0.27 (<0.001)** 0.19 (0.001)**	0.05 (0.549) 0.02 (0.701)	−0.07 (0.367) −0.05 (0.420)	−0.13 (0.150) −0.08 (0.220)	0.05 (0.534) 0.02 (0.782)
3			-	0.55 (<0.001)** 0.38 (<0.001)	−0.51 (<0.001)** −0.34 (<0.001)**	−0.56 (<0.001)** −0.38 (<0.001)**	0.62 (<0.001)** 0.43 (<0.001)**
4				-	−0.86 (<0.001)** −0.68 (<0.001)**	−0.91 (<0.001)** −0.73 (<0.001)**	0.88 (<0.001)** 0.70 (<0.001)**
5					-	0.86 (<0.001)** 0.67 (<0.001)**	−0.84 (<0.001)** −0.65 (<0.001)**
6						-	−0.90 (<0.001)** −0.73 (<0.001)**

All correlations are given in the form: Spearman's rho (significance), Kendall's Tau-B (significance).

*Significant at $p < 0.05$; **significant at $p < 0.01$.

Dep-W, estimated prevalence of depression in women (%); Suicide-W, estimated suicide rate per 100,000 women; IPV, lifetime prevalence of intimate partner violence (%); GCI, Global Collectivism Index; Education, average years of education per adult woman; GII, Gender Inequality Index; GNI, gross national income per capita (\$).

TABLE 3 Partial correlation analyses between individualism-collectivism, intimate partner violence, and mental health outcomes, controlled for confounding factors.

Variable	1 GCI	2 IPV	3 Dep-W	4 Suicide-W
1	-	−0.15 (0.103) −0.01 (0.862)	−0.03 (0.773) 0.01 (0.899)	−0.23 (0.016)* −0.09 (0.151)
2		-	0.36 (<0.001)** 0.27 (<0.001)**	0.30 (0.001)** 0.21 (0.001)**
3			-	0.34 (<0.001)** 0.24 (<0.001)**

All analyses are conditioned on gross national income per capita, average years of education in women, and gender inequality index. All correlations are given in the form: Spearman's partial rho (significance), Kendall's partial Tau-B (significance).

*Significant at $p < 0.05$; **significant at $p < 0.01$.

Dep-W, estimated prevalence of depression in women (%); Suicide-W, estimated suicide rate per 100,000 women; IPV, lifetime prevalence of intimate partner violence (%); GCI, Global Collectivism Index.

depression and suicide among women were examined, controlling for GNI, years of education in women, and the GII. In these analyses, the associations between IPV and depression ($\rho = 0.36$, $p < 0.001$) and suicide ($\rho = 0.30$, $p = 0.001$) remained significant, and were slightly stronger than those observed in the unadjusted analyses. The adjusted associations between the GCI and both depression and suicide were not significant, though a weak negative association between the GCI and suicide was observed using Spearman's partial correlation ($\rho = -0.23$, $p = 0.016$). Similarly, the unadjusted positive correlation observed between the GCI and the prevalence of IPV was no longer significant when conditioned on income, education and gender inequality.

In the second partial correlation analyses, the association between IPV and both depression ($\rho = 0.25$, $p = 0.002$) and suicide ($\rho = 0.30$, $p < 0.001$) in women remained significant when conditioned on the GCI. On the other hand, the positive correlation between the GCI and the prevalence of depression in women was not significant after adjusting for the frequency of IPV ($\rho = 0.02$, $p = 0.746$).

In the third partial correlation analysis, the negative correlation between gross national income and IPV remained significant, albeit attenuated, when correcting for the GCI ($\rho = -0.231$, $p = 0.011$). On the other hand, the negative correlation between women's education and IPV was not significant after adjusting for the GCI ($\rho = -0.10$, $p = 0.244$). The correlation between the GII and IPV, though attenuated when conditioned on the GCI, also remained statistically significant ($\rho = 0.37$, $p < 0.001$).

Analyses of a similar nature using the HOF-IC revealed that, after adjusting for GNI, education and the GII, this measure was positively correlated with the prevalence of IPV ($\rho = 0.28$, $p = 0.010$) and depression ($\rho = 0.34$, $p = 0.002$), but not the suicide rate (Supplementary Table 1).

Linear regression analyses

As only a single variable (IPV) was significantly associated with the suicide rate in women, linear regression could not be performed for this variable. The results of the multivariate linear regression analysis for the prevalence of depression in women is presented in Table 4. In this model, which attained statistical significance overall ($F = 11.42$, $p < 0.001$), three variables—the prevalence of IPV, the GII, and the average years of education for women—were retained as significant. IPV was positively associated with depression, while the GII and education were negatively associated with this variable. Variance inflation factors were below 4 for all variables, ruling out significant multicollinearity. Taken together, these three variables explained about 21% of the variance in the prevalence of depression in women ($R^2 = 0.239$, adjusted $R^2 = 0.218$).

Discussion

The current study was a preliminary attempt at elucidating the complex relationship between cultural individualism-collectivism,

TABLE 4 Multivariate linear regression analyses of the variables associated with depression in women.

Variables entered in the model	Variable(s) excluded	Variable(s) included in the final model	Regression coefficient (β)	Significance level (p)	Variance inflation factor
GCI	GNI	GII	−0.32	0.007**	1.92
IPV	GCI	IPV	0.41	<0.001**	1.37
GNI		Education	−0.36	0.001**	1.72
Education					
GII					

**Significant at $p < 0.01$.

IPV, lifetime prevalence of intimate partner violence (%); GCI, Global Collectivism Index; Education, average years of education per adult woman; GNI, gross national income per capita (\$).

intimate partner violence, and adverse mental health outcomes in women at a cross-national level.

Relationship between individualism-collectivism and mental health outcomes in women

In this study, higher scores on the GCI—which indicate more collectivistic cultural values—were positively correlated with the prevalence of depression, but not the suicide rate, in women. The strength of this correlation was weak ($\rho < 0.4$), and it was no longer significant after adjusting for the effects of IPV, or after controlling for demographic variables (income and education) and gender inequality. In the linear regression analysis, the GCI was not significantly associated with depression. Taken together, these results suggest that a simple linear association between individualism-collectivism and depression in women is unlikely. After correcting for intimate partner violence and socioeconomic status, collectivism may have a modest protective effect against suicide in women, which is consistent with some of the earlier results of cross-national analyses (Chiao and Blizinsky, 2010; Way and Lieberman, 2010; Li et al., 2021) and of individual research in specific populations (Lake et al., 2022). This effect may reflect the protective value of social support through informal networks involving extended family or friends. Though such support is difficult to quantify, it is likely to exert a significant influence on the mental health of women who are victims of IPV. There is evidence that the reactions of one's social circle to the disclosure of IPV has a considerable effect on the mental health and wellbeing of victims. Such reactions are themselves influenced by the attitudes of those receiving such disclosures (Dworkin et al., 2019; Ullman, 2023), and these attitudes, whether positive or negative, are themselves shaped by local cultural values (Dery et al., 2022; Zark and Satyen, 2022). This suggests that attempts to either enhance these local support networks (Cao et al., 2021) or promote attitudinal change among community leaders or “gatekeepers” (Dery et al., 2022), may be helpful in preventing or mitigating the effects of IPV on women's mental health.

Qualitative research from a low-income country suggests that collectivistic values may be associated with a stronger “sense of order,” fostering hope and partially countering the effects of economic deprivation; however, such values may also contribute to a sense of entrapment which runs counter to hope (Eggerman and Panter-Brick, 2010) and may trigger depression as well as suicide attempts. It is also well-known that certain emotion regulation

strategies, more commonly seen in women, may contribute to their increased risk of depression (Nolen-Hoeksema, 2012). Some authors have suggested that culture and gender may interact to influence the effectiveness of these strategies, leading to observable differences in the prevalence of depression across countries, but this hypothesis requires further testing (Vikan et al., 2009; Kwon et al., 2013; Ireland et al., 2015; De Vaus et al., 2018).

Relationship between intimate partner violence and mental health outcomes in women

In contrast to the mixed findings observed for individualism-collectivism, IPV was consistently and significantly associated with both depression and suicide in women, even after adjusting for demographic confounders and gender inequality. This association is consistent with the results of several meta-analyses (Beydoun et al., 2012; Devries et al., 2013; Bacchus et al., 2018; Hawcroft et al., 2019; Insan et al., 2022; Vicard-Olagne et al., 2022), which reveal a consistent link between IPV and depression regardless of the definition of IPV, the type of study considered (cross-sectional or longitudinal), or the measure of depression examined (any depressive disorder, post-partum depression, depressive symptoms). IPV is a chronic, traumatic stressor that is recurrent and often escalating in severity, and this leads to a sense of entrapment and hopelessness that results in depression. The presence of depression in a victim of IPV may further increase vulnerability to further IPV, creating a vicious cycle that is often difficult to break (Mazza et al., 2021). The traumatic effects of IPV may persist for several years even after separation from an abusive spouse or partner, leading to chronic or recurrent depression (Ford-Gilboe et al., 2023).

In certain cases, particularly in collectivistic Asian cultures, women may present to mental health services with medically unexplained symptoms: such symptoms are not only indicative of undiagnosed depression, but may represent a metaphorical or symbolic means of communicating their experience of physical violence (Wong et al., 2016). Due to this, it is possible that the association between IPV and depression was underestimated in the current study.

Ongoing IPV also affects treatment outcomes for depression. For example, a recent meta-analysis of psychological interventions for female victims of IPV, focusing on low- and middle-income countries, found that these interventions were ineffective in bringing about a significant improvement in depression (Keynejad

et al., 2020). Similar interventions in the same patient group, conducted in high-income countries with a more individualistic culture, were effective in alleviating depression (Hameed et al., 2020). These divergent findings suggest that a failure to protect women from IPV not only increases their risk of depression, but makes them less likely to benefit from otherwise effective forms of treatment. Therefore, the identification of IPV, and the availability of effective measures to protect women from further victimization, is essential if depression is to be effectively diagnosed and treated, particularly in women from collectivistic cultures (Connelly et al., 2013).

Relationship between individualism-collectivism and intimate partner violence

In the current study, the relationship between individualism-collectivism and IPV was not significant after adjusting for demographic factors. However, the converse was also partially true; after adjusting for individualism-collectivism, IPV was only weakly correlated with national per capita income, and was not significantly correlated with women's education. Thus, while demographic factors may significantly mediate the association between cultural values and IPV, a direct contribution from certain aspects of culture cannot be entirely ruled out. Some of these, such as an emphasis on family honor and a reluctance to discuss intra-familial problems with "outsiders," have been consistently reported in studies of migrant and ethnic minority women in Western cultures (Hulley et al., 2022) as well as in Asian and African settings (Mshweshwe, 2020; Arisukwu et al., 2021; Selim et al., 2022). Other values that have been reported to contribute to IPV in collectivist settings include notions of self-sacrifice associated with the female gender role (Natal, 2022), acceptance of cultural myths regarding the acceptability of violence among men (Toplu-Demirtas et al., 2022), and exaggerated notions of masculinity and patriarchy (Mshweshwe, 2020; Arisukwu et al., 2021). Though certain cultural models do incorporate a dimension of masculinity-femininity (Hofstede et al., 2010), this dimension is more a measure of assertiveness / competitiveness vs. consensus / cooperation, and may not map exactly onto beliefs regarding gender roles. Further research into cultural sexual scripting and masculine roles in relation to collectivism and IPV is warranted (Fleming et al., 2015; Willie et al., 2018).

The contribution of income, women's education, and gender inequality

The correlation between income and IPV observed in this study was stronger than that observed between collectivism and IPV. While an association between national wealth and the national prevalence of IPV has been identified by earlier researchers, other economic factors such as income inequality and unemployment may also contribute to variations in IPV across countries (Kebede et al., 2022). Financial hardship may contribute to the perpetration of IPV by increasing levels of childhood adversity, chronic stress, mental disorder and alcohol use in men (Thompson and Kingree,

2004; Papadakaki et al., 2009), and may also act as a barrier to women seeking help, particularly when they lack economic independence (Goodman et al., 2009). As the association between income and IPV was substantially weakened after correcting for individualism-collectivism, it is unlikely that cross-national variations in IPV can be ascribed solely to economic factors. The average level of education attained by adult women was negatively associated with both IPV and depression in women, which may reflect the association between this variable and the general level of gender equality and women's empowerment in a given society (Gomez et al., 2011); moreover, education may be protective against IPV in its own right (Zhao et al., 2022).

In this study, a composite measure of gender inequality, covering inequities in health, higher education, employment and political participation, was positively correlated with both depression and intimate partner violence in bivariate analyses; this is consistent with existing literature showing a link between gender inequality and depression in women (Van de Velde et al., 2021; Kim et al., 2023). However, this association was not replicated in the multivariate analysis, which is perhaps a reflection of the limitations inherent in such composite measures.

Differences between two measures of collectivism

It is also important to note the effect of the choice of a measure of individualism-collectivism on the associations that were observed. Though there was a reasonable degree of agreement between the GCI and the HOF-IC ($|\rho| = 0.70$), important differences emerged in the analyses based on which index was considered. IPV was more strongly correlated with the GCI than with the HOF-IC; the HOF-IC, but not the GCI, was significantly associated with the suicide rate in women; and the HOF-IC remained significantly correlated with the prevalence of IPV and depression in women even after controlling for demographic factors and gender inequality. These divergences highlight the limitations inherent in using a single numerical index to quantify collectivism, particularly when these indices are computed at different levels of analysis. Thus, the HOF-IC is based on survey data from individuals across various countries, which is then extrapolated to the national level; the IPV, on the other hand, is based on six macro-level demographic variables measured directly at the national level. Moreover, many researchers distinguish between horizontal and vertical dimensions of both individualism and collectivism in their work (Germani et al., 2021; Young et al., 2021), and these dimensions may have distinct influences on factors such as subjective wellbeing and feelings of guilt, which in turn may influence outcomes such as depression and suicide. It is likely that further work on more sensitive and multi-dimensional measures of individualism-collectivism may clarify the relationship between this aspect of culture and outcomes such as IPV and mental illness.

Strengths and limitations

This study, though preliminary in nature, is the first to examine the associations between collectivism, IPV and women's

mental health across a large number of countries, including low- and middle-income countries. The use of partial and regression analyses permits a more accurate delineation of the links between these variables.

Nevertheless, certain limitations of the study must be borne in mind. First, due to limitations in longitudinal data availability for IPV, only cross-sectional analyses were performed, precluding any definitive conclusions regarding the causal effects of this variable on women's mental health. Such effects may be inferred from the agreement between the current study's results and those involving individual subjects, but cannot be confirmed. Second, the possibility of under-reporting of both IPV and mental health outcomes may have led to an underestimation of the association between these variables. Third, other variables which could influence the links between IPV and depression, such as alcohol consumption, unemployment, or measures of gender inequality, were not analyzed as due to a lack of large-scale cross-national data on these factors was not available for most of the countries studied. Fourth, as the analyses were based on nation-level data, they cannot be directly applied to individuals. Fifth, other mental health outcomes of interest, such as post-traumatic stress disorder, could not be assessed as they were not estimated in the Global Burden of Disease studies. Sixth, this study did not examine the role of potential protective factors, such as social support, cultural values that support the protection and empowerment of women, or the effectiveness of legislation against IPV at the community level (Whitaker, 2014). Seventh, there are certain common risk factors for both IPV and suicide, such as age, employment status and prior trauma exposure, that could not be analyzed as confounders in the current study due to a lack of cross-national data (Iovine-Wong et al., 2019). Finally, and perhaps most importantly, data on the outcome variables for this study—depression and suicide—was based on direct measurements only in a minority of countries; most estimates of these variables had to be derived through statistical modeling and extrapolation from available data, which was often inadequate or absent (Brhlikova et al., 2011; World Health Organization, 2021b). This problem was of less concern in the case of IPV, where a larger body of original research was available across countries (World Health Organization, 2021a). In addition, even when official data or published research was available, there is a tendency toward under-reporting of sensitive matters such as IPV and suicide (Tollefsen et al., 2012; Barbier et al., 2022). In the case of IPV, this may be due to barriers in reporting IPV-related offenses (Dandona et al., 2022); in the case of suicide, this may be because of legislation or culture-based stigmatization (Arya et al., 2020). Due to these factors, it is likely that the current study may have underestimated the strength of the association between IPV and mental health outcomes. Though this is a significant limitation, it also highlights the need for locally-based, confidential and woman-friendly processes for the reporting of IPV and related phenomena, both for the sake of their protection and for the collection of reliable data that can be used to guide policy and advocacy (Madden et al., 2019; Vatnar et al., 2021).

Conclusion

The results of the current study, though provisional and subject to certain limitations, highlight the links between a specific dimension of culture and IPV; the consistency of the association between IPV and both depression and suicide in women; and the possible moderating effects of income, education and gender inequality on these associations in women. These results confirm and extend the work of earlier researchers, and highlight the need for culturally sensitive assessment of IPV in women presenting with depression, particularly in low- and middle-income countries. These results also suggest that structural change at multiple levels, including general economic development, measures aimed at promoting women's equality and empowerment, and the implementation of effective legal measures for the protection of women from IPV, is required to reduce the considerable burden of mental disorder associated with this form of violence.

Data availability statement

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

Author contributions

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

Conflict of interest

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

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsoc.2023.1125771/full#supplementary-material>

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Exposure, perceived risk, and psychological distress among general population during the COVID-19 lockdown in Wuhan, China

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Introduction: The COVID-19 pandemic that has been going on since the end of 2019 impacts people on both the physical and psychological levels. However, the psychological status, especially its underlying psychosocial mechanisms among the general population in Wuhan, the earliest epicenter and hardest-hit city in China during the pandemic, has not been well investigated. This study aimed to examine the relationships between exposures, perceived risk, and psychological distress among the general population in Wuhan during the COVID-19 lockdown.

Methods: Data were from a cross-sectional online survey conducted from 20 February to 4 March 2020. Final analyses included 4,234 Wuhan respondents. A 5-item Hopkins Symptom Checklist was adopted to assess respondents' psychological distress.

Results: It was found that nervousness, fear, and worry were the most common symptoms among Wuhan residents during the lockdown. Exposure within a close physical distance, exposure within the social network, and perceived risk are significantly positively related to respondents' psychological distress. Moreover, perceived risk mediated the effects of exposures on respondents' psychological condition.

Discussion: These findings conduce to identify the populations at higher risk of suffering psychological disturbance during the pandemic and are expected to inform the policymakers and mental health professionals to monitor and improve the perception of risk among the target population by appropriate interventions.

KEYWORDS

COVID-19, psychological distress, exposure, perceived risk, general population, Wuhan lockdown

Introduction

Since the first batch of cases was confirmed in late December 2019 in Wuhan, the provincial capital of Hubei Province in China, the impact of Coronavirus Disease 2019 (COVID-19) has been ongoing for more than 3 years. Currently, there have been more than 750 million confirmed cases and over 6.8 million deaths reported to WHO (1).

From the outbreak in Wuhan, the Chinese government undertook unprecedented measures, including travel restrictions and quarantines to reduce and prevent transmission (2). Wuhan, a city with more than 13 million regular residents, implemented a 76-day lockdown from 23

January to 8 April 2020. Such strict control measures were certified to efficiently contain the virus (3, 4). To date, there is considerable research into the psychological consequences caused by this precipitate pandemic and relevant responses, among which the mental health of frontline healthcare workers and vulnerable groups (like college students) received sufficient attention (5, 6). However, very few studies have focused on the mental wellbeing of the general population in Wuhan during the lockdown (7). Under this circumstance, the present study attempted to (1) describe the psychological distress experienced by the general population in Wuhan; and (2) explore the potential psychosocial mechanism leading to distress. Findings are expected to facilitate the identification of high-risk groups and the provision of effective mental health services in cities with large populations like Wuhan when confronting a similar emergency pandemic.

COVID-19 pandemic and its psychological impacts

Instant and long-term mental health concerns are common responses to the COVID-19 pandemic (8, 9). Two meta-analyses revealed that the pandemic increases the prevalence of stress, depression, anxiety, and insomnia (10, 11). COVID-19 patients, patients with preexisting psychiatric symptoms, and healthcare workers were found to suffer from poorer mental health conditions (12). In general population, female gender, younger age, chronic illnesses, unemployment, student status, and frequent exposure to social media/news concerning COVID-19 were significant correlates linked to mental distress (13). Psychological resources, such as personalized psychological flexibility, resilience, and extraversion were found to act as mediators when explaining the psychological distress among the general population (14, 15). In summary, descriptive epidemiological studies on this topic are predominant, while research on specific psychosocial mechanisms behind mental health problems, especially the interaction between objective and subjective factors among the general population during this pandemic is in its infancy (12, 16).

In China, numerous studies are carried out since the Wuhan outbreak to facilitate mental health treatment and care during the pandemic (17, 18). Despite the various sample size and measuring tools, these studies reached a consensus that mental health symptoms were common among the general population in China during the COVID-19 outbreak. Individuals' characteristics, such as gender, age, education, occupation, and geographical location were found to be significantly associated with mental wellbeing (19–22). In particular, residents in Hubei Province had increased odds of mental health symptoms such as depression, anxiety, and posttraumatic stress symptoms (23–25). Nonetheless, there are hardly any studies focused on the psychological status of the general population living in Wuhan, who were exposed to a huge risk of infection in the earliest epicenter of the COVID-19 outbreak in China.

Exposure to COVID-19 and psychological distress

COVID-19 is an infectious disease that is easily transmitted and rapidly spreading. That means, exposure to COVID-19, no matter by

contacting with an infected object or environment, or by human-to-human approach in a family or community, has a degree of risk of getting infected (26). Existing evidence suggested that exposure to infectious diseases of the respiratory system is closely associated with individuals' mental health outcomes, among which the frontline healthcare practitioners obtained more academic attention (27). For instance, Wu et al. (28) revealed that hospital employees who worked in high-risk locations or had friends or close relatives who were contracted, were more likely to exhibit posttraumatic stress symptoms during the SARS epidemic in Beijing, China. In a Korean study, medical staff who were engaged in MERS-related tasks had highest risk to exhibit post-traumatic stress disorder symptoms (29).

Jiang et al. (30) conducted a similar study among the general population in China. They cited an official guiding principle of emergent psychological crisis intervention and divided the participants recruited by social media into four groups. The participants ranged from level 1 (patients with severe symptoms of COVID-19, frontline medical workers, CDC researchers, or administrative staff) to level 4 (people in affected areas, susceptible groups, or the general public). They found that exposure level was significantly linked to participants' post-traumatic stress symptoms (PTS) only in the mildly PTS symptom subgroup, rather than the moderate and high PTS symptoms subgroups.

As suggested in prior studies, exposure to infectious diseases such as COVID-19 is uneven across different populations. Social and environmental factors contribute to shaping people's exposure risk (31). In addition to the occupational factor mentioned earlier, geographical location is also closely related to the individual's exposure. In China, Wuhan is the first city that reported confirmed cases of COVID-19 at the end of 2019, most of which had exposure history of Huanan Seafood Wholesale Market. On 20 January, the Wuhan government declared that a headquarters of epidemic prevention and control was set up. On 23 January, the headquarters announced that channels to leave Wuhan by airport or railway stations would be temporarily closed, and the residents should not leave Wuhan if not necessary (32). As of 24:00 on 9 February, there were a total of 35,982 confirmed cases in China, of which 16,902 cases were reported in Wuhan (33). On 10 February, the headquarters proclaimed that closed-off management would be carried out among all of the housing estates in Wuhan to reduce the contact of people and interrupt the transmission of COVID-19 (34). In the meantime, residents were required to stay at home and avoid visiting public places. Residential buildings which had confirmed or suspected cases of COVID-19 were strictly monitored and managed.

Although these strict measures were implemented in succession and the occupational exposure among the general population was far less than that among healthcare workers, residents inevitably experienced other forms of exposure to COVID-19 outbreak events, such as having a family member or friend who was infected. In a study based on the nationwide sample, 1.1% of the respondents had at least one family member or friend who was infected with COVID-19 (25). In an online study conducted among the general population in Hubei Province (Wuhan residents accounted for nearly half of the sample), there were 17.9% of the respondents who were familiar with someone who had COVID-19, of which three quarters revealed that a familiar relationship was friendship (23). Accordingly, we believed that this situation was not uncommon among Wuhan residents, since there were approximately half of the confirmed cases across the country

reported in Wuhan at that time, suggesting a necessity to examine its psychological impact.

Thus far, little is known about the mechanism between exposure and psychological status among the general population in Wuhan, the hardest-hit city in China. In addition, exposure to COVID-19 has different levels, which are not fully addressed in the most existing literature. Given that the general population were required to stay at home and strictly keep social distancing during the Wuhan lockdown, exposure could be divided into two categories: exposure within a certain physical distance and exposure within the social network. The former refers to having a family member living together, a neighbor living in the same building, or a resident living in the same housing estate, who contracted COVID-19. The latter includes having family members not living together or people in the social network (such as friends, colleagues, and acquaintances) who contracted COVID-19. In other words, exposure at a certain physical distance means a degree of direct infection risk, while exposure in the social network indicates the possible prevalence of the disease. Because COVID-19 is highly infectious, exposure in or out of a certain physical distance might have different impacts on individuals' psychological status at the beginning of the outbreak, when the knowledge of the virus and medical materials were extremely limited. To distinguish different levels of exposure among the general population in Wuhan and evaluate their impacts, we propose the first set of hypotheses as follows:

Hypothesis 1a: Exposure to COVID-19 within a close physical distance is positively associated with psychological distress among the general population in Wuhan.

Hypothesis 1b: Exposure to COVID-19 within the social network is positively associated with psychological distress among the general population in Wuhan.

Perceived risk of COVID-19 and psychological distress

In addition to the objective exposure experiences, people's attitudes, feelings, and perceptions are also closely related to their psychological outcomes when confronting different kinds of crisis events (35–37). Risk perception refers to people's subjective judgments about the likelihood of negative occurrences, including injury, illness, disease, and death (38). There is a body of work suggesting that perceived risk is a salient factor linked to mental health outcomes among healthcare workers or the general population during some infectious disease outbreaks. A systematic and thematic review demonstrated that perceived risk was significantly linked to the psychological wellbeing among healthcare employees during the SARS crisis (39). Jalloh et al. (40) revealed that risk perception was independently associated with anxiety-depression and PTSD symptoms in the general population in an African country affected by the Ebola pandemic.

A handful of existing studies examined the relations between the perceived risk of COVID-19 and an individual's mental health. Yildirim et al. (41) found that perceived risk positively predicted

depression, anxiety, and stress among 204 healthcare professionals who were actively treating patients confirmed with COVID-19 in Turkey. Kim et al. (42) indicated that a higher perceived risk of COVID-19 infection was associated with greater depressive symptoms during the first 6 weeks of quarantine in 221 adults in urban South Africa. Dratva et al. (43) reported that the perceived risk of COVID-19 was significantly associated with general anxiety among Swiss university students.

Similar studies were conducted among the Chinese population, all of which utilized the online questionnaire survey with a sample size ranging from 693 to 2,993 (44–46). The perceived risk of COVID-19 measured by one or more proxies, such as perceived severity, perceived controllability, perceived risk of infection, affective risk perception, or cognitive risk perception, was revealed to significantly relate to individuals' mental health in existing studies. However, scant attention had been paid to Wuhan residents, who lived in the epicenter of China at the beginning of the pandemic. At that time, the origin of the virus, patterns of spread, therapeutic strategy, and the prognosis of the disease remained unclear. In addition, unprecedented strict measures such as lockdown and closed-off management of intra-city housing estates were implemented consecutively, and more than 30,000 medical practitioners from all over the country were sent to assist the medical system in Wuhan. How Wuhan residents perceive this pandemic in such an uncertain environment and how their perceived risk relates to psychological status have not been fully addressed in previous studies. Therefore, we develop the second hypothesis as follows:

Hypothesis 2: Perceived risk is positively related to psychological distress among the general population in Wuhan.

Furthermore, although people confront the same situation during a crisis like the COVID-19 pandemic, they perceive it in different ways due to knowledge, certainty about the risk, or even individuals' characteristics. Paek and Hove (38) gave an example in the health context, indicating that people are more likely to perceive colon cancer as a highly fatal disease if they have friends or family members who died of it. This point is echoed by a study on the 2003 SARS outbreak in Beijing, indicating that hospital employees who experienced work exposure or any quarantining perceived a greater level of risk, and the perceived risk was significantly associated with PTS symptom level (28). Such mediating effects of individuals' subjective perception between the objective exposure experience and mental health outcome, demonstrated in the aforementioned study, were rarely examined among the existing studies on COVID-19. Having a family member, relative, friend, or neighbor who was infected with COVID-19 was not infrequent among the general population in Wuhan. Whether such exposure experience shapes residents' perceived risk and thereby indirectly affects their mental health status needs to be further elucidated. Furthermore, people may have different perceptions of risk when they encounter different levels of exposure. Therefore, drawing lessons from the previous empirical evidence, we propose the third set of hypotheses:

Hypothesis 3a: Perceived risk mediates the relationship between exposure to COVID-19 at a certain physical distance and psychological distress among the general population in Wuhan.

Hypothesis 3b: Perceived risk mediates the relationship between exposure to COVID-19 in the social network and psychological distress among the general population in Wuhan.

To sum up, this study had three goals: to evaluate the psychological distress among the general population during the Wuhan lockdown; to explore the relations between two levels of exposure to the COVID-19 outbreak and psychological distress; and to examine the mediating effect of perceived risk between exposure and psychological distress. To the best of our knowledge, this study was one of the first attempts to investigate the psychological impacts of COVID-19 based on a relatively large Wuhan sample.

Methods

Research design and sample

Data were retrieved from the Community Life Survey among General Population in Wuhan during the COVID-19 Outbreak, which was jointly carried out by researchers at the Zhongnan University of Economics and Law, the Hong Kong University of Science and Technology, and the Huazhong University of Science and Technology. The formal survey was conducted from 20 February to 4 March 2020, around a month after Wuhan implementing lockdown. The survey was implemented in three steps. First, we issued online recruitment notices in colleges and universities in Wuhan, setting criteria for investigators: adult and living in Wuhan at that time. More than 300 students submitted the entry form. We interviewed them and finally selected 149 investigators covering all 13 administrative districts in Wuhan, during which we considered the population size of each district. Second, a pilot study was carried out from 10 to 19 February, according to which the questionnaire was refined and finalized. Then, the investigators were strictly trained in the online meeting to ensure that they could offer the necessary assistance to their respondents.

The sampling approach of this online survey differed from most similar studies conducted simultaneously in China, that is, eligible respondents were accessed by investigators proactively. Several inclusion criteria about the respondents were set in advance: lived in Wuhan during the COVID-19 outbreak; one respondent in one household (household was defined by the independent right of property); and gender balance as much as possible. We required investigators to note the age structure of potential respondents. For instance, respondents should cover youth, middle-aged people, and old people. We did not prescribe any limits to the personal relationship between the investigator and his/her interviewees.

An online questionnaire was adopted in this survey. Each investigator was assigned a personal account so that the questionnaire that responded under this account could be easily tracked. To ensure the authenticity of the survey and the data quality, we forbade the investigators to share the questionnaire link on social network platforms (such as WeChat group and WeChat moment which were widely used in China) and required them to communicate with each potential respondent by communication tools (such as telephone and WeChat) before sending the questionnaire. Respondents were informed of the objective and the content of this survey. The website link and password of the questionnaire were sent to the respondents after obtaining their consent. Respondents were asked to directly

submit the questionnaire online once completed. Every investigator was required to send out at least 15 questionnaires, but we did not propose an upper limit on the number of questionnaires for every investigator. We terminated the survey when the sample covered all districts in Wuhan, with 4,267 completed questionnaires. To examine the quality of the survey, we randomly selected some respondents and paid a return visit to them by telephone. In the final analyses, a total of 4,234 respondents were included. This study was approved by the Ethics Committee of Zhongnan University of Economics and Law.

Measures

Psychological distress

We assessed the respondents' psychological distress using the 5-item Hopkins Symptom Checklist (HSCL-5), which was a screening instrument to measure the symptoms of anxiety and depression (47, 48). Respondents were required to describe how often they have felt nervous/fearful/blue/worried too much/hopeless about the future during the past week. Five response options, including rarely or none of the time (less than 1 day), some or a little of the time (1–2 days), occasionally or a moderate amount of time (3–4 days), frequently or most of the time (5–6 days), and all of the time (7 days), were scored 1 to 5 successively. We totaled up the score of each item and the higher total score indicated a higher level of psychological distress. HSCL-5 in this study had good reliability and the Cronbach's alpha was 0.9139.

Exposure to the COVID-19 outbreak

Respondents were asked if there was anyone around them infected with COVID-19 by five questions. We established two proxies to indicate two types of COVID-19 outbreak event exposures. One was the exposure within a close physical distance if respondents' kinsfolk who was living together, resident who lived in the same building, or resident who lived in the same housing estate were infected (no = 0, yes = 1); another was the exposure within the social network, indicating respondents' kinsfolk who was not living together or friend/schoolmate/colleague were infected (no = 0, yes = 1).

Perceived risk

Given that COVID-19 is highly contagious, we adopted a single question to assess respondents' perception of pandemic-related risk: "Are you worried about yourself getting infected with COVID-19", on a 5-point Likert scale, ranging from 1 (not at all worried) to 5 (extremely worried). Perceived risk was considered a continuous variable in subsequent analysis. We utilized mean value imputation to deal with its slight missing data ($N=4,175$).

Socio-demographic characteristics

Respondents' socio-demographic information, including gender, age, education level, marriage, employment status, and self-report family social economic status (SES), was obtained in the survey.

Statistical analyses

Random iterative method (RIM) weighting was utilized to deal with the potential sampling bias. RIM weighting allows researchers to weigh each variable as an individual entity to ensure that each data

point is accurately represented while keeping the characteristics proportionate as a whole (49). Given that the investigators in our online survey were students from colleges and universities, the unweighted sample was relatively young and well-educated. Weight factors were generated and applied to the sample such that the weighted sample matched the two independent distributions, that is, age and education status (50). Subsequent analyses were conducted in weighted data.

We used descriptive analyses to summarize the characteristics of the sample. T-tests and ANOVA were adopted to examine whether psychological distress was different across disparate groups in one category. Pairwise comparisons of HSCL-5 mean score between any two groups in one category were conducted using the Scheffé approach (51). Then, we performed the multivariate linear regressions to explore the relations among exposures, perceived risk, and psychological distress. Models 1 and 2 examined the effects of exposure within a close physical distance and within the social network on psychological distress, respectively, and Model 3 simultaneously adopted two kinds of exposures. Finally, we employed the mediating effect analyses to investigate the mediating effect of perceived risk between exposures and psychological distress. Sobel–Goodman tests were utilized to examine whether the mediating effects were significant (52, 53).

Results

The mean total score of HSCL-5 was 11.95 ($SD=5.51$). Nervousness, fear, and excessive worry were found to be the most common symptoms among Wuhan residents. There were 11.81% and 10.42% of the respondents who felt nervous and fearful all of the time. Although confronting the unprecedentedly tough situation, more than half of the respondents (54.25%) did not feel hopeless about the future.

Table 1 shows the respondents' socio-demographic characteristics. Of the sample, there were more female than male respondents. The mean age was 37.17 ($SD=14.66$). More than half of the respondents held a bachelor's or above degree. Nearly 60% of the respondents were married; 51.61% of the respondents were at work and 11.93% of the respondents were out of work. Half of the respondents regarded that their family SES was on the middle level. With respect to the explanatory variables, almost 70% of the respondents confirmed that they were confronting the exposure within a close physical distance, and nearly 40% of the respondents reported that they were encountering the exposure within the social network. The overwhelming majority of the respondents were worried about themselves getting infected with COVID-19.

Table 1 also presents the mean score of HSCL-5 in different categories among respondents. *p*-values showed that except for the education status, the remaining five socio-demographic factors and three explanatory factors were significantly associated with a mean score of HSCL-5. Results of pairwise comparisons demonstrated the significant differences between any two groups in one category. For instance, the HSCL-5 mean scores of respondents who were in work were significantly lower than respondents who were out of work, while the mean scores of respondents who were in work did not significantly differ from respondents who were retired. The mean score of respondents whose family SES was middle level was not significantly different from that of respondents whose SES was above the middle level. Education was not included in subsequent regression analyses,

because its correlation with respondents' psychological distress was not significant, it was not included in subsequent regression analyses. Two exposure-related variables and perceived risk were significantly linked to respondents' psychological distress, indicating the necessity to conduct further regression analysis.

Table 2 shows the results of three regression models, controlling for gender, age, marriage, employment status, and self-report family SES. Model 1 was the psychological distress regressed on exposure within a close physical distance and perceived risk, Model 2 was the psychological distress regressed on exposure within the social network and perceived risk, and Model 3 included two types of exposures and perceived risk. Regression results showed that female respondents were more likely to suffer psychological distress than male respondents. Compared to respondents in work, respondents who were out of work in our sample were more likely to experience psychological distress. Students had better mental health status, which was significant on the 0.1 level. Retirees also had a lower risk of suffering psychological distress compared to respondents in work, although it was not statistically significant. Compared to the respondents who regarded their families as below the middle level in society, the mental health condition of respondents who regarded their families as the middle level or above was significantly better. Age group and marriage were not significantly linked to respondents' psychological distress.

As expected, Hypotheses 1a, 1b, and 2 were supported by empirical data. To be specific, exposures, no matter whether within a close physical distance or within the social network, were saliently linked to respondents' psychological distress. Perceived risk was significantly positively associated with psychological distress, that is, the more worried about getting infected with COVID-19, the worse the mental health status. In Model 3, the standard coefficient of exposure within the social network was slightly larger, indicating that its effect was slightly stronger than the exposure within a close physical distance on psychological distress. Moreover, the variance inflation factor (<10) displayed in the last column of Table 2 indicated that there were no obvious collinearity problems in these regression models.

Then, we examined the mediating effects of perceived risk between exposures and respondents' psychological distress, controlling for gender, age, marriage, employment, and self-report family SES. The main findings are displayed in Figure 1. As for the relationship between exposure within a close physical distance and psychological distress, the direct effect was 0.8712 and the indirect effect was 0.2916. The mediating effect of perceived risk was statistically significant with 25.08% of the total effect being mediated. With regard to the relationship between exposure within the social network and psychological distress, the direct effect was 0.9033 and the indirect effect was 0.1968. The mediating effect of perceived risk was of statistical significance, with 17.89% of the total effect being mediated. Hypotheses 3a and 3b were confirmed.

Discussion

Main findings and implications

The current study focuses on the psychological distress among the general population in Wuhan, who lived in the earliest epicenter of the COVID-19 outbreak and experienced the unprecedented lockdown. According to an online questionnaire survey, we collected valid data

TABLE 1 Descriptive statistics of individual characteristics and psychological distress in different categories among Wuhan residents ($N=4,234$).

	N (%)	<i>p</i> value	Mean score of HSCL-5
<i>Gender</i>			
Male	1821 (43.01)	0.000	11.34
Female	2,413 (56.99)		12.41
<i>Age</i>			
< 30	1,570 (37.08)	0.006	11.27 _a
30–60	2077 (49.06)		12.39 _b
>60	587 (13.86)		12.21 _b
<i>Education</i>			
Primary school or below	55 (1.30)	0.151	12.56
Junior secondary school	377 (8.90)		12.11
Senior secondary school	750 (17.71)		12.21
Junior college	884 (20.88)		12.07
Bachelor degree or above	2,168 (51.20)		11.77
<i>Marriage</i>			
Unmarried	1,580 (37.32)	0.001	11.30 _a
Married	2,438 (57.58)		12.33 _b
Others	216 (5.10)		12.43 _b
<i>Employment status</i>			
In work	2,185 (51.61)	0.002	12.17 _a
Out of work	505 (11.93)		13.15 _b
Student	1,126 (26.59)		11.03 _c
Retirement	418 (9.87)		11.85 _a
<i>Self-report family SES</i>			
Below the middle level	1806 (42.65)	0.004	12.54 _a
Middle level	2,117 (50.00)		11.53 _b
Above the middle level	311 (7.35)		11.41 _b
<i>Exposure within close physical distance</i>			
Yes	2,943 (69.51)	0.000	12.31
No	1,291 (30.49)		11.13
<i>Exposure within social network</i>			
Yes	1,618 (38.21)	0.000	12.64
No	2,616 (61.79)		11.53
<i>Perceived risk</i>			
Not at all worried	589 (14.11)	0.000	9.29 _a
Slightly worried	767 (18.37)		10.93 _b
Moderately worried	1,430 (34.25)		11.74 _c
Very worried	614 (14.71)		12.61 _d
Extremely worried	775 (18.56)		14.66 _e

p-values in the third column were obtained by *T*-test (for binary variables: gender and two exposure factors) and ANOVA (for multinomial variables). Subscripted lowercase letters (a, b, c, d, e) in the fourth column represented the results of pairwise comparisons of the mean total score of HSCL-5. The same letters meant that the difference between any two disparate groups in one category was not statistically significant, while the different letters meant significant differences at 0.001, 0.01, or 0.05 levels.

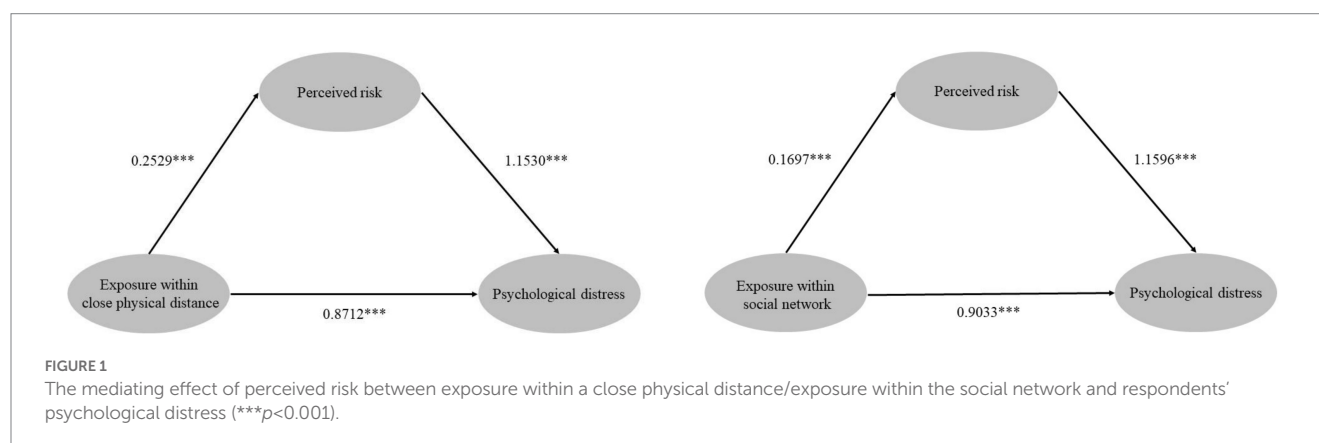
from 4,234 respondents. We found that nervousness, fear, and worry were the most common symptoms among Wuhan residents, while depressed feeling was relatively less prevalent. Although confronting an extremely tough situation during the early outbreak, most of the respondents did not feel hopeless about the future.

We also investigated the exposure to the COVID-19 outbreak among the general population in Wuhan, by asking them if there were anyone physically close to them or in their social network who had contracted the virus. In our sample, nearly 70% of the respondents reported that their families who lived together and the residents who

TABLE 2 Results of three multivariate linear regressions ($N=4,234$).

	Model 1	Model 2	Model 3	Model 3
	Coefficient	Coefficient	Coefficient	Standardized coefficient
<i>Gender (Male = 0)</i>				
Female	0.9517***	0.9622***	0.9387***	0.0845***
<i>Age (<30 = 0)</i>				
30–60	0.4179	0.4024	0.3631	0.0330
>60	0.4541	0.4576	0.4342	0.0272
<i>Marriage (Unmarried = 0)</i>				
Married	−0.0508	−0.0276	−0.0374	−0.0034
Others	0.0580	0.0072	0.0403	0.0016
<i>Employment (In work = 0)</i>				
Out of work	0.8110**	0.7970**	0.8771**	0.0516**
Student	−0.5473 [‡]	−0.5065 [‡]	−0.5017 [‡]	−0.0404 [‡]
Retirement	−0.4199	−0.4237	−0.4295	−0.0232
<i>Self-report family SES (Below the middle level = 0)</i>				
Middle level	−0.7610***	−0.7690***	−0.7987***	−0.0727***
Above the middle level	−0.6901*	−0.6509*	−0.7247*	−0.0345*
<i>Exposure within close physical distance (No = 0)</i>				
Yes	0.8712***		0.7210***	0.0605***
<i>Exposure within social network (No = 0)</i>				
Yes		0.9033***	0.7782***	0.0687***
Perceived risk	1.1530***	1.1596***	1.1390***	0.2651***
Constant	7.5309***	7.7544***	7.4152***	
Adjusted R^2	0.1087	0.1098	0.1130	0.1130
Variance inflation factor	1.93	1.93	1.87	1.87

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; [‡] $p < 0.1$.



lived in the same building or the same housing estate were infected. In addition, there were approximately 40% of the respondents reported that their families who were not living together or their friends/schoolmate/colleagues were infected. Even though the exposures in our study were self-reported, these findings contributed to the current knowledge of the prevalence of COVID-19 in Wuhan

from the perspective of local residents. Moreover, although the social and economic consequences of this pandemic are far-reaching, people's perceptions of the same situation are divergent. In our sample, less than 15% of the respondents were not worried about contracting the coronavirus at all, and nearly 20% of the respondents were extremely worried about getting infected.

We performed multivariate linear regressions to explore the correlates of psychological distress among Wuhan residents. Female respondents were more likely to experience psychological distress, which was consistent with the results of previous studies with a national sample, even though we utilized different measuring tools for mental health outcomes (21, 22). Compared with the respondents who were at work, those who were out of work were more vulnerable to poor mental health, which was in accordance with a previous study (54). Students had better mental health on the 0.1 level, which differed from the finding of Wang et al. (22). In the research of Wang et al. (22), student status was significantly associated with a greater psychological impact of the outbreak and higher levels of stress, anxiety, and depression. The possible reason is that the surveys were conducted at different time points and distinct measuring tools were adopted. We found that higher family SES was a protective factor of people's mental health status during the pandemic. Those Wuhan residents who regarded their family SES as the underclass were at higher risk of psychological distress. These findings may assist policymakers in accurately identifying people who are more susceptible to psychological disturbance and providing essential mental health services to target populations during and after the pandemic in time.

As Hypotheses 1a and 1b suggested, exposure within a close physical distance and exposure within the social network were significantly associated with psychological distress among Wuhan residents independently. This result was partly in accordance with a national online survey study involving all 34 province-level regions in China, indicating that people who had a relative with confirmed or suspected COVID-19 were more likely to have negative mental health outcomes (25). However, this study did not distinguish the disparate types of exposure and failed to compare their effects consequently.

We included two types of exposures simultaneously in one linear regression model (Model 3), finding that the standard coefficient of exposure within the social network was slightly larger than that of exposure within a close physical distance. An Individual's social network size is usually larger than the size of his/her kinship (55, 56). To some extent, more exposure within the social network meant that the infectivity and severity of COVID-19 were great and uncontrollable, which might cause more panic and distress among residents directly. Hypotheses 2, 3a, and 3b, focusing on the direct and mediating effects of perceived risk on Wuhan residents' psychological distress, were all confirmed by empirical data. Respondents who were exposed to COVID-19 were more likely to be worried about being contracted, and those who were more worried exhibited more distress. What is noteworthy is that perceived risk mediated more of the total effect of exposure within a close physical distance on psychological distress than that of the exposure within the social network (25.08 vs. 17.89%) in our study. This finding was consistent with the contagious nature of COVID-19, which can rapidly transmit within the family and the community (57). Infected family members who were living together or infected residents who lived in the same building or the same housing estate enabled respondents to perceive a higher risk of getting infected, and then to express more distress. The mediating effect of the perceived risk between exposure within the social network and psychological distress was relatively weaker.

We argue that demonstrating the interaction between objective exposures to the COVID-19 outbreak and subjective perception of risk on psychological distress among the general population in Wuhan is a distinct contribution of the present study. Perceived risk is

associated with a greater likelihood of engagement in preventive behaviors, such as wearing the mask, avoidance of public transportation, frequent handwashing, COVID-19 testing, and vaccination (58, 59). Understanding the complicated mechanisms between inevitable exposures, psychosocial factors, and an individual's mental wellbeing during the pandemic is beneficial to increase preparedness for the unforeseeable future outbreak and other public health crises. However, given the negative impact of perceived risk on an individual's psychological outcome, the governmental sector and healthcare institutions have obligation to apply the appropriate health communication strategy, medium, and tool to allay the fears and maintain the perceived risk at a moderate level. Diversity of exposure level and risk perception across different social groups should be taken into consideration when designing and delivering health education and crisis intervention program. Moreover, people's exposure and risk perception vary across different stages of the pandemic, which should be fully considered by policymakers.

Limitations and future directions

This study has the following limitations. First, our sample was obtained from the social networks of the investigators recruited from colleges and universities in Wuhan, which might explain that around 27% of the respondents were students, even if this number was much smaller than that in similar studies (60). Hence, we collected data using the web-based questionnaire survey, implying that only those residents who were accessed by our investigators and who were able to answer the questions subjectively and objectively (e.g., can use a computer or smartphone), were sampled in our survey. Unlike other similar studies, we did not release the questionnaire directly on the social network platform to assure the survey quality. We also used the Random Iterative Method weighting to minimize the sampling bias in analyses.

Although the nonrandom sampling prevented statistical inference from the sample to the whole population, our study provided valuable information about the real situation among Wuhan residents, who lived in the city that was most severely hit by this pandemic. The online survey was one of the most appropriate options to timely collect valid information in such an emergent period that the new infectious disease caused panic and anxiety widely. Second, although we found that exposure to the COVID-19 outbreak and perceived risk were significantly associated with Wuhan residents' psychological distress, it should be cautious to establish a causal relationship due to the cross-sectional design. Large-scale longitudinal research based on random sampling is needed to address the long-term psychological impacts of this pandemic.

Last but not the least, even though the present study provided a psychosocial perspective to understand the psychological distress of Wuhan residents, a more comprehensive theoretical model and multidimensional measurements should be adopted in future work. For instance, exposure to the pandemic is diversiform, containing but not limited to occupational exposure, media exposure, and family or community sources of exposure. People may experience one or more exposures during the pandemic. Considering that the lockdown and closed-off management of housing estates were strictly implemented in Wuhan and the whole city nearly ceased to function when the survey was carried out, we merely evaluated two types of exposures

among the general population (exposure within a certain physical distance vs. exposure within the social network), which were not underlined in previous studies. In addition, considering that the perceived risk of infection was of most concern during the pandemic, we enrolled it as the indicator of perceived risk. Future studies should seek to reveal the complicated mechanisms between different types of exposures, multifaceted risk perceptions, and individuals' mental health outcomes, using more integrated statistical instruments.

Moreover, we utilized HSCL-5, an economical symptom assessment measure instead of the scales with dozens of items to evaluate the mental health consequence among Wuhan residents. Our concern was that the lengthy questionnaire might negatively affect the quality of answers during that rattled time. Although HSCL-5 had good internal consistency in the present study, combining the screening tool with the diagnostic tool to accurately assess the mental health outcome of people affected by the pandemic is of significance in future studies.

Conclusion

In conclusion, based on the data collected by an online questionnaire survey, the present study described the psychological distress exhibited by the general population in Wuhan during the COVID-19 lockdown. Nervousness, fear, and worry were found to be common among Wuhan residents. More importantly, the present study was among the first to elucidate the underlying mechanism between COVID-19 exposures, perceived risk, and psychological distress in the general population in Wuhan. Exposure, no matter within a close physical distance or social network, was significantly linked to psychological distress. Perceived risk was not only directly associated with psychological distress but also mediated the effects of exposures. These findings highlight the necessity to include the psychosocial perspective in the emergency response and risk management system during the public health crisis, especially in the early stage when people are easy to panic. To cope with potential waves of the COVID-19 outbreak and similar pandemics in future, health education and crisis intervention focused on the perception among different social groups are expected to design and deliver based on valid empirical evidence.

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Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: data are available from the authors upon reasonable request and with permission of the project group of Community Life Survey among General Population in Wuhan during COVID-19 Outbreak. Requests to access these datasets should be directed to shizhilei2004@126.com.

Author contributions

YL and ZS jointly framed the idea, developed the initial structure of the article, and finalized the manuscript. YL wrote the first draft. ZS revised the draft. LL took part in the revision of the introduction, methods, and discussion. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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Depression symptoms, anxiety, and stress among undergraduate entrance admission seeking students in Bangladesh: a cross-sectional study

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Background: Intense academic pressure and unhealthy competition have turned the university entrance exam scenario in Bangladesh into a Pandora's Box, which might cause mental health difficulties among young students. However, there is a severe scarcity of studies concerning such issues of university entrance examination-seeking students in Bangladesh.

Methods: This study aimed to assess the prevalence and associated factors of depression symptoms, anxiety, and stress among undergraduate entrance admission-seeking students in Bangladesh. A cross-sectional study design was followed using an online tool including socio-demographic questions, and the 21-item Bangla Depression, Anxiety and Stress Scale (BDASS-21). The survey form was completed by 452 Bangladeshi students who passed the higher secondary certificate (HSC) examination in 2020 and were planning to get admission to the undergraduate level during the data collection.

Results: The prevalence of mild to extremely severe levels of depression symptoms, anxiety, and stress was 57.7%, 61.4%, and 44.6%, respectively. Females were more likely to have depression, anxiety, and stress symptoms than males. The students from science backgrounds were at higher risk of developing depression and stress symptoms when compared with students from business studies backgrounds. Besides, students with a previous history of mental illness, a preference for getting admitted into the public university, and less monthly family income (<25,000 BDT) were more likely to develop depression, anxiety, and stress symptoms. In addition, students with a previous history of neurological disorders were more likely to develop anxiety symptoms than those without.

Conclusion: This study revealed a high level of depression, anxiety, and stress symptoms among undergraduate entrance admission-seeking students, which calls for in-depth exploratory investigations. Adequate low-intensity interventions should be designed to support this young population.

KEYWORDS

depression, anxiety, stress, university admission, young students, Bangladesh

Background

Mental health concerns are emerging as a significant public health challenge in low- and middle-income countries such as Bangladesh (1). According to a systematic review, the prevalence of mental disorders in Bangladesh ranged from 6.5 to 31.0% for adults (18–65 years), and 13.4 to 22.9% for children (5–17 years) (2). And to make it worse, mental health services in Bangladesh are severely compromised due to a lack of skilled mental health professionals. The Bangladesh government only spends 0.44% of its overall health budget on mental health. Only 0.11% of people have free access to the necessary psychiatric help (3).

Students' mental health is a legitimate concern all over the world. Globally students have a high prevalence of depression, anxiety, and stress symptoms (4–7). These can have a detrimental effect on the individual. The examination can be a source of anxiety for students who are preparing for the university entrance examination. Students in Turkey were found with a high prevalence of university entrance test anxiety which is around 48.1% (8). Exams can become a major cause of stress, especially when they function as a criterion for future prospects and professional paths (9, 10). Exam-related anxiety and stress have a negative impact on student's academic performance, physical health and development, and quality of life (4). Bangladeshi youths were found with a negative impact on their mental health in terms of stress, anxiety, and depression due to examination (11). In Bangladesh, university entrance examinations are particularly important and also have a significant impact on career choices. Students preparing for these exams are trained in private educational institutions. They set aside an expenditure for it based on socioeconomic capabilities.

The university entrance exam in Bangladesh is a competitive examination where the students who have completed their secondary and higher secondary studies need to seat for competitive tests to get selected for their desired educational institution. Each undergraduate university conducts the examinations separately and the students need to prepare themselves rigorously for these tests. However, universities can only admit a small number of students who are meritoriously qualified in the entrance tests due to very limited seats (about 51-thousand seats in public universities) (12). These create overwhelming challenges for them considering the time they receive to get prepared. Subsequently, students who are preparing for such a challenging entrance examination go through a major change in their lifestyle.

In the year 2020, Bangladeshi government was unable to organize the Higher Secondary Certificate (HSC) and equivalent exams due to the COVID-19 pandemic. Hence, all 13, 67,377 students who took the HSC or an equivalent exam were successful in obtaining their certificates without the formal examination process. About 11.83 % of these students earned a GPA-5 of (Grade Point Average—5, highest GPA), nearly tripling the percentage from the previous year (13). The undergraduate entrance admission-seeking candidates had to wait longer than usual because of the pandemic stresses and altered administration decisions. This potentially resulted in heightened mental health difficulties among the students. Additionally, this specific cohort of students faced social neglect by the neighbors and even family members as they

received the auto pass status without attending the test which might be a factor contributing to their poor mental health (13).

Some studies provided evidence regarding the poor mental health condition of Bangladeshi university students (14, 15). Additionally, Bangladeshi medical students show a very high frequency of depression symptoms, with the COVID-19 pandemic underway, the concerning prevalence and associated variables of depression point to the necessity for follow-up psychological interventions targeted at medical students (16). Safa et al. (17) found that 27.3% of medical students have mild anxiety, 26.8% have moderate anxiety, and 11.8% have severe anxiety.

To the best of the authors' knowledge, there was no such published report at the time of conceptualization of the present study that described the mental health difficulties of university entrance examination-seeking students in Bangladesh. We suspect the effect of the university entrance exam on the mental health of examinees may impact them lifelong, for this phase of their life is one of the most challenging. Thus, the present study aimed to investigate the prevalence and associated factors of depression symptoms, anxiety, and stress among undergraduate entrance admission-seeking students in Bangladesh during a period of global uncertainties and overwhelming challenges.

Methods and materials

Study design and participants

A web-based cross-sectional survey was conducted among undergraduate entrance admission seeking students in Bangladesh from April 25 to July 28, 2021. Data were collected from both male and female Bangladeshi students (18 years and above) who passed the Higher Secondary Certificate (HSC) examination in 2020 and planning to get admission to university settings during the time of the data collection. There was no restriction on which part of the country they belong to or which course they are planning to get admission into. Data was collected through an online survey using the convenience sampling technique.

The sample size is calculated from the prevalence estimate using the following formula (18):

$$n = \frac{z^2 p(1-p)}{d^2}$$

where, n = number of samples, $z = 1.96$ for 95% confidence level (CI), p = "best guess" for prevalence, and d = precision of the prevalence estimate. We assumed that the prevalence of mental health difficulties among undergraduate admission test examinees might be 50%. The calculated sample size was 384 participants. Assuming a 15% non-response rate, we calculated the sample size as 442. However, a total of 466 participants took part in the study. About 14 data were discarded due to incomplete submission. In order to acquire more precise results, 452 data were included in the final analyses.

Measurement tool

The online assessment tools that were used in this survey had three sections. The first section included details of the survey followed by an electronic consent form; the second part consists of socio-demographic variables such as sex, age, education group (Science/Arts/ Business studies), grade point average (GPA) of Secondary School Certificate (SSC) and Higher Secondary Certificate (HSC; later categorized as 4–5 and 3–3.99), residence (rural/urban), desired university type (public/private), family income range, and two additional questions. The first additional question was whether or not the participant had any previous mental disorder-related history. The second additional question was whether or not the participant had any previously diagnosed neurological disorder-related history. The third section includes the validated Bangla version of the Depression, Anxiety, and Stress Scale (DASS-21), which had Cronbach's Alpha scores for Depression, Anxiety, and Stress subscales of 0.987, 0.957, 0.964 for Depression, Anxiety, and Stress subscales respectively (19). The original DASS-21 is a 21-item self-report scale composed of three self-report scales (depression, anxiety, and stress) (20). The DASS-21 indicated satisfactory internal consistency with a Cronbach's alpha score of 0.92 (21). The results of each sub-total scale will fall into one of five categories: minimal, mild, moderate, severe, or extremely severe. It's a four-point Likert scale that considers the activity and feelings of the most recent week. The Bangla DASS-21 is a significant tool for assessing Bangladeshis' psychological wellbeing (22). In the present study, the overall Cronbach's alpha of the DASS-21 scale was 0.96; and the Cronbach's alpha for the depression, anxiety, and stress subscales were 0.92, 0.88, and 0.91, respectively.

Procedure

After getting approval from the *Ethical Review Committee of the Public Health Foundation, Bangladesh (PHF, BD; ref. no. 03/2021)*, the data collection was initiated via online methods using Google Forms owing to considering the pandemic situation. The research team distributed the survey link through social media to participants from all administrative divisions of Bangladesh. The survey link was also shared on social media across numerous university entrance-seeking student forums (e.g., Facebook groups). The survey form of the present study was also uploaded to the Facebook groups of the HSC 2020 batch as they are university admission seekers. It was an open and voluntary survey where no incentives were provided. The technical functionality of the electronic questionnaire was tested before implementing the questionnaire. After giving the electronically written instructions on what to do and ensuring confidentiality, the participants were asked to go through the three parts of the survey form. The procedure followed the Checklist for Reporting Results of Internet E-surveys (CHERRIES) guideline (23). All procedures used in this study follow the ethical standards of the relevant national and institutional human experimentation ethical guidelines and the Helsinki Declaration of 1975, as revised in 2008.

Statistical analysis

Some descriptive analyses (e.g., frequencies, percentages, means, and standard deviations) were performed to determine the characteristics of the participants. The relationship between DASS

TABLE 1 General characteristics of the participants (N = 452).

Variables	n (%)
Sex	
Male	272 (60.18)
Female	180 (39.82)
Age	
18–20 years	400 (88.5)
21–24 years	52 (11.5)
Study major	
Science	220 (48.67)
Arts	157 (34.73)
Business studies	75 (16.59)
HSC GPA	
3–3.99	45 (9.96)
4–5	407 (90.04)
SSC GPA	
3–3.99	43 (9.51)
4–5	409 (90.49)
Preferred university for undergrad	
Public	341 (75.44)
Private	111 (24.56)
Marital status	
Married	48 (10.62)
Unmarried	404 (89.38)
Residence	
Urban	317 (70.13)
Rural	135 (29.87)
Monthly family income	
<25,000	104 (23.01)
25,000–50,000	194 (42.92)
50,001–100,000	131 (28.98)
>100,000	23 (5.09)
Mental disorder history	
Yes	33 (7.3)
No	419 (92.7)
Neurological disorder history (e.g., epilepsy, migraine, Alzheimer's)	
Yes	38 (8.41)
No	414 (91.59)

subscale scores and other studied variables was also predicted using bivariate and multivariable linear regression. The variables that were significant in the bivariate analysis were modeled separately for depression, anxiety, and stress in the multivariable regression analysis. A p -value of 0.05 was deemed significant. Two statistical packages of software (i.e., IBM SPSS Statistics version 25.0 and STATA version 14.0) were used for all types of statistical analyses.

Results

Characteristics of the participants

A total of 452 participants (60.18% males; mean age = 19.31 ± 0.98 years) were included in the final analysis. Of them, most were unmarried (89.38%), and almost half had a science background (48.67%). Sizeable participants expressed their preference to get admitted into public universities (75.44%). Most had Grade Point Average (GPA) between 4 and 5 in their higher secondary certificate exam (90.04%), while nearly equal participants (90.49%) had GPA between 4 and 5 in their secondary school certificate exam. More than one-third (42.92%) had monthly family income between 25,000 and 50,000 BDT (Bangladeshi Taka; \approx 300–600 USD), and nearly three-fourth lived in urban areas (70.13%). A small group of participants reported previous history of mental (7.3%) and neurological (8.41%) disorders (Table 1).

Depression symptoms

The prevalence estimates of mild, moderate, severe, and extremely severe depression were 10.4%, 15.9%, 12.2%, and 19.2%, respectively (Figure 1). As per as multiple linear regression analysis (Table 2), the positively predicting factors of depression score included: (i) being female ($\beta = 0.18$, $p < 0.001$), (ii) having “science” major ($\beta = 0.16$, $p = 0.011$) in reference to “business studies”, (iii) having “public” as preferred university for undergrad ($\beta = 0.18$, $p < 0.001$), and (iv) having mental disorder history ($\beta = 0.19$, $p < 0.001$). Whereas, the negatively predicting factor of depression score was having monthly family income “25,000–50,000 BDT” ($\beta = -0.13$, $p = 0.026$) in reference to “<25,000 BDT.”

Anxiety

The prevalence estimates of mild, moderate, severe, and extremely severe anxiety were 10.2%, 15.3%, 10.2%, and 25.7%, respectively (Figure 1). As per as multiple linear regression analysis (Table 3), the positively predicting factors of anxiety score included: (i) being female ($\beta = 0.22$, $p < 0.001$), (ii) having “public” as the preferred university for undergrad ($\beta = 0.13$, $p < 0.001$), (iii) having mental disorder history ($\beta = 0.22$, $p < 0.001$), and (iv) having neurological disorder history ($\beta = 0.10$, $p = 0.039$). Whereas, the negatively predicting factor of anxiety score was having a monthly family income of “25,000–50,000 BDT” ($\beta = -0.15$, $p = 0.009$) in reference to “<25,000 BDT.”

Stress symptoms

The prevalence estimates of mild, moderate, severe, and extremely severe stress were 9.1%, 13.3%, 16.4%, and 5.8%, respectively (Figure 1). As per as multiple linear regression analysis (Table 4), the positively predicting factors of stress score included: (i) being female ($\beta = 0.22$, $p < 0.001$), (ii) having “science” major ($\beta = 0.14$, $p = 0.021$) in reference to “business studies,” (iii) having “public” as preferred university for undergrad ($\beta = 0.19$, $p < 0.001$), and (iv) having mental disorder history ($\beta = 0.21$, $p < 0.001$). Whereas, the negatively predicting factor of stress score was having monthly family income “25,000–50,000 BDT” ($\beta = -0.19$, $p = 0.001$) in reference to “<25,000 BDT.”

Discussion

The present study aimed to investigate the prevalence of depression symptoms, anxiety, and stress among undergraduate admission-seeking students of Bangladesh and to identify the associated factors related to depression symptoms, stress, and anxiety. According to the responses of undergraduate entrance-seeking participants, 57.7% of students reported mild to extremely severe depression symptoms, 61.4% of students reported mild to extremely severe anxiety, and 44.6% of students reported mild to extremely severe stress (Figure 1), indicating a higher prevalence rate of stress, anxiety, and depression symptoms in comparison with a countrywide study of student mental health in Bangladesh (14). The prevalence of depression, anxiety, and stress among students were lower than a larger spectrum of students in the present study in contrast to the prior Bangladeshi studies (19, 24, 25). This discrepancy in the prevalence rate of our study may be due to the difference in the geographical area or education level of the participants from where they were sampled. Also, the pandemic factor might be played a role in this discrepancy.

We further divided the discussion with relevant subheadings for a clear understanding as follows.

Depression symptoms

A study that estimated the prevalence of depression in Bangladeshi adolescent students discovered that 61.3% of students experienced depression symptoms, which is higher than what we observed in this study. Age range or the use of different scales to assess levels of depression may result in discrepancies in the study findings (26).

Anxiety

The prevalence rate of anxiety was 61.4% among our study participants, indicating a higher prevalence rate of anxiety levels before the undergraduate entrance exam compared to a similar kind of study with the students of Turkey who were going to take the university entrance examination (8).

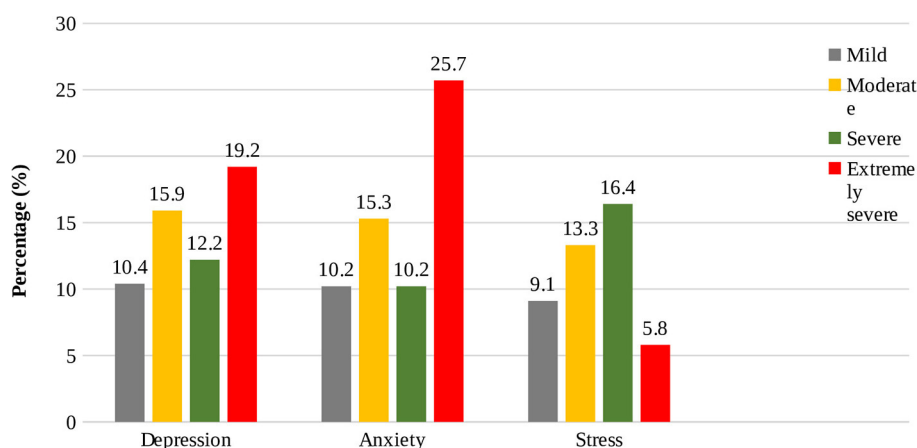


FIGURE 1

The level of respondents ($n = 452$) experiencing varying levels of depression, anxiety, and stress.

Stress

The prevalence of stress in the current study was lower than in one Egyptian study when compared to the prevalence levels of stress using the DASS globally [62.4% (27)] but higher than in another Malaysian study [23.7% (28)].

Severity of symptoms

Our findings reveal that undergraduate admission-seeking students in Bangladesh suffer from serious mental health issues, which is consistent with the findings by Roy et al. (29) that indicated uncertainties regarding academic progress for young individuals can be problematic. This may be higher due to factors such as a lack of social or familial support or both, fears about the future, a toxic psychosocial environment, the extent of the exam curriculum, and the limited amount of preparation time available (4, 30).

Gender

In the present study, females were more likely to have higher depression symptoms, anxiety, and stress scores, which is consistent with the findings of several international studies (28, 31). Possible causes include the enormous rise in teen marriage and gender-based violence against women since the beginning of the pandemic in 2020 (25). This result also loosely supports the study which is conducted with Turkish students, where the female population showed more severe stress symptoms compared to male participants (4) while contradicting few other studies which suggest that male students are more likely than female students to experience a high level of depression, anxiety and stress (32, 33).

Relationship status

The present study showed no significant difference among participants in their depression symptoms, anxiety, and stress levels regarding their marital status, which is somewhat in line with the findings by Marthoenis et al. (34), which found that marital status has no relevance to the occurrence of anxiety symptoms. This result shows disagreement with findings from several studies that claim unmarried people are more likely to experience depression, anxiety, and stress (27, 35), as well as with the findings of Hossain et al. (25) that claimed that being in a committed relationship was found to be a predictor of experiencing higher levels of anxiety and stress.

Academic background

The present findings indicated a higher level of depression and stress scores among the participants studying in the science group compared to students who were from the business studies background, which is slightly consistent with the findings of a prior study conducted with ZagaZig University students that participants in the faculty of pharmacy reported more depression symptoms than students in other faculties (36). Students in the sciences may experience more obstacles and competition, which might lead to mental health issues. This result is in parallel with the findings of several studies conducted among physicians and medical students in Bangladesh, which also indicated the high prevalence of anxiety, stress, and depression symptoms among them (37, 38).

Aim for public vs. private universities

The present study found that students aiming for public universities at their undergrad level have more depression, anxiety, and stress symptoms than those who seek private universities. None of the previous studies investigated this association. This may result from the excessive study load they go through

TABLE 2 Bivariate and multivariable regression analyses by depression score.

Variables	Mean (SD)	Unadjusted estimate					Adjusted estimate				
		<i>B</i>	SE	<i>t</i>	β	<i>p</i> -value	<i>B</i>	SE	<i>t</i>	β	<i>p</i> -value
Sex											
Female	17.76 (12.71)	4.29	1.12	3.84	0.18	<0.001	4.26	1.05	4.05	0.18	<0.001
Male	13.46 (10.86)	Ref.					Ref.				
Age											
21–24 years	17.73 (12.51)	2.89	1.74	1.66	0.08	0.097					
18–20 years	14.84 (11.69)	Ref.						Ref.			
Study major											
Science	17.85 (12.64)	5.06	1.54	3.28	0.21	0.001	3.82	1.49	2.56	0.16	0.011
Arts	12.55 (10.1)	−0.25	1.62	−0.16	−0.01	0.876	0.57	1.57	0.36	0.02	0.720
Business studies	12.8 (10.93)	Ref.					Ref.				
HSC GPA											
4–5	15.53 (11.9)	3.57	1.85	1.93	0.09	0.054					
3–3.99	11.96 (10.47)	Ref.						Ref.			
SSC GPA											
4–5	15.5 (11.97)	3.46	1.89	1.83	0.09	0.068					
3–3.99	12.05 (9.62)	Ref.						Ref.			
Preferred university for undergrad											
Public	16.55 (12.16)	5.59	1.26	4.42	0.02	<0.001	4.93	1.27	3.89	0.18	<0.001
Private	10.95 (9.53)	Ref.					Ref.				
Marital status											
Unmarried	15.52 (11.91)	3.27	1.80	1.82	0.09	0.070					
Married	12.25 (10.56)	Ref.						Ref.			
Residence											
Urban	15.46 (11.93)	0.98	1.21	0.80	0.04	0.422					
Rural	14.49 (11.52)	Ref.						Ref.			
Monthly family income (BDT)											
25,000–50,000	13.16 (11.56)	−4.49	1.42	−3.16	−0.19	0.002	−3.06	1.37	−2.23	−0.13	0.026
50,001–100,000	15.91 (11.61)	−1.75	1.54	−1.14	−0.07	0.257	0.14	1.49	0.10	0.01	0.924
>100,000	16.7 (14.84)	−0.96	2.70	−0.36	−0.02	0.722	−0.22	2.59	−0.09	<-0.01	0.931
<25,000	17.65 (11.3)	Ref.					Ref.				
Mental disorder history											
Yes	23.82 (11.8)	9.33	2.09	4.46	0.21	<0.001	8.74	2.19	3.99	0.19	<0.001
No	14.49 (11.55)	Ref.					Ref.				
Neurological disease history (e.g., epilepsy, migraine, Alzheimer's)											
Yes	19.68 (12.03)	4.93	1.99	2.48	0.12	0.014	1.90	2.03	0.93	0.04	0.352
No	14.76 (11.71)	Ref.					Ref.				

during their admission-seeking days before the undergrad entrance test for the public university. In addition, parental or family expectations and pressures for getting admitted into public universities might worsen the condition though this influence needs further exploration.

Income status

In the present study, participants with lower monthly family income (>25,000 BDT) showed more depression symptoms, anxiety, and stress. A survey of Turkish university students found

TABLE 3 Bivariate and multivariable regression analyses by anxiety score.

Variables	Mean (SD)	Unadjusted estimate					Adjusted estimate				
		<i>B</i>	SE	<i>t</i>	β	<i>p</i> -value	<i>B</i>	SE	<i>t</i>	β	<i>p</i> -value
Sex											
Female	15.22 (10.71)	4.44	0.94	4.74	0.22	<0.001	4.39	0.89	4.96	0.22	<0.001
Male	10.79 (9.03)	Ref.					Ref.				
Age											
21–24 years	13.65 (10.6)	1.24	1.47	0.85	0.04	0.397					
18–20 years	12.41 (9.88)	Ref.									
Study major											
Science	13.93 (10.6)	2.97	1.32	2.24	0.15	0.025	1.84	1.26	1.47	0.09	0.143
Arts	11.39 (9.35)	0.43	1.39	0.31	0.02	0.758	0.88	1.32	0.66	0.04	0.507
Business studies	10.96 (8.76)	Ref.					Ref.				
HSC GPA											
4–5	12.71 (9.9)	1.60	1.57	1.02	0.05	0.307					
3–3.99	11.11 (10.46)	Ref.									
SSC GPA											
4–5	12.67 (9.95)	1.23	1.60	0.77	0.04	0.442					
3–3.99	11.44 (10.08)	Ref.									
Preferred university for undergrad											
Public	13.35 (9.91)	3.24	1.08	3.00	0.14	0.003	3.08	1.07	2.88	0.13	0.004
Private	10.11 (9.75)	Ref.					Ref.				
Marital status											
Unmarried	12.63 (9.95)	0.71	1.52	0.47	0.02	0.640					
Married	11.92 (10.11)	Ref.									
Residence											
Urban	13 (9.99)	1.49	1.02	1.45	0.07	0.147					
Rural	11.51 (9.84)	Ref.									
Monthly family income											
25,000–50,000	11.07 (10)	−3.62	1.20	−3.01	−0.18	0.003	−3.01	1.16	−2.61	−0.15	0.009
50,001–100,000	13.18 (9.52)	−1.52	1.30	−1.17	−0.07	0.243	−0.23	1.25	−0.18	−0.01	0.853
>100,000	11.83 (10.85)	−2.87	2.28	−1.26	−0.06	0.209	−2.57	2.18	−1.18	−0.06	0.239
<25,000	14.69 (9.9)	Ref.					Ref.				
Mental disorder history											
Yes	21.39 (9.89)	9.54	1.75	5.46	0.25	<0.001	8.49	1.85	4.60	0.22	<0.001
No	11.86 (9.64)	Ref.					Ref.				
Neurological disorder history (e.g., epilepsy, migraine, Alzheimer’s)											
Yes	18.42 (11.57)	6.41	1.66	3.85	0.18	<0.001	3.55	1.71	2.07	0.10	0.039
No	12.01 (9.64)	Ref.					Ref.				

similar results in terms of depression that students from low-income families had higher depression scores than those from wealthier families (4). Another longitudinal study by Lorant et al. (39) supports our observations that students in the lowest socioeconomic group are more likely to experience depression

than those in the highest socioeconomic group, even though a separate study indicated no connection between the socioeconomic status of the family and students' depression, anxiety, and stress levels (28). The high prevalence of depression, anxiety, and stress symptoms among students from low-income families

TABLE 4 Bivariate and multivariable regression analyses by stress score.

Variables	Mean (SD)	Unadjusted estimate					Adjusted estimate				
		<i>B</i>	SE	<i>t</i>	β	<i>p</i> -value	<i>B</i>	SE	<i>t</i>	β	<i>p</i> -value
Sex											
Female	17.78 (11.63)	4.93	1.03	4.79	0.22	<0.001	4.89	0.95	5.13	0.22	<0.001
Male	12.85 (10.03)	Ref.					Ref.				
Age											
21–24 years	16.19 (11.62)	1.56	1.62	0.96	0.05	0.335					
18–20 years	14.63 (10.87)	Ref.									
Study major											
Science	17.14 (11.19)	4.76	1.44	3.32	0.22	0.001	3.14	1.35	2.32	0.14	0.021
Arts	12.73 (10.44)	0.35	1.51	0.23	0.02	0.815	0.73	1.43	0.51	0.03	0.611
Business studies	12.37 (9.99)	Ref.					Ref.				
HSC GPA											
4–5	15.09 (10.88)	2.78	1.72	1.62	0.08	0.106					
3–3.99	12.31 (11.43)	Ref.									
SSC GPA											
4–5	15.07 (10.9)	2.65	1.75	1.51	0.07	0.132					
3–3.99	12.42 (11.28)	Ref.									
Preferred university for undergrad											
Public	16.19 (10.87)	5.59	1.17	4.78	0.22	<0.001	4.83	1.15	4.20	0.19	<0.001
Private	10.59 (10.16)	Ref.					Ref.				
Marital status											
Unmarried	15.15 (10.99)	3.15	1.67	1.89	0.09	0.060					
Married	12 (10.3)	Ref.									
Residence											
Urban	15.05 (10.79)	0.80	1.13	0.71	0.03	0.477					
Rural	14.25 (11.35)	Ref.									
Monthly family income											
25,000–50,000	12.77 (11.04)	−5.53	1.31	−4.23	−0.25	<0.001	−4.25	1.24	−3.42	−0.19	0.001
50,001–100,000	15.28 (10.5)	−3.03	1.42	−2.14	−0.13	0.033	−1.17	1.35	−0.87	−0.05	0.386
>100,000	13.57 (11.88)	−4.74	2.48	−1.91	−0.10	0.057	−4.05	2.34	−1.73	−0.08	0.085
<25,000	18.31 (10.36)	Ref.					Ref.				
Mental disorder history											
Yes	23.52 (9.61)	9.39	1.93	4.86	0.22	<0.001	8.89	1.99	4.47	0.21	<0.001
No	14.13 (10.77)	Ref.					Ref.				
Neurological disorder history (e.g., epilepsy, migraine, Alzheimer’s)											
Yes	19.95 (11.45)	5.60	1.84	3.05	0.14	0.002	2.51	1.84	1.36	0.06	0.174
No	14.34 (10.8)	Ref.					Ref.				

may be related to the pressure that is often brought on by financial hardship (40). In a systematic review, Lund et al. (41) also found that poverty is associated with greater rates of mental illness in low and middle-income nations (LMIC) like Bangladesh.

Previously diagnosed mental disorders

Students diagnosed with previous mental disorders were more likely to have more depression, anxiety, and stress symptoms than those who did not have such experience. In contrast, students with a

history of previous neurological disorders were more likely to have anxiety symptoms than those who did not have such experience. Both of these findings are consistent with Bass et al. (1) that mental and neurological disorders profoundly impact the mental wellbeing of individuals.

Parent-children relationship

The high rates of depression, anxiety, and stress among Bangladeshi undergraduate entrance exam students may be attributable to several factors which include trouble interacting, family and societal pressure, high parental expectations, parental conflicts, insufficient financial assistance and difficulties, concerns about the future, a toxic psychological environment, a large admission test curriculum, and massive test timeframes (33). Furthermore, it is considered that when parents get too concerned in children's lives, it might hinder the growth of their autonomy, resulting in a diminished sense of personal capability or mastery and an increased awareness that the world is "uncontrollable" (42). The assertion is that all of these things add up to a strenuous environment for students. Caster et al. (43) observed that anxious students evaluated their parents as more socially isolated, preoccupied with others' judgments, and unhappy with their poor performance. Therefore, it may be possible to reduce the prevalence of mental health problems related to entrance examinations among undergraduate entrance admission-seeking students in Bangladesh by strengthening the parent-children relationship. Students struggling with exam-related anxiety may engage in suicidal behavior if they fail the exam (44). One suicide due to failing the medical college entrance exam in 2021 drew nationwide public attention, which indicated a critical need to look into the current mental health difficulties among Bangladeshi undergraduate entrance admission-seeking students (45).

COVID-19 pandemic

High rates of depression, anxiety, and stress may be partially explained by the timing of our study, which coincided with the COVID-19 pandemic. They may feel pressed by their delayed undergraduate entry admittance test, which they have not taken or have had to reschedule owing to the pandemic. Agitation, hostility, and regressive behavior are just some of the issues that could emerge or worsen as a result of that. There will soon be widespread emotional discomfort and an elevated risk of mental health issues because of the imposed measures that restrict their freedoms during the pandemic in response to that unknown diseases with unpredictable prognoses (46).

Fountoulakis et al. (47) discovered that a sizable percentage of persons experienced a decline in their mental health, family relationships, and general quality of life during the COVID-19 epidemic. Fountoulakis et al. (47) created the *COMET-G model*, which uncovered multiple vulnerabilities and an interplay that can lead to clinical depression and suicidal ideation through distress. As our study was conducted during the pandemic, considering the model, this particular dynamics might have played a critical role

to develop symptoms that could have been investigated though we missed this opportunity to capture this critical data adequately.

Limitations

There were some limitations to this study. First, it was self-reported, which has specific limitations than a clinically diagnosed study. Second, there was a chance of recall bias as it was impossible to validate the information due to the study's cross-sectional design. The participants only included internet users, which can cause a bias in the perceived result. As the study was cross-sectional in nature, the causal relationships between depression, anxiety, stress symptoms, and associated factors cannot be established. Finally, the present study used the convenience sampling technique, which may not reflect the actual condition of the whole population.

Further studies are needed using more representative samples to get generalizable findings for the entire population. Acknowledging these limitations, it can be argued that this study reported some novel findings from a tender population group and calls for in depths explorations of the factors associated with these mental health difficulties faced by the young students.

Conclusion

The current study revealed high depression symptoms, anxiety, and stress among Bangladeshi undergraduate admission-seeking students. Being a female student, having a lower monthly family income, preferring to attend a public university, and having a previous history of mental disorders were factors associated with experiencing adverse mental health symptoms among this young population. Furthermore, majoring in science was related to the development of depression and stress symptoms, whereas a history of neurological disorders was associated with the development of anxiety symptoms. These critical and novel findings could aid in the design of specific mental health interventions for this subset of the population. Furthermore, these findings may be used to develop appropriate student-friendly, empathetic community or family-focused strategies and action plans to support the mental health of this vulnerable group engaging their families. This also calls for revisiting the admission examination process, creating an additional burden on the students.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by Ethical Review Committee of the Public Health Foundation, Bangladesh. The patients/participants provided their written informed consent to participate in this study.

Author contributions

The study was conceptualized by MR. The theoretical background and methodology portions were developed by MR, MO, and MH. The data was collected by MR, MO, and AJ. The data was evaluated by MR and MI. The discussion parts were written by MR, MO, and MI. MH contributed as the senior author. All authors provided feedback on the manuscript draft. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships

that could be construed as a potential conflict of interest.

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The well-being of Iranian adult citizens; is it related to mental health literacy?

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Background: Subjective well-being (SWB) is a fundamental concept in the definition of mental health and is a significant health indicator for individuals and societies. Mental health literacy (MHL) is a modifiable variable with known effects on mental health, but its relationship with SWB is not recognized. In this study, the SWB is measured, and its relationship to MHL is investigated.

Methods: In this cross-sectional study conducted in Iran in 2019, 1,682 individuals participated using a convenient sampling method. Participants with a basic ability to use internet were included. A simple online form was used to collect data. SWB and MHL were measured with three questionnaires: WHO-5 Well-Being Index, Mental Health Literacy Scale, and Mental Health Positive Knowledge.

Results: Most of the participants were young (mean age 25.99, SD 9.14), female (71.9%), and had a university degree (78.5%). The mean SWB was 50.19 out of 100 (SD 20.92). More than half of the participants (50.4%) were screen-positive for clinical depression regarding their low well-being. Significant but very small correlations were detected between SWB and both MHL measures.

Conclusion: The well-being of half of the educated Iranian citizens who participated in this study was poor and lower than previous measurements. No strong correlation is detected between SWB and MHL measures in this study. This suggests that people's well-being cannot be improved by merely implementing mental health educational programs.

KEYWORDS

subjective well-being, mental health literacy, mental health, positive mental health, depression screening

1. Introduction

The concept of well-being is fundamental in the definition of mental health and is considered an outcome variable of the person's whole life (1, 2). It is also proposed as an indicator of human development in communities and is therefore crucial at both individual and societal levels (2, 3). Although difficult to define, well-being is considered an individual's

beliefs and feelings about the extent their life is going well (4). Therefore, it is a subjective evaluation that can be cognitive or affective and is recommended to be assessed as a subjective measure (4, 5). The affective part is more related to the hedonic perspective of well-being, and the cognitive aspects are more associated with the eudaimonic view; these are the two basic paradigms that construct the meaning of subjective well-being (SWB) for individuals (6, 7).

There has been an enormous growth in SWB studies in the last two decades (4). According to current empirical findings, higher SWB is related to many positive outcomes, including health and help-seeking behavior, longevity, social relationships, citizenship and organizational success, productivity, and resilience (4, 5, 8, 9). On the other hand, higher SWB results from external objective factors like better health, higher income, stronger social relationship, and more religiosity, along with internal mental factors such as personality, comparison processes, needs, and desires (4).

Worldwide inequality in SWB has been rising in recent years, and middle-east is among the regions with more inequality and the lowest reported well-being (2, 10). Several studies estimating Iranian's SWB are available with variable results. In the recent World Happiness Report, Iran ranked low, 118th among 153 nations (11). Similarly, Iranians showed relatively low SWB in many other national and international investigations (12–14). In a national survey of Iranian young adults' happiness in 2017, however, better results were reported (15).

Mental health literacy (MHL), also a growing study field, is a modifiable factor that influences mental health in various ways (16–18). It is recently formulated as a four-domain construct: (1) understanding how to maintain and improve mental health, which is known as positive MHL, (2) understanding mental disorders and treatments, (3) mental illness stigma, and (4) competency for help-seeking behavior (19). Higher MHL improves help-seeking, treatment compliance, relationship with health staff, attitude toward mental health issues, and lessens stigma (16, 17).

As MHL is one of the predictors of mental health, and mental health is, in turn, one of the determinants of SWB, the relationship between MHL and SWB is tested in a few studies. No association between SWB and MHL is detected in recent investigations of Australian adolescents, British university students, and sports coaches (8, 9, 20). On the other hand, a significant small correlation was reported in a study of SWB and positive MHL in Norwegian youths (21). In Iran, a study detected a small correlation between the quality of life of the general population of a city and MHL, while another recent study found no correlation between the general health of female adolescents and MHL (22, 23). Such findings may have practical implications as MHL is a modifiable factor that can be improved through education (18, 24).

There are inconsistent reports about Iranian citizens' well-being. Besides, the country has experienced rapid economic changes in recent years. Therefore, it is necessary to have up-to-date SWB estimations. To improve SWB, a candidate may be promoting MHL as it is modifiable by the health system, but current evidence is not conclusive about such a relationship, and studies had mixed results. Therefore, in this study, we aimed to (1) estimate SWB in a sample of Iranian citizens and (2) inspect the relationship of SWB with MHL.

2. Materials and methods

2.1. Study design and sampling

In this analytical cross-sectional study, we recruited participants from April to December 2019 from different counties of Iran including large cities, small towns, and some villages. All adult users of online social media across the country could be included. Living in Iran, being literate, and having elementary internet skills were necessary for inclusion; a properly completed online form was considered proof that the inclusion criteria of being literate and able to use the internet are met. No exclusion criteria were considered. We used a convenient sampling method to collect data by sharing the study materials online. A sample size of 1,500 was calculated using the formula of estimating a mean in which n is the sample size, α is the expected type I error, σ is the standard deviation, and d is the marginal error. In this study α was considered 0.05, σ was estimated 5 according to previous studies in Iranian populations, and d was considered 1 (25, 26).

$$n = \frac{(Z_{1-\frac{\alpha}{2}})^2 \times \sigma^2}{d^2}$$

2.2. Assessment

An online form containing required informed consent, baseline characteristic questions, and three questionnaires were prepared. We used two instruments to evaluate MHL; one for evaluating positive MHL and the other for measuring other aspects of MHL. The 3rd questionnaire was a measure of SWB. The baseline questions inquired about the history of mental health service use and the individual's perceived mental health status. Socioeconomic status was estimated by calculating the Household Crowding Index by dividing the number of the individual's home mates by the number of rooms in the home (27). The time needed to complete the form was about 20 min. The explanation and instruction were summarized in a text message and disseminated through online social networks like WhatsApp and Telegram messengers.

2.3. Measurements

2.3.1. WHO-Five well-being index (WHO-5)

This short and practical instrument is extracted from the longer 28 and then 10-item questionnaires (28). It has five non-invasive six-point agreement scale questions with scores from 0 to 5. These scores are summed up to result in the WHO-5 score, which is recommended to multiply by 4 to shape into a 0–100 score range. A higher score indicates better subjective well-being (SWB) in the past 2 weeks, and less than half of the total score shows poor well-being. WHO-5 has shown high clinometric validity and is sensitive to interventions. It is considered a useful final outcome scale of different well-being perspectives, i.e., hedonic and eudaimonic. WHO-5 is translated into more than 30 languages and is used widely across different cultures in the world. Although it was not developed for

clinical applications, studies showed that WHO-5 scores of ≤ 50 are a good screening tool for clinical depression, with sensitivity and specificity of 0.86 and 0.81, respectively (28). The Persian version of WHO-5 is valid and reliable, with Cronbach's α of 0.89 among university students and 0.91 among psychiatric outpatients (25, 26).

2.3.2. Mental health literacy scale (MHLS)

Mental health literacy scale is one of the recommended instruments to evaluate MHL, which covers its various aspects except for positive MHL (29, 30). It has 35 questions with four or 5-point Likert scales and is shown to be valid and reliable with Cronbach's α of 0.87. The number of questions in the validation and adaptation process of the Persian version is reduced to 23, resulting in a score range of 23–106. This Persian version is also reported to be valid and reliable (31).

2.3.3. Mental health positive knowledge (MHPK)

To have a complete assessment of MHL, we also used MHPK, a measure of positive MHL. It is tested in Norwegian youth and showed good validity and reliability with McDonald's ω of 0.84. It has ten items with a six-point agreement scale from 0 to 5, and their mean makes the total positive MHL score. Higher scores show better awareness about mental health promotive factors. The Persian version of MHPK has demonstrated good validity and reliability with Cronbach's α of 0.81 (32).

2.4. Statistical methods

The main variables are described using mean, standard deviation (SD), and 95% confidence interval (95% CI), and frequency percentages are reported for categorical variables. Pearson correlation test is used to investigate the potential relationship between SWB and

MHL scores and other quantitative measures. The association of SWB to other variables was tested using the independent-samples t-test. A multiple linear regression model was recruited to explore the amount of variance of SWB accounted for by MHL measures and two other mental health-related variables assessed in this study controlling for their interactions. SPSS Statistics for Windows, version 16 (SPSS Inc., Chicago, IL, United States) is used for these analyses, and the level of statistical significance and statistical power is considered to be 0.05 and 80%, respectively.

2.5. Ethics statement

The principles of the Helsinki Declaration were observed in this study. Confirming the informed consent part of the online form was required before completing it. An e-mail address was provided in the online form to answer any questions about confidentiality or problems in working with the form. Participants' data were anonymous and protected confidentially. The research protocol was approved with the ethics reference number of IR.IUMS.FMD.REC.1397.173 by the medical ethics committee of Iran University of Medical Sciences.

3. Results

A total of 1,682 individuals participated in the study with a mean age of 25.99 (ranging from 18 to 69, SD 9.14). Most of the participants were female and 467 (28.1%) were male. The mean Household Crowding Index (HCI) was 1.12 (SD 0.57). Table 1 summarizes other baseline characteristics and associated WHO-5 scores and their association's significance level.

The mean WHO-5 score was 50.19 (SD 20.92) with 95%CI of 49.18–51.19 and a range of 0 to 100. The number of participants with

TABLE 1 Baseline characteristics and associated WHO-5 scores; statistically significant differences are marked by the * sign.

		Frequency (Valid %)	WHO-5	
			Mean (SD)	p-Value
Gender	Females	1,196 (71.9%)	49.91 (20.67)	0.493
	Males	467 (28.1)	50.69 (21.44)	
Marriage	Single	927 (60.3%)	49.06 (20.97)	0.022*
	In a relationship	202 (13.1%)	52.49 (20.87)	
	Married	374 (24.3%)	50.77 (19.70)	
	Divorced	35 (2.3%)	42.62 (18.12)	
University education	No	358 (21.5%)	50.84 (22.35)	0.485
	Yes	1,309 (78.5%)	49.96 (20.51)	
Mental illness in acquaintances	No	885 (57.4%)	51.82 (20.52)	<0.001*
	Yes	656 (42.6%)	47.22 (20.53)	
Perceived mental health	Completely Ill	33 (2.1%)	33.33 (22.84)	<0.001*
	Partially Ill	262 (16.9%)	33.53 (17.53)	
	Partially Healthy	931 (60.2%)	50.05 (18.50)	
	Completely Healthy	320 (20.7%)	64.30 (17.56)	
Mental health service use	No	764 (49.5%)	51.69 (21.03)	0.001*
	Yes	780 (50.5%)	48.09 (20.17)	

a WHO-5 score below 50—a known depression screening cut-off—was 839 (50.4%).

As shown in Table 1, SWB showed a significant positive association with higher perceived mental health status. The history of mental health service use and familiarity with someone suffering from mental illness was associated with lower SWB; the differences, however, were small. Individuals who described their marital status as “in a relationship” showed significantly higher SWB than divorced participants. Age or HCI were not significantly correlated to SWB. SWB was also not different among genders or education groups.

The mean MHLS score was 71.37 (SD 8.33) with 95%CI of 71.00–71.89. The mean MHPK score was 4.21 (SD 0.72) with 95%CI of 4.20–4.28. Pearson’s test showed a significant but very small correlation between WHO-5 and both MHL measures; it was correlated to MHLS with $r=0.062$ ($p=0.021$) and to MHPK with $r=0.073$ ($p=0.003$).

Using a multiple regression model, we tested the amount of variance of WHO-5 predictable by including these four independent variables: MHLS, MHPK, previous mental health service use, and mental illness in acquaintances. These factors are somehow related to mental health system services. Perceived mental health was not included as it is another subjective measure of one’s well-being. Although the model and all four variables were statistically significant, the resulting R square was 0.03.

4. Discussion

In this study, we estimated subjective well-being (SWB) in a sample of Iranian citizens. Furthermore, we explored the relationship of SWB with mental health literacy (MHL). The average SWB score was around half of the total possible score. More than half of the participants’ SWB was below the screening cut-off for clinical depression (28). Although statistically significant, the correlation of SWB with both MHL measures was small.

The level of SWB revealed in this study is low. Except for an investigation of mentally ill people, all previous studies that used WHO-5 in Iranian populations reported higher scores (26). In an analysis of people with infertility in 2019, 44.3% scored below the instrument’s cut-off, and in a sample of medical students studied in 2017, the below cut-off frequency was 34%; this number in our study was 50.4% (33, 34). On the other hand, in a nationwide survey in 2017 using Oxford Happiness Questionnaire, Montazeri, et al. reported an average score of 4.08 out of 6, labeled as “rather happy, pretty happy,” in 14,292 Iranian young adults. We expected better SWB results in our investigation because similar to the 2017 survey, participants in the current study were a sample of the general population, not ill or at-risk individuals. Our results, however, are similar to other recent studies that reported Iranian citizens’ happiness as relatively low and the recent World Happiness Report (11, 12, 14).

The lower SWB of divorced individuals in the current study is compatible with previous results in Iranian populations (12). However, a previous systematic review of the literature has shown the complicated relationship between SWB and divorce (35). Future investigations among Iranian divorced couples are needed to understand this less studied field. This study’s lack of difference in SWB scores among genders and education levels is consistent with

current well-being knowledge and with previous investigations in Iranian populations (4, 12, 15).

Socioeconomic status is a determinant of SWB, so we used the Household Crowding Index (HCI) to estimate it (4, 12, 15). No significant association, however, was found between SWB and HCI in our study. This may show that our sampling has been limited to one social class, especially regarding the high education level of respondents, or may raise some questions about using HCI in Iranian populations despite satisfactory results in other societies (27).

A limited number of studies have inspected the relationship between MHL and SWB. Gorczynski et al. explored the association of MHLS and the Warwick–Edinburgh Mental Well-Being Scale in the United Kingdom in two populations, including university students and sports coaches, and found no correlation (8, 20). A similar result was found in an investigation of Australian adolescents using MHLS and EPOCH Measure of Adolescent Well-Being (9). We found a small significant correlation between MHLS and WHO-5 which may be explained by our different SWB instruments or by the much smaller sample size of those studies. We also detected a small significant correlation between positive MHL and SWB. This was similar to the findings of Bjørnsen et al.; they examined the association of positive MHL with another measure of well-being in 1888 Norwegian adolescents and found a small significant correlation ($r=0.17$, $p<0.01$).

As it is evident that MHL can be improved through education, it may be tempting to consider it a practical solution to enhance the SWB of individuals and communities (18, 24). However, the limited studies mentioned above do not support such a hypothesis. Although Bjørnsen et al. (21) concluded that positive MHL education could improve youth’s well-being, small correlation coefficients in Norwegian and Iranian samples indicate many other influential contributing factors. Our multiple regression model showed that all four mental health-related variables assessed in this study—including MHL measures, history of mental health service use, and relationship with a mentally ill person—only account for 3% of the SWB variance. This finding is in line with the current science of well-being which has shown that satisfactory SWB is not merely the product of good mental health. In other words, SWB cannot be reduced to good mental health by neglecting its other strong contributors such as good physical health, employment and high income, successful social relationships, fruitful spiritual and religious tendencies, and personality and thinking patterns (4, 15). Therefore, although MHL education benefits individuals’ mental health, it would not be a solitary solution to improve SWB. To address the low well-being of Iranians, a comprehensive plan which addresses scientifically approved determinants of well-being as a system would be an immediate necessity (11, 12, 15).

This study, along with presenting a recent SWB estimation of 1,682 Iranians, was the first study investigating the relationship between MHL and SWB in Iran and was one of the few in the world. In this study, we used a relatively big sample size. However, the sampling method is non-random, and the frequency of female and educated participants is higher than the general population. Therefore, the findings may only be generalized cautiously to educated citizens. Using a brief measure of well-being that cannot discriminate between hedonic and eudaimonic domains of SWB is another limitation of this

study. Despite using this short instrument, overall, the participants needed 20 min to complete the form. This can be a source of bias as individuals with more interest or higher SWB may be selected. However, using the online form allowed participants to fill it in at the time and place they preferred and this may reduce the mentioned problem. Finally, although we inspected some of the external determinants of SWB, we did not explore its mental or cultural determinants.

This study indicates that the subjective well-being of half of the educated Iranian citizens in this sample is poor; this population is screen-positive for clinical depression and needs further mental health evaluations. The high frequency of poor well-being in this educationally successful population may warn of a national mental health and well-being problem that requires comprehensive assessments and interventions. Quite a small correlation between well-being and MHL measures confirms that well-being-improving programs cannot be reduced to mental health education interventions. A multicomponent systemic approach to improve scientifically approved determinants of well-being would be necessary.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by the medical ethics committee of Iran University of Medical Sciences. The patients/participants provided their written informed consent to participate in this study.

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Author contributions

SM contributed to the design of the work, data acquisition, analysis, interpretation, and drafting of the manuscript. MR and MA-A contributed to the conception and design, data interpretation, and revising of the manuscript critically. EK, ZJ, and SE contributed to designing the study, data collection, statistical analysis, and constructing the final manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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Understanding the effect of angina on general and dimensions of psychological distress: findings from understanding society

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Background: The current study aimed to examine how the general and dimensions of psychological distress are affected by angina.

Methods: First, a confirmatory factor analysis (CFA) was used to produce the three-factor solution of the GHQ-12. Second, a predictive normative modeling approach to predict the expected scores for 1,081 people with angina based on a model trained on demographics from 8,821 age and sex-matched people without angina. Finally, one-sample *t*-tests were used to determine the differences between the actual psychological distress scores and expected psychological distress scores in participants with angina.

Results: There were three underlying structures of the GHQ-12 labeled as GHQ-12A (social dysfunction & anhedonia), GHQ-12B (depression & anxiety), and GHQ-12C (loss of confidence). Moreover, participants with angina had more psychological distress as indicated by the GHQ-12 summary score (Cohen's *d* = 0.31), GHQ-12A (Cohen's *d* = 0.34), GHQ-12B (Cohen's *d* = 0.21), and GHQ-12C (Cohen's *d* = 0.20) comparing to controls.

Conclusion: The current study implies that GHQ-12 is a valid measure of psychological distress in people with angina, and there is a need to consider the dimensions of psychological distress in angina rather than solely focusing on certain dimensions of psychological distress such as depression or anxiety issues in people with angina. Clinicians should come up with interventions to reduce psychological distress in people with angina which can then lead to better outcomes.

KEYWORDS

angina, psychological distress, GHQ-12, depression, anxiety, anhedonia, social dysfunction, loss of confidence

1. Introduction

Psychological distress involves an alteration in an individual's emotional state because of one's inability to respond to life pressures or unmet demands (1). Psychological distress generally can be expressed in various forms such as depression, anxiety, and anhedonia. Moreover, these negative symptoms tend to overlap, which leads to the cooccurrence of various symptoms (2, 3). Drapeau et al. (2) estimated that the general population's prevalence of psychological distress ranges from 5% to 27%. The 12-item general health survey (GHQ-12) has been examined in the literature as a reliable measure of psychological distress (11, 13, 23, 31, 41, 42) and has good specificity, reliability,

and sensitivity (4, 5). The GHQ-12's dimensionality has been a topic of controversy, with advocates for the unidimensional scale citing the high correlation between the identified factors (6, 7) and many others supporting the use of the 3-factor model, including GHQ-12A, GHQ-12B, and GHQ-12C (6–13). Recent studies have demonstrated that the imposition of a simple structure may artificially generate high correlations between modeled factors [e.g., (14)]. Thus, as suggested by Griffith and Jones (15), “taking these correlations as justification for unidimensionality risks a self-fulfilling prophecy of simplicity begetting simplicity.” In light of the ongoing debates regarding the structure of the GHQ-12, the present study investigates both the unidimensional and multidimensional models of the measure.

Angina is a prevalent symptom of coronary artery disease; however, it may also arise from other non-coronary artery related conditions, such as respiratory disease, valvular disease, anemia, and hyperthyroidism. These conditions can predict the occurrence rates of cardiovascular diseases and myocardial infarction independently of age. Moreover, alterations in pain sensitivity and stimuli *via* the vagal nerve fibers that are shared with the heart can result in non-cardiac chest pain resembling angina, which can be induced by gastrointestinal disorders. A meta-analysis revealed a wide prevalence range of angina, ranging from 0.7% to 15% (16–19).

It is important to understand psychological distress in angina given poorer cardiovascular disease outcome in people with higher psychological distress (20). Research has demonstrated that individuals who experience higher levels of psychological distress tend to have a greater number of comorbidities and physical disabilities (21), which may indicate the psychological distress is associated with severe disease, which in turn leads to poorer outcomes (22). Other studies have also looked at the possible biological mechanisms between psychological distress and poor outcome (23, 24), and suggested that secondary prevention may explain such a relationship. For instance, people with higher levels of psychological distress may be unlikely to participate in cardiac rehabilitation programs and change their lifestyles such as

quitting smoking and increasing physical activities (25, 26), which then leads to adverse outcomes.

Indeed, there are some studies that have looked at the association between psychological distress and angina [e.g., (1, 21, 27–32)]. However, previous studies have primarily examined small clinical samples and focused on specific psychological distress such as depression and anxiety. There is limited research on the impact of angina on general psychological distress and different dimensions of psychological distress in population-based studies. Therefore, this study aims to investigate the relationship between angina and dimensions of psychological distress. Specifically, the study hypothesizes that there are three underlying factor structures of the GHQ-12: GHQ-12A (social dysfunction and anhedonia), GHQ-12B (depression and anxiety), and GHQ-12C (loss of confidence). Additionally, the study predicts that participants with angina will experience higher levels of both general psychological distress and dimensions of psychological distress.

2. Methods

2.1. Data

The study utilized data from the first wave of Understanding Society: the UK Household Longitudinal Study (UKHLS), which collects yearly information from a representative sample of UK households since 1991 under the name of The British Household Panel Study (BHPS; University of Essex, 2022). All participants provided informed consent prior to the study, which was conducted between 2009 and 2010. To ensure comparability, age and sex-matched healthy controls were selected, and those with incomplete data on the variables of interest were excluded from the analysis. The final sample consisted of 1,081 participants with angina and 8,821 age and sex-matched controls without a clinical diagnosis of angina. Table 1 provides descriptive statistics.

TABLE 1 The demographic characteristics of healthy controls and people with angina.

	Healthy controls		People with angina	
	Mean	S.D.	Mean	S.D.
Age	67.83	8.04	67.84	12.11
Income (monthly)	1233.89	1408.77	1059.56	839.12
	<i>N</i>	%	<i>N</i>	%
Sex				
Male	4,883	55.36	603	55.78
Female	3,938	44.64	478	44.22
Education				
Below college	7,242	82.10	937	86.68
College	1,579	17.90	144	13.32
Marital status				
Single	3,053	34.61	459	42.46
Married	5,768	65.39	622	57.54
Residence				
Urban	6,252	70.88	813	75.21
Rural	2,569	29.12	268	24.79

2.2. Measures

2.2.1. Angina

The validity of self-reported angina has been appraised [e.g., (33)]. Participants answered the question “Has a doctor or other health professional ever told you that you have any of these conditions? Angina.” to indicate if they have been clinically diagnosed with angina.

2.2.2. Psychological distress

The level of psychological distress was evaluated in this study using the GHQ-12, a unidimensional questionnaire that consists of 12 items designed to measure psychological distress (34). The Likert method was utilized to score the responses, ranging from 0 to 3, with 0 indicating “Not at all” and 3 indicating “Much more than usual.” A cumulative score of all 12 items was calculated to reflect the overall level of psychological distress, with higher scores indicating greater distress. For the factor analysis, responses on the GHQ-12 were rescored from 1 to 4, with 1 representing “Not at all” and 4 representing “Much more than usual.”

2.2.3. Demographic variables

Demographic variables in the linear models include age, sex, income (monthly), education, marital status, and residence.

2.3. Analysis

2.3.1. Factor model

In this study, a confirmatory factor analysis (CFA) using oblique rotation was conducted in MATLAB 2018a. The CFA was performed based on a pre-specified three-factor structure, with each factor representing a distinct dimension of mental health: GHQ-12A (social dysfunction and anhedonia, consisting of 6 items), GHQ-12B (depression and anxiety, consisting of 4 items), and GHQ-12C (loss of confidence, consisting of 2 items). The GHQ-12 summary score and factor scores were standardized with a mean of 0 and a standard deviation of 1 for further analysis.

2.3.2. Predictive normative modeling

The study utilized a three-step predictive normative modeling approach. Firstly, four generalized linear models were trained using non-clinically diagnosed angina participants’ demographics as predictors and GHQ-12 summary score, GHQ-12A, GHQ-12B, and GHQ-12C as predicted variables. Secondly, expected scores were generated using the demographic information of angina patients as predictors in the generalized linear models. Lastly, one-sample *t*-tests were conducted to compare actual and expected scores in individuals with angina. This method was preferred over paired-sample *t*-tests since it allowed for demographic covariate control.

3. Results

The results of the factor analysis produced three distinct factors that were labeled as GHQ-12A, GHQ-12B, and GHQ-12C. GHQ-12A consisted of six items related to social dysfunction and anhedonia, GHQ-12B included four items related to depression and anxiety, and GHQ-12C consisted of two items related to loss of confidence. The specific loadings for each item can be found in Table 2.

The current study found a main effect of age [$F(1, 8,814) = 23.88, p < 0.01$], sex [$F(1, 8,814) = 25.12, p < 0.001$], monthly income [$F(1, 8,814) = 16.36, p < 0.001$], highest educational qualification [$F(1, 8,814) = 12.39, p < 0.001$], legal marital status [$F(1, 8,814) = 57.09, p < 0.001$] and residence [$F(1, 8,814) = 7.98, p < 0.01$] on GHQ-12 summary score in healthy controls. Similarly, there was a main effect of age [$F(1, 8,814) = 58.47, p < 0.001$], monthly income [$F(1, 8,814) = 16.42, p < 0.001$], highest educational qualification [$F(1, 8,814) = 6.41, p < 0.01$], legal marital status [$F(1, 8,814) = 19.73, p < 0.001$] and residence [$F(1, 8,814) = 6.51, p < 0.05$] on GHQ-12A (social dysfunction & anhedonia). However, the main effect of sex was insignificant. Moreover, there was a main effect of age [$F(1, 8,814) = 120.38, p < 0.001$], sex [$F(1, 8,814) = 69.70, p < 0.001$], monthly income [$F(1, 8,814) = 6.38, p < 0.05$], highest educational qualification [$F(1, 8,814) = 5.54, p < 0.05$], legal marital status [$F(1, 8,814) = 11.87, p < 0.001$] and residence [$F(1, 8,814) = 10.96, p < 0.001$] on GHQ-12B

TABLE 2 The factor loadings for the three-factor structure of the GHQ-12.

GHQ-12 Items	GHQ-12A (social dysfunction & anhedonia; 6 items)	GHQ-12B (depression & anxiety; 4 items)	GHQ-12C (loss of confidence; 2 items)
Concentration	0.57	0.20	−0.11
Loss of sleep	0.01	0.68	0.02
Playing a useful role	0.61	−0.17	0.13
Constantly under strain	0.74	−0.13	−0.02
Problem overcoming difficulties	−0.03	0.86	−0.08
Unhappy or depressed	0.08	0.50	0.20
Losing confidence	0.57	0.23	−0.12
Believe worthless	0.69	−0.05	0.04
General happiness	0.01	0.53	0.34
Capable of making decisions	0.01	0.17	0.72
Ability to face problems	0.09	−0.01	0.73
Enjoy day-to-day activities	0.49	0.12	0.12

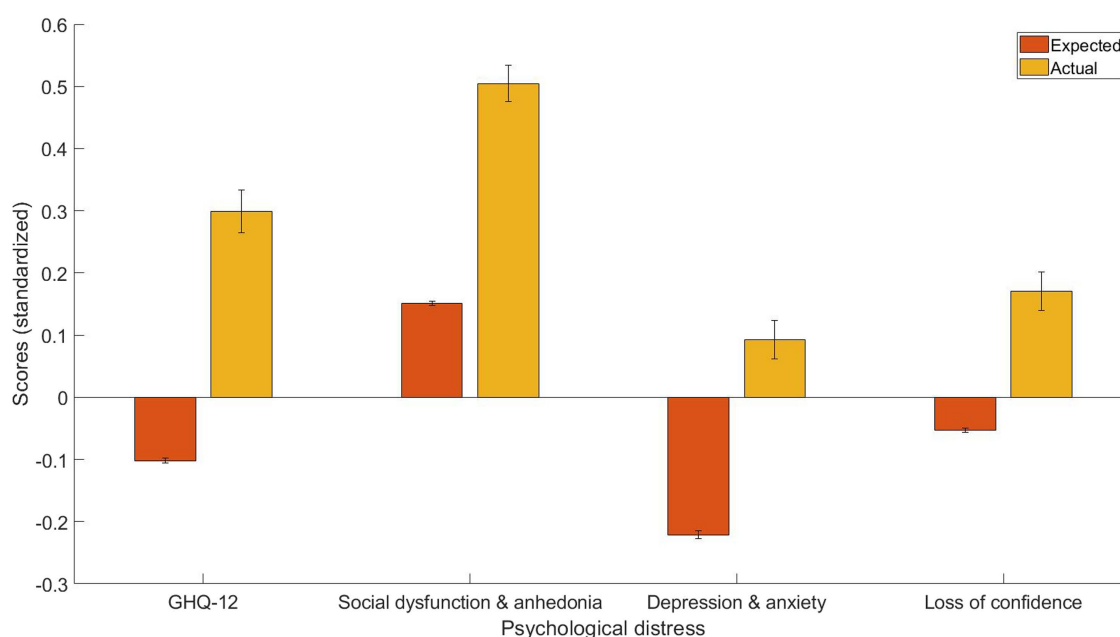


FIGURE 1

The expected and predicted GHQ-12 summary scores, GHQ-12A (social dysfunction & anhedonia), GHQ-12B (depression & anxiety), and GHQ-12C (loss of confidence) for people with angina.

(depression & anxiety). Finally, there was a main effect of monthly income [$F(1, 8,814) = 12.47, p < 0.001$], highest educational qualification [$F(1, 8,814) = 12.07, p < 0.001$], and legal marital status [$F(1, 8,814) = 75.91, p < 0.001$]. However, the main effect of age, sex, and residence was not significant.

Additionally, it was observed that individuals with angina had a significantly higher level of psychological distress, based on the GHQ-12 summary score [$t(1080) = 11.75, p < 0.001$, Cohen's $d = 0.40$, 95% C.I. (0.33, 0.47)], GHQ-12A [$t(1080) = 12.01, p < 0.001$, Cohen's $d = 0.35$, 95% C.I. (0.30, 0.41)], GHQ-12B [$t(1080) = 10.57, p < 0.001$, Cohen's $d = 0.31$, 95% C.I. (0.26, 0.37)], GHQ-12C [$t(1080) = 7.37, p < 0.001$, Cohen's $d = 0.22$, 95% C.I. (0.16, 0.28)]. Further, Figure 1 provides a visual representation of the mean and standard error of predicted and actual standardized scores.

4. Discussion

The aim of this research was to examine the influence of angina on individuals' psychological distress, including its impact on three distinct dimensions of psychological distress, namely GHQ-12A (comprising social dysfunction and anhedonia), GHQ-12B (encompassing depression and anxiety), and GHQ-12C (reflecting loss of confidence). Using a predictive normative modeling approach with one-sample t -tests, a total of 1,081 participants with angina and 8,821 without angina were examined through the UKHLS dataset. Results revealed that individuals with angina experience greater levels of psychological distress compared to those without angina, as demonstrated by higher GHQ-12 summary scores (Cohen's $d = 0.31$), GHQ-12A (Cohen's $d = 0.34$), GHQ-12B (Cohen's $d = 0.21$), and GHQ-12C (Cohen's $d = 0.20$). To the best of my knowledge, this study is the first one that demonstrated the

feasibility of using the GHQ-12 to screen psychological distress in individuals with angina and looked at how dimensions of psychological distress are affected by angina.

In this study, a CFA was conducted to identify underlying factors in the GHQ-12 scale. The analysis revealed a three-factor solution, including GHQ-12A (consisting of 6 items related to social dysfunction and anhedonia), GHQ-12B (consisting of 4 items related to depression and anxiety), and GHQ-12C (consisting of 2 items related to loss of confidence). The results of this study are consistent with previous research studies which also identified three factors in the GHQ-12 scale, as reported in studies by Campbell and Knowles (8), El-Metwally et al. (6), Gao et al. (7), Graetz (9), Martin et al. (10), Padrón et al. (11), Penninkilampi-Kerola et al. (12), and Rajabi et al. (13). Furthermore, the factor loadings in the current study were found to be high, as presented in Table 2.

The results showed that participants with angina have higher psychological distress is also consistent with previous studies [e.g., (1, 21, 27–32)]. Moreover, it has been demonstrated that the presence of new or persistent psychological distress can considerably heighten the likelihood of a future diagnosis of angina, as evidenced by follow-up research (32). Moreover, a large-scale study discovered that there are positive associations between psychological distress and self-reported clinical diagnoses of angina or heart attack (21). Another more recent study found that angina is associated with more psychological distress (1). The finding that participants with angina have more social dysfunction & anhedonia is consistent with studies that found a positive association between cardiovascular disease and social dysfunction & anhedonia [e.g., (35)]. Moreover, the effect size as indicated by Cohen's d was the biggest for social dysfunction & anhedonia, which may indicate that dysfunction & anhedonia is the most pronounced psychological distress problem in people with angina but was largely ignored in the literature. The finding that participants

with angina have more depression & anxiety problems is also consistent with several studies [e.g., (28, 30)]. Finally, participants with angina had more loss of confidence problems, which is of particular importance given that confidence in patients is closely related to clinical outcomes. Furthermore, the varying effect size of distinct dimensions of psychological distress suggests that the impact of angina on different dimensions of psychological distress may differ. This implies that an examination of specific dimensions of psychological distress is warranted in addition to assessing general psychological distress.

Angina has been found to be linked to psychological distress through various pathways. Psychological distress has been found to have a significant impact on the risk of myocardial ischemic changes, as observed through exercise electrocardiography or nuclear medical imaging examinations, as well as on the frequency of angina in patients with acute myocardial infarction. This is attributed to a combination of behavioral and biological factors, with negative emotions experienced during psychological distress leading to a decrease in medical compliance and health-promoting behaviors. Moreover, psychological distress can affect various biological activities, including those of the hypothalamic-pituitary-adrenal axis, autonomic nerves, platelets, and inflammatory cytokines, potentially increasing the risk of coronary artery disease such as angina. These factors can induce endothelial dysfunction and atherosclerosis, cause vasoconstriction, accelerate heartbeat, increase ventricular load, and raise the incidence of angina symptoms. The association between psychological distress and angina is also influenced by the interactions between behavioral and biological factors. For example, non-adherence to antidepressant medications and physical inactivity can increase inflammation and depressive symptoms in individuals with angina.

Although the current study has several strengths, it also has some limitations that need to be acknowledged. Firstly, the study's cross-sectional design hinders the ability to establish causality due to the possible bidirectional association between psychological distress and angina. Longitudinal studies would be useful in determining the causal relationship between these two variables. Secondly, angina was evaluated using self-reported responses, thus the study cannot confirm the association between angina and clinical medical evidence or diagnoses. Hence, the current study does not establish whether angina was caused by cardiac or noncardiac factors. Future research could investigate how different types of angina, grouped by their causes, may relate to psychological distress differently. The study's exclusive focus on individuals with angina in the United Kingdom presents a challenge in generalizing the findings to other cultural or national contexts. As a result, it is imperative that future research endeavors aim to reproduce the current results in diverse settings.

The current study aimed to investigate the impact of angina on general and dimensional aspects of psychological distress. The results indicated that psychological distress, both general and dimensional, was affected by angina. These findings support the validity of using

GHQ-12 as a measure of psychological distress in individuals with angina. Moreover, the study suggests that it is crucial to consider all dimensions of psychological distress rather than solely focusing on specific dimensions, such as depression or anxiety, in individuals with angina. Clinicians should come up with interventions to reduce psychological distress in people with angina, which can then lead to better outcomes.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found at: <https://www.understandingsociety.ac.uk>.

Ethics statement

The studies involving human participants were reviewed and approved by University of Essex. The patients/participants provided their written informed consent to participate in this study.

Author contributions

WK: conceptualization, data curation, formal analysis, investigation, methodology, resources, software, writing—original draft, and writing—review and editing.

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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.

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Depression, anxiety and insomnia in Chinese older adults and their family caregivers during the COVID-19 pandemic: an actor-partner interdependence model approach

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Aims: This study aimed to explore the dyadic effects of depression and anxiety on insomnia symptoms in Chinese older adults and their caregivers living in a community setting.

Methods: Data were collected from 1,507 pairs of older adults and their caregivers who were in the Guangdong Mental Health Survey in China. The 9-item Patient Health Questionnaire (PHQ-9), Generalized Anxiety Disorder module 7 (GAD-7), and Insomnia Severity Index (ISI) were used to measure depression, anxiety, and insomnia symptoms. Actor-Partner Interdependence Models (APIM) were used to determine whether anxiety or depression symptoms predicted individual or dyadic insomnia.

Results: Older adults' and caregivers' depression and anxiety had significant positive correlations with their own and their caregivers' insomnia symptoms (all $P < 0.001$). Actor effects were found between depression and insomnia symptoms in both older adults and caregivers ($B = 0.695$, $P < 0.001$; $B = 0.547$, $P < 0.001$, respectively), with one significant partner effects ($B = 0.080$, $P = 0.007$). Actor effects were also found between anxiety and insomnia symptoms in both older adults and caregivers ($B = 0.825$, $P < 0.001$; $B = 0.751$, $P < 0.001$, respectively), with one significant partner effects ($B = 0.097$, $P = 0.004$). However, the caregivers' depression and anxiety were not associated with older adults' insomnia symptoms in the APIM analyses.

Conclusions: Older adults and their caregivers had an interrelationship between psychological distress and insomnia. Consequently, healthcare providers might consider involving dyads when designing programs to reduce insomnia and improve psychological distress for family caregivers.

KEYWORDS

depression, anxiety, insomnia, older adults, actor-partner interdependence model

1. Introduction

China bears a heavy burden of disease due to its large population of older adults aged 65 or more, which accounts for 13.5% of the total population (1). China is already amongst the aging societies and the burden of diseases has subsequently risen as a result (2). Sleep disturbance, depressive and anxiety disorders are relatively prevalent psychiatric conditions in late life. A meta-analysis of older people in Europe and North America illustrated a lifetime prevalence of major depression of 16.5% (3). Similarly, a systematic review showed that the point prevalence of late-life mild depression varies from 0 to 18.6% (4). According to former findings, the current and lifetime prevalence rates of anxiety disorders among older adults were 14.2 and 30.0%, respectively (5). In addition, over half of older adults worldwide experienced trouble sleeping, and 20 to 40% reported insomnia (6). Mental health problems not only worsened older adults' quality of life and social function, but also increased caregiver burden.

Owing to the Chinese traditional Confucian contexts, China places a great importance on respecting and caring for older adults, as well as an old age of want. In China, older adults are generally living with spouse and/or children, which provides material, emotional, and other supports to older adults and promote interaction with family members (7). Family members are main providers of care for the Chinese older adults (8, 9). This brings the multiple burdens to family caregivers, including objective burdens (caregiving-related negative things and changes in physical health and behavior) and subjective burdens (emotional reactions such as anxiety, worry, frustration, and fatigue) (10). With the COVID-19 pandemic, quarantine was considered as a protective strategy and has a radical impact on older adults' lifestyle (11). Older adults were required to stay at home, it increases the caregiving load (12) and exacerbates generational family conflict with caregivers (13). Older adults had a higher risk of COVID-19 infection and mortality rate than other individuals, which can detriment their mental health (14, 15). Some studies showed that older adults with chronic disease and their family caregivers experienced more psychological distress, such as depression, anxiety and sleep problems (16–18). Many studies on mental health at work concentrated on the anxiety and depressive symptoms of caregivers (19). Previous research displayed that 46.8 and 29.8% of older adults' caregivers had anxiety and depressive symptoms during the COVID-19 outbreak (15). Another undesirable outcome of long-term care is insomnia. Financial strain, limited leisure time, social isolation, and somatic condition of cared-for people may contribute to psychological distress and insomnia of caregivers (20–23).

Multiple studies have examined the relationship between psychological distress and sleep problems in older adults and caregivers (24–27). But older adults-caregiver dyadic associations between psychiatric symptomatology and insomnia have not received adequate attention. Although anxiety, depression and sleep problems were often studied on an individual level, the effect of interpersonal factors has increasingly become the focus of researchers in recent years (28, 29). Analyses of the dyadic data indicated inter-person correlations between chronic disease patients' and their caregivers' emotions (e.g., anxiety, depression) (16–18). Similarly, the congruence in emotions and

sleep has also been reported in cancer patients and their spouses (30).

However, very few studies focused on general aged population, and how the dyadic relationship of depression and anxiety affects insomnia among Chinese older adults and their family caregivers was even rarely mentioned in COVID-19 outbreak. This gap in the literature potentially restricts the development and application of dyad-based interventions. Therefore, this study aimed at examining whether there is a dyadic relationship between depression, anxiety and insomnia among Chinese older adults and their family caregivers during the COVID-19 outbreak.

We proposed three hypotheses as follows:

1. Hypothesis 0: Individuals' depression and anxiety were positively associated with their own insomnia (actor effects).
2. Hypothesis 1: Older adults' depression and anxiety were positively associated with their caregivers' insomnia (partner effects).
3. Hypothesis 2: Caregivers' depression and anxiety were positively associated with older adults' insomnia (partner effects).

2. Methods

2.1. Participants and procedure

Participants in this study were older adult-caregiver dyads drawn from the Guangdong Mental Health Survey in China, which was conducted from October 2021 to December 2021. The target sample was picked from community-dwelling residents adopting multistage stratified cluster sampling, which included all the 21 administrative regions of Guangdong province. In the first stage, probability proportional to size (PPS) sampling was applied to choose 3 to 5 districts or counties from each administrative region. In the second stage, based on the population size of each district or county, we chose 1 to 4 subdistricts or towns from each selected district or county. Subsequently, we chose 2 to 4 village councils or neighborhood committees from each subdistrict or town using PPS, and then 50 residents were picked from each neighborhood. Finally, one adult resident older than 18 years was randomly chosen from each family in the selected village council or neighborhood committee. The sample included 18,464 residents aged 18 years and above, of whom 4,018 were aged 65 or over and completed the survey. For the selected older adults, their family caregivers were invited to participate in this survey. For this study, the definition of family caregivers is family members who provides care (daily life) for older adults.

In this study, the inclusion criteria of older adults were: (1) community-living older adults aged 65 years or older, (2) fluent Chinese language speaking, (3) provided informed consent, and (4) the selected older adults have caregivers who agreed to participate in this study and provided an informed assent. Exclusion criteria were: (1) residing in a nursing home, (2) hospitalization during the study period.

A total of 1,507 dyads provided complete data out of the 4,018 older individuals who were invited to participate in this study. Thus, 1,507 dyads in total were included for dyadic analyses. The questionnaire had a 37.5% response to invitation rate.

TABLE 1 Sociodemographic, health related factors and mental health characteristics of older adults and their caregivers ($N = 1,507$ dyads).

Variables	Older adults	Caregivers	McNemar	P
	n (%)	n (%)		
Gender			8.455	0.004
Female	787 (52.2)	869 (57.7)		
Male	720 (47.8)	638 (42.3)		
Region			1.235	0.267
Rural	732 (48.6)	721 (47.8)		
Urban	775 (51.4)	786 (52.2)		
Education			786.387	<0.001
Primary school or lower	910 (60.4)	219 (14.5)		
Junior high school	338 (22.4)	452 (30.0)		
Senior high school	201 (13.3)	343 (22.8)		
College or higher	58 (3.8)	493 (32.7)		
Income (RMB)			146.445	<0.001
<3,500	927 (61.5)	693 (46.0)		
3,500–5,999	367 (24.4)	478 (31.7)		
6,000–9,000	100 (6.6)	162 (10.7)		
>9,000	113 (7.5)	174 (11.5)		
Occupation			578.237	<0.001
Government officer/teacher/healthcare provider	20 (1.3)	250 (16.6)		
Factory/business/agriculture/service industry employee	694 (46.1)	659 (43.7)		
Retired	579 (38.4)	115 (7.6)		
Other	214 (14.2)	483 (32.1)		
Marital status			95.608	<0.001
Married/cohabitation	1,114 (73.9)	1,329 (88.2)		
Single/widowed/divorced/separated	393 (26.1)	178 (11.8)		
Current smoking			0.110	0.740
Yes	280 (18.6)	288 (19.1)		
No	1,227 (81.4)	1,219 (81.9)		
Current alcohol drinker			0.938	0.333
Yes	114 (7.6)	129 (8.6)		
No	1,393 (92.4)	1,378 (91.4)		
Tea-drinking habits			6.840	0.009
Yes	709 (47.0)	771 (51.2)		
No	898 (53.0)	736 (48.8)		
Exercise frequency			251.626	<0.001
Hardly ever	362 (24.0)	299 (19.8)		
1–3 times/month	105 (7.0)	301 (20.0)		
1–2 times/week	126 (8.4)	272 (18.0)		
3–5 times/week	138 (9.2)	161 (10.7)		
Almost everyday	776 (51.5)	474 (31.5)		

(Continued)

TABLE 1 (Continued)

Variables	Older adults	Caregivers	McNemar	P
	n (%)	n (%)		
Number of chronic diseases			458.264	<0.001
0	504 (33.4)	1,089 (72.3)		
1	529 (34.4)	279 (18.5)		
≥2	484 (32.1)	139 (9.2)		
	Mean (SD)	Mean (SD)	t ^a	P
Age (years)	72.6 (6.3)	45.7 (12.6)	78.059	<0.001
Depression	0.99 (2.82)	1.15 (2.89)	−1.663	0.097
Anxiety	1.03 (2.43)	1.16 (2.45)	−1.654	0.098
Insomnia	3.37 (4.24)	2.85 (3.62)	4.043	<0.001

Findings significant at the $P < 0.05$ level are shown in bold. ^aPaired sample t-test.

TABLE 2 Bivariate correlation matrices of depression, anxiety and insomnia for older adults and caregivers (r).

Variables	1	2	3	4	5	6
1. Older adults Depression	1.00					
2. Older adults Anxiety	0.541***	1.00				
3. Older adults Insomnia	0.397***	0.450***	1.00			
4. Caregivers Depression	0.238***	0.190***	0.135***	1.00		
5. Caregivers Anxiety	0.245***	0.271***	0.167***	0.587***	1.00	
6. Caregivers Insomnia	0.192***	0.199***	0.247***	0.411***	0.497***	1.00

***Significant at the 0.001 level (two-tailed).

Socio-demographics, health-related factors, and mental health were interviewed face-to-face by investigators who have gone through uniform training, using an electronic structured questionnaire at local health service centers. The Research protocol was approved by the Ethics Committee of the Guangdong Provincial People’s Hospital, Guangdong Academy of Medical Sciences (Reference number: KY2020-268-01).

2.2. Measures

2.2.1. Mental health characteristics

Older adults and caregivers rated their own depression symptoms in the past year using the 9-item Patient Health Questionnaire (PHQ-9). The PHQ-9, a self-reported 4-point Likert scale, contained nine items that measure depression in the past years. The total score ranges from 0 to 27, with higher scores representing worse depressive symptoms. A total score of 5 or more was considered as having depression symptoms (31). The Chinese version of PHQ-9 has already been used in many studies and proved to be reliable and valid (32, 33). We use Cronbach’s alpha coefficient to assess internal consistency reliability of the questionnaires. In this study population, Cronbach’s alpha coefficient of PHQ-9 was 0.940 for older adults and 0.924 for caregivers.

The Generalized Anxiety Disorder-7 item (GAD-7) (34) was used to measure older adults’ and caregivers’ anxiety symptoms

in the past year. The GAD-7 contains seven items rated on a 4-point Likert scale, measuring anxiety in the past years. The total score ranges from 0 to 21, and each item rated a score of 0 to 3 (“not at all,” “several days,” “more than half the days,” “almost every day”). GAD-7 score of 5 or more was considered having anxiety symptoms. Scores are summed, with higher scores indicating more serious anxiety. It has been proved to have acceptable reliability and validity in the Chinese population (35). In the current study, the Cronbach’s alpha coefficient of GAD-7 for older adults and their caregivers were 0.917 and 0.894, respectively.

Older adults and caregivers reported their insomnia symptoms in the past month using Insomnia Severity Index (ISI) (36). The ISI embodies seven items scored from 0 to 4, assessing the severity of insomnia. The total score ranges from 0 to 21, with higher scores indicating more severe insomnia and a score of 7 or more representing insomnia symptoms (37, 38). The scale has shown good psychometric properties in China (39). In this study, the Cronbach’s alpha coefficient of ISI was 0.929 and 0.893 for older adults and caregivers, respectively.

2.2.2. Socio-demographics and health-related factors

The socio-demographics data include age, gender, region (urban/rural), education status, monthly income, marital status, and occupation group. Education level was recoded into

TABLE 3 APIM results between older adults and caregivers for depression, anxiety and insomnia.

Model	Paths	Estimate (B)	SE	95%CI	P	β
Model 1^a	Actor effect					
	Older adults depression → older adults insomnia	0.695	0.035	0.558,0.817	<0.001	0.460
	Caregivers depression → caregivers insomnia	0.547	0.029	0.460,0.637	<0.001	0.446
	Partner effect					
	Older adults depression → caregivers insomnia	0.080	0.030	0.023,0.154	0.005	0.062
	Caregivers depression → older adults insomnia	0.040	0.034	−0.020,0.111	0.236	0.025
Model 2^b	Actor effect					
	Older adults depression → older adults insomnia	0.674	0.035	0.537,0.796	<0.001	0.450
	Caregivers depression → caregivers insomnia	0.557	0.029	0.470,0.648	<0.001	0.443
	Partner effect					
	Older adults depression → caregivers insomnia	0.083	0.030	0.025,0.156	0.005	0.064
	Caregivers depression → older adults insomnia	0.035	0.034	−0.024,0.106	0.293	0.024
Model 3^c	Actor effect					
	Older adults anxiety → older adults insomnia	0.825	0.041	0.676,0.963	<0.001	0.472
	Caregivers anxiety → caregivers insomnia	0.751	0.033	0.635,0.869	<0.001	0.508
	Partner effect					
	Older adults anxiety → caregivers insomnia	0.097	0.034	0.021,0.178	0.004	0.065
	Caregivers anxiety → older adults insomnia	0.028	0.040	−0.053,0.124	0.481	0.016
Model 4^d	Actor effect					
	Older adults anxiety → older adults insomnia	0.802	0.041	0.655,0.942	<0.001	0.462
	Caregivers anxiety → caregivers insomnia	0.749	0.033	0.639,0.865	<0.001	0.508
	Partner effect					
	Older adults anxiety → caregivers insomnia	0.093	0.033	0.018,0.173	0.005	0.063
	Caregivers anxiety → older adults insomnia	0.031	0.040	−0.050,0.126	0.477	0.018

APIM, Actor-Partner Interdependence Models; B, unstandardized coefficients; β , standardized coefficients; SE, standard error; 95% CI, 95% Bias Corrected Confidence Interval. Findings significant at the $P < 0.05$ level are shown in bold. ^aModel 1 is a crude model to examine the relationship between depression and insomnia without covariates. ^bModel 2 is a covariates-adjusted model based on model 1 after controlling age, gender and region. ^cModel 3 is a crude model to examine the relationship between anxiety and insomnia without covariates. ^dModel 4 is a covariates-adjusted model based on model 3 after controlling age, gender and region.

five categories: primary school or below, junior high school, senior high school, college, and graduate school or above. Monthly income was categorized into 4 classes: <3,500, 3,500–5,999, 6,000–8,999, >9,000 ¥. Occupation group was divided into four categories: government officer/teacher/healthcare provider, factory/business/agriculture/service industry employee, retired, and others (40, 41). Marital status was dichotomized: married/cohabitating, and single/widowed/divorced/separated. Smoking status was divided into two groups: not smoking (including past smoking) and current smoking. Current smoking was defined as smoking at least one cigarette per day and continuing to smoke in the past 6 months. Alcohol consumption was defined as drinking at least once a week. The definition of tea-drinking habits was those of participants drinking tea at least four times a week. The exercise habits in the past year were grouped into five levels: hardly exercise, occasionally exercise (1–3 times/month), sometimes exercise (1–2 times/week), often exercise (more than 3 times/week), and almost every day. Chronic diseases were self-report of doctor-diagnosis and were listed based

on International Classification of Disease, 10th revision (ICD-10), which contained hypertension, diabetes, cardio vascular disease, cerebrovascular disease, chronic obstructive pulmonary disease (COPD), hyperlipidemia, arthritis, discogenic diseases, chronic gastroenteritis/peptic ulcer, gallstones/chronic cholecystitis, urolithiasis, chronic hepatitis/hepatocirrhosis, cataract/glaucoma, gout, nervous system disease, cancer and anemia. Participants were asked “In the past year, have you ever been diagnosed by a physician that you have any of chronic disease in the list?” The number of chronic diseases was calculated and divided into three groups: 0 (no chronic disease), 1 (one chronic disease), and ≥ 2 (the co-occurrence of two or more chronic diseases) (42).

2.3. Statistical analyses

The paired sample *t*-tests, McNemar tests and McNemar-Bowker tests were used to compare characteristics between older adults and caregivers. Spearman bivariate correlations were

conducted to examine older adult-caregiver associations between all primary variables. An actor-partner interdependency model (APIM) was used to examine the actor and partner effects on insomnia. Actor effects refer to whether a person's PHQ-9 score is related to their own ISI score. Partner effects mean the association between an individual's PHQ-9 score and another individual's ISI score. We specified older adults' and caregivers' depressive symptoms and anxiety symptoms as predictors, respectively, and their insomnia symptoms as outcome variables in the APIM analyses. In the final model, older adults' and caregivers' age, gender, and region were added as covariates. Restricted maximum likelihood estimation methods were applied. Model fit was evaluated by using the chi-square statistic, root mean square error of approximation (RMSEA), comparative fit index (CFI), standardized root mean residual (SRMR), and goodness of fit index (GFI). APIM models were performed in AMOS 24.0 and the rest of data analyses were performed in SPSS 25.0. All statistical tests were two-tailed with the level of significance set as 0.05.

3. Results

3.1. Characteristics description

A total of 1,507 older adults and their corresponding primary caregivers participated in this study (3,014 individuals). Table 1 reports the distribution of older adults' and caregivers' characteristics.

3.2. Bivariate correlations

All bivariate correlations are presented in Table 2. For the older adults, their insomnia was significantly positively correlated to their own depression ($r = 0.397$, $P < 0.001$) and anxiety ($r = 0.450$, $P < 0.001$), and was also correlated to their caregivers' depression ($r = 0.135$, $P < 0.001$) and anxiety ($r = 0.167$, $P < 0.001$). In addition, the older adults' depression, anxiety and insomnia were associated with the caregiver's depression ($r = 0.238$, $P < 0.001$), anxiety ($r = 0.271$, $P < 0.001$), and insomnia ($r = 0.247$, $P < 0.001$), respectively. The levels of older adult-caregiver correlation among depression, anxiety, and insomnia were lower than those of intra-subject correlation ($r = 0.135$ to 0.271 vs. $r = 0.397$ to 0.587 , respectively).

3.3. Actor-partner interdependence models

Two hypotheses were examined and four APIMs were established (Table 3). The collective covariates associated with insomnia for the older adults and caregivers contained age, gender and region, which were ultimately considered into our models as control variables to help explain interdependence among older adults and caregivers' insomnia ($P < 0.05$). Screening results of covariates are shown in Supplementary material (Table S1).

Interdependence among older adults-caregivers dyads' depression and insomnia were explored without adjusting

for covariates. Firstly, the overall Chi-square testing of distinguishability was significant ($\chi^2_{(2)} = 10.377$, $P = 0.006$, CFI = 0.989, GFI = 0.997, RMSEA = 0.053, SRMR = 0.019), indicating that actor and partner effects were statistically distinguished between older adults and their caregivers. Accordingly, dyadic interdependence was further analyzed and illustrated in Figure 1A.

Older adults' and caregivers' more serious depression was related to their own more serious insomnia ($B_{\text{Olderadults}} = 0.695$, 95% CI: 0.558~0.817, $P < 0.001$; $B_{\text{Caregivers}} = 0.547$, 95% CI: 0.460~0.637, $P < 0.001$) and thus significant actor effects were found. In the partner effect, older adults' depression was associated with caregivers' insomnia ($B = 0.080$, 95% CI: 0.023~0.154, $P = 0.005$), whereas caregivers' depression was not associated with older adults' insomnia ($B = 0.040$, 95% CI: -0.020~0.100, $P = 0.236$).

After adjusting age, gender and region, the APIM performing impact of depression on insomnia was reconstructed as shown in Figure 1B. As with initial crude model (model 1), the actor and partner effects of adjusted model (model 2) were also distinguishable. Two actor effects and one partner effect have been identified: older adults' depression positively impacted their own and caregivers' insomnia ($B_{\text{Olderadults}} = 0.674$, 95% CI: 0.537~0.796, $P < 0.001$; $B_{\text{Caregivers}} = 0.557$, 95% CI: 0.470~0.648, $P < 0.001$), while caregivers' depression only had a positive effect on their own insomnia ($B = 0.083$, 95% CI: 0.025~0.156, $P = 0.005$), but not on older adults' insomnia ($B = 0.035$, 95% CI: -0.024~0.106, $P = 0.293$). More details of APIM results are summarized in Table 3.

We analyzed dyadic interdependence between older adults and caregivers about impact of anxiety on insomnia. The global model also displayed adequate fit ($\chi^2_{(2)} = 2.653$, $P = 0.265$, CFI = 0.999, GFI = 0.999, RMSEA = 0.015, SRMR = 0.010). Greater older adults' and caregivers' anxiety was significantly correlated to their own greater insomnia ($B_{\text{Olderadults}} = 0.825$, 95% CI: 0.676~0.963, $P < 0.001$; $B_{\text{Caregivers}} = 0.751$, 95% CI: 0.635~0.869, $P < 0.001$). Furthermore, partner effect from older adults' anxiety to caregivers' insomnia was observed ($B = 0.097$, 95% CI: 0.021~0.178, $P = 0.004$), but corresponding effect from caregivers' anxiety to older adults' insomnia was not found ($B = 0.028$, 95% CI: -0.053~0.124, $P = 0.481$). Figure 2A and Table 3 show the coefficients and effects of each path.

Considering covariates, the adjusted model is depicted in Figure 2B and Table 3. We found two significant actor effects: older adults' and caregivers' anxiety worsen their own insomnia ($B_{\text{Olderadults}} = 0.802$, 95% CI: 0.655~0.942, $P < 0.001$; $B_{\text{Caregivers}} = 0.749$, 95% CI: 0.639~0.865, $P < 0.001$), and one partner effect of older adults' anxiety aggravated caregivers' insomnia ($B = 0.093$, 95% CI: 0.018~0.173, $P = 0.005$). No partner effect for caregivers' anxiety on older adults' insomnia was identified ($B = 0.031$, 95% CI: -0.050~0.126, $P = 0.477$).

4. Discussion

This study added to the evidence on the partner effects of depression and anxiety on insomnia in community-living older adults and their family caregivers in China. We found significant older adults-caregiver associations in depression, anxiety, and insomnia. Specifically, older adults' and caregivers' depression and

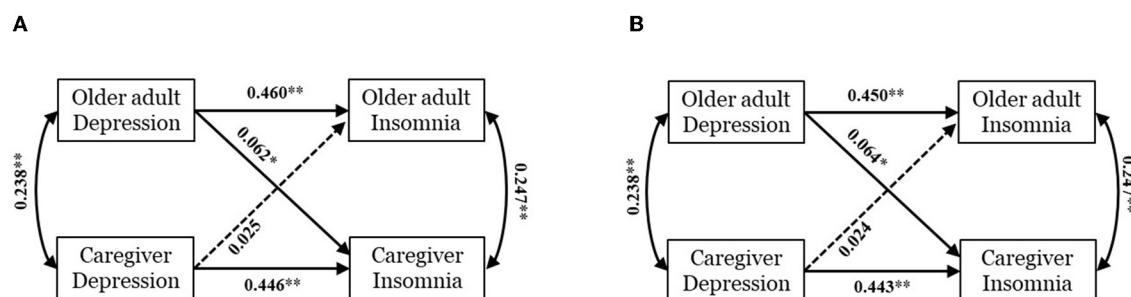


FIGURE 1

Actor-partner interdependence model of depression and insomnia within older adults-caregivers dyads. Model (A) is a crude model without covariates. Model (B) is an adjusted model controlling age, gender and region. Standardized coefficients (β) are presented on straight lines with single arrow and correlation coefficients are reported on curves with double-headed arrows. A solid line and dotted line represent significant path and non-significant one respectively. * $p < 0.01$; ** $p < 0.001$.

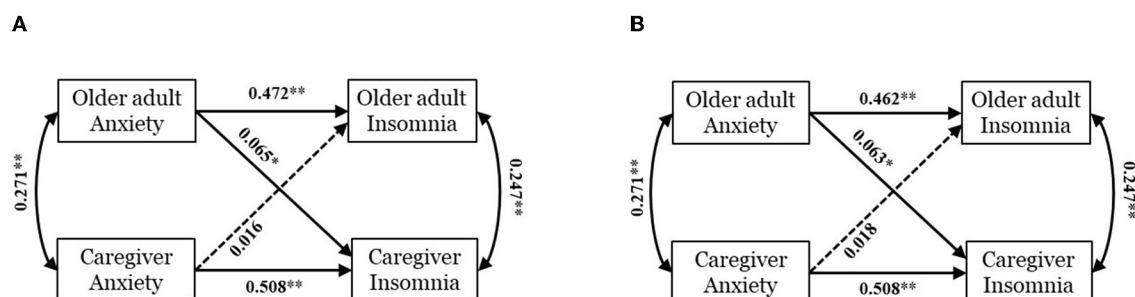


FIGURE 2

Actor-partner interdependence model of anxiety and insomnia within older adults-caregivers dyads. Model (A) is a crude model without covariates. Model (B) is an adjusted model controlling age, gender and region. Standardized coefficients (β) are presented on straight lines with single arrow and correlation coefficients are reported on curves with double-headed arrows. A solid line and dotted line represent significant path and non-significant one respectively. * $p < 0.01$; ** $p < 0.001$.

anxiety had an influence on their own insomnia (actor effects); older adults' depression and anxiety had an influence on caregivers' insomnia (partner effects). Our findings indicate that it is feasible to embed emotional interventions for older adults within family care support services.

We found significant correlations in depression, anxiety and insomnia between older adults and caregivers, representing emotional contagion occurred in the family's environment (43), which is consistent with previous studies on patients with cancer (44). The psychological distress of patients and family caregivers are closely linked (45). These results could be explained by emotional contagion theory, in which emotional state can be transmitted from one person to another through nonverbal communication information during social interactions (46). Secondly, according to the interdependence theory, older adults and family caregivers are in the same social system, and they can influence each other (47). Stay-at-home orders during the COVID-19 outbreak increased family conflict and financial strain (48). Such stress may affect caregivers' sleep. Future study should pay attention to the nature of the interactions between the caregivers and the older adults in family environment other than material supports to older adults.

Consistent with earlier studies (30, 49), we found a significant actor effect of older adults' depression or anxiety on their own insomnia, which fully supports our hypothesis 0. Depression or anxiety in older adults can influence their sleep quality, and this also appears to be the case for caregivers. Present day research considers insomnia as a transdiagnostic symptom for many mental disorders, and it has been found that the relationship between depression and insomnia is bidirectional: people with depression have changes in sleep, and insomnia increases the risk of depression (50). Similar to depression, the APMI showed that more anxiety symptoms were associated with severe insomnia. Previous epidemiological research has shown that people with anxiety have a high prevalence of sleep problems (51). Anxiety is particularly characterized by a state of mental hyperarousal, which can display as a lower wake threshold, increasing the likelihood of sleep disturbance in reaction to external stimuli. Insomnia can be caused by false beliefs, bad sleep habits, somatic hyperarousal, and mental hyperarousal (52). Relaxation techniques used in Cognitive Behavioral Therapy for Insomnia (CBT-I) may help improve anxiety status by reducing hyperarousal (53). The successful use of relaxation techniques in CBT-I demonstrated that insomnia is caused by anxiety in certain extent.

The partial partner effect of depression or anxiety on insomnia was observed in this study: older adults' depression or anxiety had an effect on caregivers' insomnia, while caregivers' depression or anxiety had no effect on older adults' insomnia. Hypothesis 1 was supported and Hypothesis 2 was not supported. This is in line with the results of a previous study of patients and their carers (30). However, a former study in couples found that between-person effect was stronger than the within-person effect, and that anxiety symptoms predicted more aspects of sleep than depression (54). When an individual shared a bed with a partner, anxiety status might increase the risk of waking up, whereas depression, which is a psychomotor retardation, might not produce the same risk of waking up. In the current sample, caregivers are family member of older adults, including spouses, daughters, sons, kins or daughters-in-law. We cannot distinguish family caregivers' relationship to older adults. To remedy this defect of the study design, the covariate age was adjusted in APIM analyses due to the age of the spouse was greater than daughters, sons, kins or daughters-in-law. Though the main results did not change, these results should be viewed with some caution. Future research should focus on caregivers from specific gender group or different relationships, and use methods with better ecological validity and involve longitudinal and causal study designs. One possible reason why caregivers' depression or anxiety did not have a partner effect on older adults' insomnia is the difference in roles. Caregiving activities can disturb caregivers' daily lives, causing physical, emotional and financial stress, and finally consuming their energy (10). We guess, as care recipients, older adults are more likely to be influenced by the reality of caregivers' care activities than by the caregivers' emotions. Therefore, further research is needed to confirm our speculation.

Overall, this study added to the literature on psychological distress and insomnia within the older adults-caregiver dyads, and explored the between-person effects of emotion. Previous studies of psychological distress and insomnia among older adults and caregivers examined unidirectional effects instead of mutual effects in focus. However, care recipients and caregivers have a close relationship and may influence each other through emotional, cognitive and behavioral clues in social interactions, and may eventually affect the health of the caregivers (23, 55). There are several limitations in this study. First, we didn't distinguish the roles of informal family caregivers (spouse caregiver, son caregiver, or daughter caregiver). Second, Selection bias may exist in this study. The general demographics are significantly different between the two groups of older adults. For more information, see the [Supplementary material](#) (Table S2). The rest of 2,511 older adults did not report having caregiver or their caregiver declined to participate in this study. Third, the cross-sectional design did not allow us to produce causal relationships. Fourth, the results from the provincial data could not be generalized to the whole country.

5. Conclusion

Psychological distress in older adults may affect the sleep of their caregivers. Healthcare providers should provide mental health services based on family or group interaction. Our findings highlight the need for older adult-caregiver dyad interventions and

strategies for managing older adults' emotions in the treatment of insomnia in family caregivers.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of the Guangdong Provincial People's Hospital, Guangdong Academy of Medical Sciences (Reference number: KY2020-268-01). The patients/participants provided their written informed consent to participate in this study.

Author contributions

K-RD: conceptualization, methodology, formal analysis, investigation, writing-original draft, and writing—review and editing. W-QX: methodology, writing-original draft, and writing—review and editing. Y-YH: formal analysis, investigation, and writing—review and editing. J-HH: writing-review and editing. W-YT: resources and supervision. JL: methodology. C-LH: conceptualization. F-JJ: conceptualization, resources, and supervision. S-BW: conceptualization, methodology, investigation, writing-original draft, and writing—review and editing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships

that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2023.1163867/full#supplementary-material>

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Machine learning models for predicting depression in Korean young employees

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Background: The incidence of depression among employees has gradually risen. Previous studies have focused on predicting the risk of depression, but most studies were conducted using basic statistical methods. This study used machine learning algorithms to build models that detect and identify the important factors associated with depression in the workplace.

Methods: A total of 503 employees completed an online survey that included questionnaires on general characteristics, physical health, job-related factors, psychosocial protective, and risk factors in the workplace. The dataset contained 27 predictor variables and one dependent variable which referred to the status of employees (normal or at the risk of depression). The prediction accuracy of three machine learning models using sparse logistic regression, support vector machine, and random forest was compared with the accuracy, precision, sensitivity, specificity, and AUC. Additionally, the important factors identified via sparse logistic regression and random forest.

Results: All machine learning models demonstrated similar results, with the lowest accuracy obtained from sparse logistic regression and support vector machine (86.8%) and the highest accuracy from random forest (88.7%). The important factors identified in this study were gender, physical health, job, psychosocial protective factors, and psychosocial risk and protective factors in the workplace.

Discussion: The results of this study indicated the potential of machine learning models to accurately predict the risk of depression among employees. The identified factors that influence the risk of depression can contribute to the development of intelligent mental healthcare systems that can detect early signs of depressive symptoms in the workplace.

KEYWORDS

machine learning, depression, employees, workplace, prediction

Introduction

Depression in the workplace and young adults have become a growing global concern due to greater societal costs and reduced work productivity (1). In 2019, the incremental economic burden of Korean adults with depression was an estimated a total of KRW 4.83 trillion, with 14.3% in direct costs and 85.6% in indirect costs. Among indirect costs, workplace costs accounted for the highest percentage (65.6%) including absenteeism (18%) and presenteeism (42%) (2). Employees' depression severity increased direct costs through utilization of mental health services and indirect costs attributable to overall work impairment (1, 3).

The highest prevalence of depression in young adults especially contributes to increasing an enormous economic and social burden (4). Approximately 25% of Korean younger adults aged 19–39 years experienced moderately severe depression, compared with about 18% of adults aged 40–50 years (5). However, only 7.4% of Korea employees had a diagnosis of depression by a doctor, while more than 20% had a diagnosis of depression in Canada (20.7%), United States (22.7%) and South Africa (25.6%) (6). Owing to fear of losing their job and mental health stigma, they were reluctant to disclose mental health problems and seek mental health service (6, 7).

Previous studies commonly used traditional statistical methods, such as regression analysis, to infer the relationships between depression and specific variables (8–10) which were derived from work-related theories such as the conservation of resources theory (11), self-determination theory (12), and the job demands-resources theory (13). Several studies identified factors associated with depression, including sociodemographic factors, traits, stressors, relationship stability, and cognitive processes (14, 15). In particular, work-related factors such as long working hours, workload, and burnout have been found to increase the risk of depression among employees (16, 17). However, traditional statistical methods are limited on representing real-world complexities and predicting future data due to their assumption of linearity between variables (18, 19).

Traditional statistical methods aim to test hypotheses which derive from theories, while machine learning (ML) methods focus on discovering hidden interaction in the specific data-set to make predictions (8, 9, 20). ML methods provide more accurate prediction by analyzing complex and non-linear interactions among datasets rather than separately considering the effect of one variable on an outcome of interest (21, 22). ML methods can facilitate early detection by predicting the risk of diseases (23–25). However, there were few studies on the prediction of depression using ML algorithms in young children (26), university students (27), and older adults (24).

Therefore, this study aimed to evaluate the performance the performance of different ML algorithms, such as sparse logistic regression, support vector machines (SVM), and random forest (RF), and identify the important factors influencing the risk of depression among Korean employees.

Methods

Data and sample

The target population were Millennial and Generation Z (MZ) employees in South Korea. This study included participants who were aged between 20 and 40; Millennials were born between 1983 to 1994, and Generation Zs were born between 1995 to 2004.

The Ewha womans university institutional review board approved this study (ewha-202206-0001-01). Potential participants were recruited from a website and social networking services during June 2022. Of the 505 employees completed the survey *via* the online survey platform, we excluded two participants (0.4%) who were over the age of 40. A total of 503 employees were used for data analysis.

Outcome variable

The outcome variable was the depression CES-D score (28), which consists of 20 items that are rated on a 4-point Likert scale (0–3). Possible score ranges from 0 to 60, with a higher score indicating more depression-related symptoms. The Cronbach's alpha of the CES-D was 0.85–0.90 (28) and 0.91 in the current study. Based on the CES-D cutoff score ≥ 16 (29), we divided the young employees into two groups: normal ($n = 176$) and at risk of depression ($n = 327$).

Predictor variables

The predictor variables consisted of a set of demographics, physical health-related, job-related, and study variables that were selected based on literature reviews of the risk and protective factors for depression among employees. Study variables included personality-related variables, psychosocial protective variables, psychosocial risk variables in the workplace, and psychosocial protective variables in the workplace. Cronbach's alpha test was used to determine inter-item reliability (Table 1). However, due to the potential for misleading results stemming from limited item variance (30, 31), Cronbach's alpha test was not applied to measures with fewer than three items, including the 10-item Big Five Inventory (32, 33) and relationship questions (34).

Demographic characteristics included age, gender, religion, and marital status. Age was used as a continuous variable, while the rest of variables were used as dummy variables.

Personality-related factors included physical activity per week; the amount of sleep and number of meals per day; and drinking and smoking. The frequency of physical activity per week and the number of meals per day were used as continuous variables, while the rest of the variables were used as dummy variables.

Regarding job characteristics, we examined total years of job experience, employment period at their current workplace, number of turnovers, weekly working hours, monthly salary, and income satisfaction.

As psychosocial protective factors, we considered personality, grit, attachment, satisfaction with life, and interpersonal relationships. For personality, the 10-item Big Five Inventory (32, 33) was used. Grit was measured using the short grit scale (35), and attachment was measured by the relationship questions (34). The satisfaction with life scale (36) and relationship change scale (37) were also included.

Psychosocial risk factors in the workplace included burnout and occupational stress. Burnout was measured by the burnout assessment tool (38). Occupational stress was measured by the Korean Occupational Stress Scale-Short Form (39).

Psychosocial protective factors in the workplace included occupational self-efficacy, social problem-solving style, meaning in work, work-life balance, and psychological safety. Occupational self-efficacy was assessed using the occupational self-efficacy scale (40), social problem-solving style was evaluated using the Social Problem-Solving Inventory-Revised Short Form (41), meaning in work was measured by using the Working and Meaning Inventory (42), work-life balance was assessed using the Work-life Balance Scale (43), and psychological safety was evaluated using the Team Psychological Safety Scale (44).

TABLE 1 Predictor variables.

Factors	Variables	Indicator	Cronbach' α
Demographic	Age		
	Gender:	Male = 0, Female = 1	
	Religion	Nonreligious = 0, Religious = 1	
	Marital status	Single = 0, Married = 1	
Physical health-related factors	Psychical activity per week		
	Amount of sleep	Less than 6 h = 0 More than 6 h = 1	
	Number of meals per day		
	Drinking	Nondrinker = 0, Drinker = 1	
	Smoking	Nonsmoker = 0, Smoker = 1	
Job-related factors	Total years of job experience		
	Employment period at their current workplace		
	Number of turnovers		
	Weekly working hours	Less than 40 h = 0 40 h = 1 From 40 to 52 h = 2 More than 52 h = 3	
	Monthly salary		
	Income satisfaction	Dissatisfied = 0 Satisfied = 1	
Psychosocial protective factors	Personality (10-item big five inventory)	Extraversion, Conscientiousness, Openness to experience, Neuroticism, Agreeableness	
	Grit (Short Grit scale)	Consistency of interest, Perseverance of effort	0.63
	Attachment (Relationship questions)	Secure, Fearful, Preoccupied, Dismissing attachment.	
	Satisfaction with life (Satisfaction with Life Scale)		0.84
	Interpersonal relationships (Relationship Change Scale)	Satisfaction, Communication, Trust, Intimacy, Sensitivity, Openness, Understanding.	0.90
Psychosocial risk factors in the workplace	Burnout (Burnout Assessment Tool)	Exhaustion, Mental distance, Emotional impairment, Cognitive impairment	0.88
	Occupational stress (Korean Occupational Stress Scale– Short Form)	Job demands, Degree of autonomy, Job instability, Organizational system, Lack of reward, Occupational climate	0.79
Psychosocial protective factors in the workplace	Occupational self-efficacy (Occupational Self-Efficacy Scale)		0.87
	Social Problem-Solving style (Social Problem-Solving Inventory-Revised-Short Form)	Positive problem orientation, Negative problem orientation, Rational problem solving, Impulsive/careless style, Avoidance style	0.76
	Meaning in work (Working and Meaning Inventory)	Positive meaning in work, Meaning-making through work, Greater good motivation	0.87
	Work-Life Balance (Work-Life Balance Scale)	Family, Leisure, Growth, Life	
	Psychological safety (Team Psychological Safety Scale)		0.54

With advances in data science technology, this study demonstrated the practical applicability of ML algorithms in predicting the risk of depression among MZ employees. We applied three different ML algorithms – sparse logistic regression, RF, and SVM. We found the highest accuracy of RF. Our study identified the important variables influencing the risk of depression among Korean employees such as

gender, inadequate sleep, smoking habits, occupational stress, burnout, social problem-solving styles, sense of meaning at work, attachment, interpersonal relationships, and satisfaction in life. These findings contribute to the development of intelligent mental healthcare systems for the early detection of depression. Additionally, our study can help develop target interventions designed to prevent employees'

depression and provide a situation-specific theory that predicts depression among MZ employees. However, this study focuses solely on MZ employees, and thus, careful consideration is recommended before generalizing these findings to other demographic groups.

Statistical analysis

Prediction models

Our goal is to predict the class of a sample given set of predictor variable values. Three different models are considered for the risk prediction: sparse logistic regression, support vector machine, and random forest. Logistic regression is one of the most widely used statistical prediction model for binary classification problem. When the response variable is binary, logistic regression predicts the probability to be classified to one of two groups given a set of covariate values. The model has the nice property that the estimated coefficients is log odds ratio. However, it is hard to interpret the results when the number of variables gets bigger. To overcome this problem, sparse logistic regression that employs least absolute shrinkage and selection operator (LASSO) in the model is considered in our problem. This model conducts feature selection and the estimation simultaneously, which enables interpretation with few selected important predictors.

Support vector machine is a famous machine learning technique for the binary classification problem. SVM seeks a decision boundary that well separate the data into two groups. It is well known that SVM performs well when data exhibit high-dimensionality while its computational cost is relatively cheap compared to other machine learning methods (45).

Random forest is the representative classification method of ensemble models, which consists of many decision trees. Ensemble method is an approach to combines prediction results from numerous algorithms to improve prediction power by avoiding overfitting. Random forest aggregates the prediction results from many decision trees to make the final decision.

To evaluate the prediction performance of above three estimated models, we used 70% of dataset for the estimation of models and last 30% of data were used for the test. To select the optimal hyperparameters in each model, 5-fold cross validation (CV) were used. For sparse logistic regression, we re-fit logistic regression using only selected features from sparse logistic regression with CV to avoid possible bias of results. Various measures including accuracy, precision, sensitivity, specificity, F1, and AUC were calculated to compare prediction performance. All statistical analyses were performed using R version 4.1.13 statistical package (R Project for Statistical Computing).

Results

Table 2 shows the participants' characteristics by their level of depressive symptoms. The *p*-values were computed using the t-test or chi-square test depending on the type of each variable. The results demonstrated that gender and marital status were significantly different between the normal and depression-risk groups.

Performance measures calculated from analysis results of three methods are shown in Table 3. While all three models show relatively comparable performance, random forest shows little higher

performance on every performance measure except AUC. This implies that random forest predicts the risk of depression more accurately. Also, random forest ranks the importance of features by comparing the reduction of average impurity on prediction for each feature. Figure 1 shows the results including first five features selected as important variables: Cognitive impairment, Negative problem orientation, emotional impairment, satisfaction with life, and employment period at their current workplace.

It is worth to note that sparse logistic regression shows better performance on AUC compared to random forest. These results imply that sparse logistic regression shows better performance in terms of arrangement of samples from low depression probability to high probability. In addition to that, sparse logistic regression yields interpretable results with the estimated effect size of selected features. Table 4 includes the estimated result of logistic regression model using selected features from the sparse logistic regression. Gender, amount of sleep hours, smoking status, year of job experience, weekly working hours, interpersonal relationships, occupational stress, and social problem-solving style were shown to be important to predict the risk of depression for workers in Korea. Several features including negative problem orientation, emotional impairment is commonly shown as important features for the risk prediction in both random forest and sparse logistic regression models. Figure 1 shows significant RF variables. Burnout, social problem-solving style, and satisfaction with life were selected as important features in the RF.

Discussion

This study provides evidence that the ML algorithms can help reduce bias and accurately predict the likelihood of depression among MZ employees. The main strength of this study was the use of the MZ employees' dataset to predict and identify personal and work-related factors of depression using ML techniques. MZ employees exhibited unique depression symptoms, such as narcissistic tendencies, a feeling of victimization from supervisors, difficulty accepting criticism, and an inferiority complex (46). Our study applied to advanced ML techniques to improve intelligent mental healthcare systems which will be used to detect early depressive symptoms and increase access to mental health services for MZ employees in Korea.

The primary objective of this study is to develop ML algorithms to predict the risk of depression among MZ employees. This objective differs from hypothesis testing, which seeks statistically effective variables in relationship with response variables. In this case, too small sample size leads to low power of the test, which means inefficient use of resources including data and time. To overcome the problem, often optimal sample size calculation for getting enough power based on the expected type I and II error of hypothesis test can be conducted (47). This approach can be wildly found in randomized control trials (RCT), especially clinical trials.

On the other hands, our study is focused on developing the predictive model, and we assess their performance using several prediction performance measures such as sensitivity and specificity. To assess the generalizability of their prediction power, ML typically uses partial portion of the data called the training dataset, and test their prediction performance using the data unused for the model construction, called the test dataset. The test set is used to get the accuracy of the ML algorithms and assess model performance

TABLE 2 Socio-demographic characteristics (N=503).

		Young employees' depression		p-Values
		Normal range (n =176, 35.0%)	Risk of depression (n =327, 65.0%).	
Age	Median [1st, 3rd quartile]	32.00 [29.00, 3,500]	32.00 [30.00, 36.00]	0.204
Gender				
Male	n (%)	81 (46.0%)	112 (34.3%)	0.010
Female	n (%)	95 (54.0%)	215 (65.7%)	
Religion				
Nonreligious	n (%)	115 (65.3%)	220 (67.3%)	0.661
Religious	n (%)	61 (34.7%)	107 (32.7%)	
Marital status				
Single	n (%)	109 (61.9%)	245 (74.9%)	0.003
Married	n (%)	67 (38.1%)	82 (25.1%)	
Work related characteristics				
Total years of experience	Median [1st, 3rd quartile]	6.00 [3.00, 10.00]	5.00 [3.00, 9.00]	0.482
Employment period at their current workplace	Median [1st, 3rd quartile]	3.00 [1.00, 5.00]	4.00 [2.00, 5.00]	0.001
Number of turnovers	Median [1st, 3rd quartile]	1.00 [0.00, 2.00]	0.00 [0.00, 2.00]	0.371
Monthly salary (mln won)	Median [1st, 3rd quartile]	2.80 [2.50, 3.50]	3.00 [2.50, 3.20]	0.453

TABLE 3 Performance of machine learning algorithms.

	Accuracy	Precision	Sensitivity	Specificity	AUC
Sparse logistic regression	0.8675	0.8700	0.9255	0.7719	0.9171
SVM	0.8675	0.8491	0.9574	0.7192	0.8384
Random Forest	0.8874	0.8889	0.9362	0.8070	0.8716

regardless of sample size (10, 48). This approach enables us to estimate a prediction error (generalizability) on new data. In our study, the dataset was divided into a training set (70%) and a testing set (30%). Also, cross-validation method the we employed for ML model training is one of the representative devised method to overcome the situation with not enough sample size situation.

Machine learning techniques, sparse logistic regression, SVM, and RF, were applied to develop models for predicting the risk of depression among MZ employees. In this study, sparse logistic regression, SVM, and RF techniques yielded very close accuracies, with RF being slightly higher. Feature selection performed using sparse logistic regression and RF showed similar variables as the important factors of the risk of depression. Sparse logistic Regression provided interpretable results *via* feature selection procedure with the estimated effect size and *p*-values for testing its significance, while RF gives a comprehensive view of variable importance through impurity reduction (49, 50). SVM also showed comparable prediction performance, but also limitation of the method is clear that it does not yields any results regarding importance of each feature for prediction. The important variables identified by Sparse logistic Regression and RF could be useful as a selection tool for mental health professionals to identify employees at risk of depression.

We found that female employees were more likely to suffer from depression than male employees. This result in consistent with

previous studies which reported higher levels of depression among female employees (51–53). Although the mechanisms that underlie this gender difference remain unclear, one possible explanation is related to sex-specific factors. A reduction in estrogen levels may contribute to an increased risk of depression among women (54). Moreover, female employees in East Asia face heavier domestic workloads, including housework and childcare than males, which may contribute to their depression (2, 55). These results highlight the need to identify the mechanisms underlying depression among female employees and develop tailored interventions to address their needs.

Our finding indicates that employees who sleep less than six hours per night were at a higher risk of depression than those who sleep for more than six hours. This is consistent with previous studies which reported that short sleep was associated with a performance of works and depression (56, 57). Our result suggests that adequate sleep is crucial for preventing depression among employees. Additionally, smokers were more likely to suffer from depression than non-smokers in this study. This result was consistent with previous studies that depression was associated with current smoking (58, 59). Chronic nicotine exposure can affect neurotransmitters such as dopamine and 5-HT, leading to depression (60, 61). To successfully prevent the risk of young employees' depression, smoking cessation and preventive interventions must be developed.

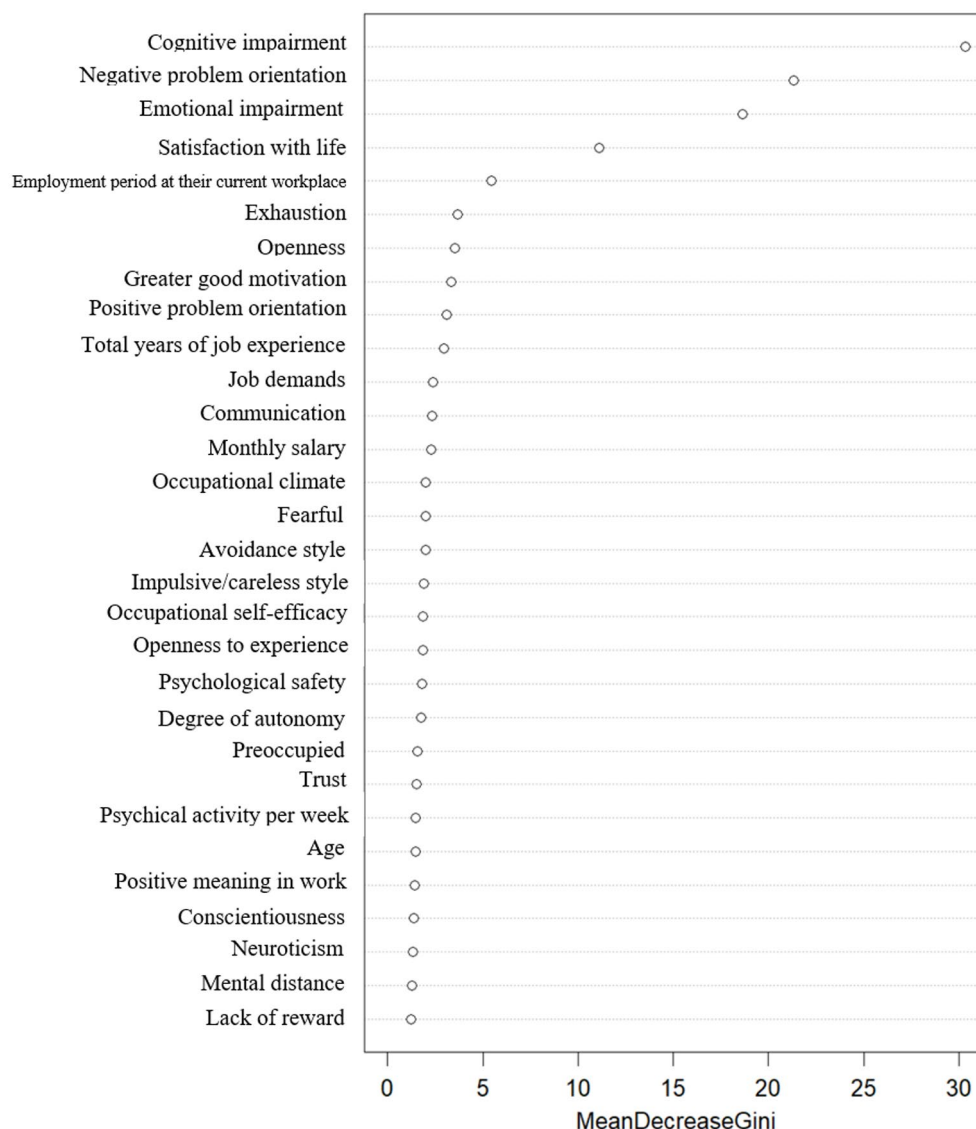


FIGURE 1
Random forest analysis results.

In our study, occupational stress and burnout were identified as psychosocial risk factors in the workplace pivotal in predicting depression risk in young generation employees. These findings were in similar with the results from prior studies, which reported that work-related stress was associated with higher depression in employees (4, 62). A logistic regression analysis also showed that higher occupational stress from highly demanding jobs were more likely to lead to depression. However, employees whose years of job experience were longer and weekly work hours were between 40 to 52h showed a lower risk of depression. A potential explanation is that employees who face high job demands such as high workloads, time pressure, and long working hours may tend to develop the risk of depression by feeling hopelessness and powerlessness at work when they have little or no control over their work (63–66).

Moreover, higher burnout from emotional impairment was a predictor in both Logistic Regression and RF approach. This

supports the results of previous studies showing that individuals with major depressive disorder struggle with regulating emotions due to a dysfunction of their emotional brain systems (67, 68). This result can be explained that employees who experience difficulty in understanding, recognizing, and controlling emotions may undergo decreased contextual information and memory processing that subsequently impairs the autonomic nervous system and brain structure, which results in depression (67, 69, 70). Consistent with this notion, an emotional regulation program such as mindfulness and Emotional Focused Therapy (EFT) is needed to prevent young employees' depression.

We discovered a social problem-solving style and meaning in work as significant psychosocial protective factors in the workplace for predicting employees' depression. According to earlier studies, the deterioration of social problem-solving was associated with depression (71). Negative interpretations of the

TABLE 4 Logistic regression analysis results.

	Estimate	Std error	Exp coef	p-Value
Gender				
Male	–	–	–	–
Female	1.216	0.544	3.374	0.025
Marital status				
Single	–	–	–	–
Married	–0.836	0.579	0.434	0.149
Sleep hours				
Less than 6 h.	–	–	–	–
More than 6 h.	–1.069	0.536	0.343	0.046
Smoking status				
Non-smoker	–	–	–	–
Currently smoker	4.530	1.263	92.776	0.000
Total years of job experience	–0.227	0.081	0.797	0.005
Weekly working hours				
Less than 40 h	–	–	–	–
40 h	–1.578	0.850	0.206	0.063
From 40 to 52 h	–2.379	1.012	0.093	0.019
More than 52 h	0.690	1.701	1.994	0.685
Income satisfaction	–0.664	0.697	0.515	0.341
Personality				
Conscientiousness	–0.042	0.423	0.959	0.921
Openness to experience	0.376	0.329	1.457	0.253
Grit				
Consistency of interest	–0.624	0.439	0.536	0.155
Attachment				
Fearful	0.418	0.180	1.520	0.020
Preoccupied	0.192	0.197	1.211	0.330
Satisfaction with life	–0.115	0.062	0.891	0.065
Interpersonal relationships				
Openness	–0.211	0.098	0.809	0.031
Burnout				
Exhaustion	0.294	0.359	1.342	0.413
Emotional impairment	1.493	0.486	4.451	0.002
Cognitive impairment	0.368	0.418	1.446	0.378
Work and meaning				
Greater good motivation	–0.256	0.141	0.774	0.071
Occupational stress				
Job demands	0.034	0.017	1.035	0.042
Social Problem-Solving style				
Negative problem orientation	0.240	0.087	1.271	0.006
Work-Life Balance				
Work-Family Balance	–0.026	0.227	0.975	0.909
Work-Growth Balance	–0.296	0.222	0.744	0.182

work environment and events tend to be likely to increase depressive rumination as individuals recall more negative past experiences. In contrast, a greater sense of meaning in work predicted lower depression and higher psychological well-being. Employees who have a desire to help others and contribute to society experienced fewer symptoms of depression (72, 73). To reduce depression, intervention can help MZ employees view their work as meaningful, understand challenges, and develop abilities to deal with stress and difficulties at work.

Three psychosocial protective factors, including attachment, interpersonal relationships, and satisfaction in life, were identified in predicting depression in young employees. Young employees with fearful attachments were more likely to become depressed, while young employees with interpersonal openness were less likely to become depressed. Employees with fearful attachment likely have a negative view of themselves and others causing social isolation and loneliness, but those who are confident in self-expression and have higher self-esteem feel socially connected to others which results in preventing depression (74, 75).

The current study has some limitations. First, cross-sectional data restricts the interpretation of causal relationships. Secondly, the sample was limited to young Korean young employees, making it difficult to generalize to older employees, those at different career stages, and individuals from other cultural backgrounds. Finally, the RF approach identified several important predictive factors, but the direction of effect is unclear.

Conclusion

With advances in data science technology, this study demonstrated the practical applicability of ML algorithms in predicting the risk of depression among MZ employees. We applied three different ML algorithms – sparse logistic regression, RF, and SVM. We found the highest accuracy of RF. Our study identified the important variables influencing the risk of depression among Korean employees such as gender, inadequate sleep, smoking habits, occupational stress, burnout, social problem-solving styles, sense of meaning at work, attachment, interpersonal relationships, and satisfaction in life. These findings contribute to the development of intelligent mental healthcare systems for the early detection of depression. Additionally, our study can help develop target interventions designed to prevent employees' depression and provide a situation-specific theory that predict depression among MZ employees. However, this study focuses solely on MZ employees, and thus, careful consideration is recommended before generalizing these findings to other demographic groups.

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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.

Ethics statement

The studies involving human participants were reviewed and approved by Ewha Womans University Institutional Review Board. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

S-SK, MG, and EM performed the study and manuscript conceptualization and contributed to methods, results, and discussion. S-SK and MG contributed to the background. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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Prevalence of common mental disorders and associated factors among adults living in Harari regional state, eastern Ethiopia: a community based cross-sectional study

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Background: Common mental disorders are highly prevalent in the population, affecting people across all regions of the world. In Ethiopia, mental disorders are the leading non-communicable disorders. World Health Organization (WHO) report shows that 4,480,113 (4.7%) and 3,139,003 (3.3%) people in Ethiopia are estimated to suffer from depression and anxiety, respectively. However, there are only limited studies conducted on common mental disorders in Africa including Ethiopia. Even if there was a previous study conducted among Harari regional state residents 7 years back, nowadays there are many possible factors that could increase the prevalence of common mental disorders in the community like the novel coronavirus pandemic, ethnic war, and current socio-economic crises in Ethiopia.

Objective: To assess the prevalence of common mental disorders and associated factors among adult residents of Harari regional state, eastern Ethiopia.

Methods: A community-based cross-sectional study was conducted from March 1 to March 30, 2022. A systematic random sampling technique was used to select 1,192 study participants. Data were collected by interviewer-administered structured and semi-structured questionnaires. A common mental disorder was assessed by the Self-Reporting Questionnaire of 20-Item (SRQ-20) questionnaire. Data were entered into Epi Data version 3.2 and exported to Stata Version 16 for analysis. The multivariable binary logistic regression analysis with a 95% confidence interval and $p < 0.05$ was used to identify factors associated with common mental disorders.

Result: From a total of 1,192 eligible participants, 1,168 responded to this survey, giving a response rate of 97.98%. The prevalence of common mental disorders among adults in the Harari Region of this study was 21.31% (95% CI, 18.8–23.60). Being female with Adjusted Odds Ratios (AOR=1.31, 95%CI, 1.09–2.09), single

(AOR=2.03, 95%CI, 1.37–3.01), divorced (AOR=3.06, 95%CI, 1.97–4.76), widowed (AOR=1.79, 95%CI, 1.23–3.26), unemployed (AOR=1.97, 95%CI, 1.18–3.31), having family history of mental illness (AOR=3.17, 95%CI, 1.54–6.96) and age greater or equal to 55 years (AOR=105, 95%CI, 1.69–3.54) were statistically associated with common mental disorders.

Conclusion: The prevalence of common mental disorder in the study area was sharply increased. Being female, single, divorced, widowed, family history of mental illness, being unemployed and age greater or equal to 55 years old were statistically positively associated with common mental disorder. Considering these determinants, screening, early identification, and providing appropriate intervention for common mental disorders in the community should be of great concern.

KEYWORDS

common mental disorders, prevalence, associated factors, community, Ethiopia

Introduction

Mental health is a state of well-being in which every individual realizes his or her potential, can cope with the normal stresses of life, can work productively and fruitfully, and can contribute to her or his community (1). Common mental disorders (CMD) indicate the more prevalent mental health problems and are characterized by a range of anxiety and depressive disorders which have a long-term impact on human life (2).

Common mental disorders are highly prevalent in the population, affecting people across all regions of the world (3). The global burden of mental illness accounts for 32.4% of years lived with disability (YLDs) and 13.0% of disability-adjusted life-years (DALYs) (4). Of the global burden, almost three-quarters of the burden lies in low-and middle-income countries (LMICS) (5). Globally, 300 million (4.4%) and 264 million (3.6%) people are estimated to suffer from depression and anxiety, respectively, and more than 80% of this burden occurred in low-and middle-income countries (2).

There are limited studies conducted on common mental disorders in Africa. Besides, the available studies reported different figures from different countries. A population-based epidemiological survey of a rural area in Kenya revealed the point prevalence of CMD was 10.8%, largely comprising mixed anxiety-depression (6.1%), panic disorder (2.6%), generalized anxiety disorder (1.6%), and depressive episodes (0.7%) (6). The other population-based studies in Ghana and South Africa showed that the prevalence of CMD among adult residents was 51.8% and 25.0%, respectively (7, 8).

In Ethiopia, mental disorders are the leading non-communicable disorders (9). World Health Organization (WHO) report shows that 4,480,113 (4.7%) and 3,139,003 (3.3%) people in Ethiopia are estimated to suffer from depression and anxiety respectively; the total years lived with a disability was about 837,683 (10.1%) led by depressive disorder and 292,650 (3.6%) by anxiety disorder (2). Previous cross-sectional community-based studies in Jimma Town, South West Ethiopia, Illu Ababor zone, southwest Ethiopia, Silte Zone, Southern Ethiopia, in Addis Ababa, and Harari Regional State, Eastern Ethiopia reported that the prevalence of CMD among adult residents

was 33.6%, 27.2%, 39.7%, 24.7%, and 14.9%, respectively (10–14). These past studies more focused on the southern part of Ethiopia and could not give national representative data. Ethiopia has many regional states with different socio-cultural contexts. Therefore, different studies across the country are expected to provide nationally representative evidence. Besides, in Harari regional state the studies are very limited. The only available population-based study on CMD in this region was conducted around 6 years back (14) and studies with current evidence are needed.

Individuals with an untreated CMD have increased odds of medical illness, suicide, and early mortality (15). Individuals with CMD cannot perform their occupation adequately and they are highly experiencing low workability (16). It has an impact on the mood or feelings of affected persons; the severity of the symptoms ranges from mild to severe and it stays from months to years. It causes marked emotional distress and interferes with daily function (17).

On the other hand, different variables were reported as having a significant association with common mental disorders in the community. Some of them include lower socioeconomic status, history of psychological illnesses, poor reproductive health, gender disadvantage, physical ill-health, Smoking and sedentary behavior, older age, being female, housewife, educational status (unable to read and write), and chewing Khat (10, 11, 18).

Generally, even if there was a previous study conducted among Harari regional state residents 6 years back (14), nowadays there are many possible factors that could increase the prevalence of common mental disorders in the community like the novel coronavirus pandemic, ethnic war, and current socio-economic crises in Ethiopia; even though these variables were not incorporated into the independent factors of this study. So, it is important to know the current prevalence using a representative sample of the population. The public health significance of mental and behavioral disorders is demonstrated by the fact that they are among the most important causes of morbidity in primary care settings and produce considerable disability. Therefore, this study aimed to assess the prevalence of CMD and associated factors among adult residents in Harar Town of Harari regional state, eastern Ethiopia.

Materials and methods

Study setting, design, and period

A community-based quantitative cross-sectional study was conducted from March 1 to March 30, 2022, in Harari regional state, which is located 510km away from the capital, Addis Ababa. The region is divided into nine districts, with three of them being rural and six being urban. The urban districts are subdivided into 19 kebeles (the lowest administrative division in the country), and the rural districts are subdivided into 17 peasant associations (which is equivalent to kebeles in the urban case).

Population and eligibility criteria

Harari regional state residents were a source population. All residents living in randomly selected kebeles of Harari regional state with age greater or equal to 18 years were a study population. Residents living in randomly selected households as heads or any other household members greater than or equal to 18 years of age and residents living more than 6 months and available during data collection were included in the study. Peoples who left the house for some reason and who were seriously ill during the data collection period were excluded.

Sample size determination and sampling procedure

The sample size was calculated by using a single population proportion formula with the following statistical assumptions: n = the minimum sample size required, p = the estimated proportion of CMD, z = the standard value of confidence level of $\alpha = 95\%$, d = the margin of error between the sample and the population (0.03). For this study $p = 14.9\%$ (the prevalence of common mental disorders from a similar study) was used (14).

$$n = \frac{\left(Z_{\alpha/2}\right)^2 P(1-P)}{d^2}$$

$$n = \frac{(1.96)^2 0.149(1-0.149)}{0.03^2} = 542$$

Accordingly, with a design effect of two and adding a 10% non-response rate, the final sample size was 1,192. A multi-stage random sampling technique was used in sampling the study participants. From 9 districts, 13 kebeles were selected using a simple random sampling (lottery) method. Then, from selected kebeles, 1,192 households were allocated proportionally. Each study unit (HH) was selected using a systematic random sampling method. Then, the eligible individual within the selected household was selected using a simple random sampling method.

Data collection procedure and tools

Face-to-face interviews were used to collect data using a semi-structured questionnaire. The questionnaire contains four parts, which are socio-economic characteristics of the patients adapted and modified from reviewing similar literature, and clinical, psychosocial, and substance-related factors. Common mental disorders were assessed by using the Self-Reporting Questionnaire of 20-Item (SRQ-20) developed by the World Health Organization. It has 20 questions that are answered by YES or NO with codes “1” which represent the presence of a symptom, and “0” if the symptom is absent. If the submission of the respondent answers more than six of the twenty questions the respondent was considered to have common mental disorders (19–21). With a cut-off score of 6, the positive predictive value of SRQ-20 is 83.9%. This assessment instrument (SRQ 20) was validated in Ethiopia. It showed better validity as a dimensional scale, with area under the receiver operating characteristic (AUROC) of 0.82 (95%CI, 0.68–0.96) and 0.70 (95%CI, 0.57–0.83) in two different validation studies. The internal consistency, measured by Cronbach's alpha, was excellent in both validation studies: 0.84 (study 1), 0.88 (study 2) (22). The SRQ-20 in this study showed a high internal consistency reliability coefficient (Cronbach's alpha = 0.86).

Social support was assessed by the Oslo social support scale (Oslo-3) which contains three items. It is a 3 item questionnaire, commonly used to assess social support and it has been used in several studies. The sum score scale ranged from 3 to 14, which had three categories: poor support 3–8, moderate support 9–11, and strong support 12–14 (23), and it was validated in Ethiopia (24).

Substance-related factors were assessed by Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST), which is a brief screening questionnaire developed and validated by the World Health Organization (WHO) to find out about people's use of psychoactive substances. It was used to assess the current and ever substance use history of the participants (25). Data were collected by 10 BSc psychiatric nurses and supervised by 2 mental health professionals who were master holders in integrated clinical and community mental health.

Study variables

Dependent variable

Status of common mental disorders (yes/no).

Independent variables

Socio-demographic variables (sex, age in years, marital status, religion, occupational status, educational status, residence, and monthly income in Ethiopian birr), **clinical factors** (family history of mental illness, emotional stress, and comorbid medical illness), **substance-related factors** (current and lifetime substance use of alcohol, tobacco, khat, and cannabis/ hashish), and **psychosocial factor** (perceived social support).

Data quality control

Data collectors and supervisors were trained for 1 day on the data collection approach of the study. The questionnaire was translated into local languages, Amharic and Afan Oromo, by an expert and back-translated into English by another person to check for consistency. A pretest was conducted among 60 adults (5% of the sample size) living in Haramaya town, which is nearest to the study areas but not part of the study areas, to see the applicability of the instruments, and feedback was incorporated into the final tool to improve the quality. Supervision was done by the supervisors and principal investigator throughout the data collection period and checked daily for completeness and consistency of questioners.

Data processing and analysis

The data were coded, cleaned, and entered into Epi Data version 3.2 and then exported to Stata version 16 for analysis. Bivariable and multivariable logistic regression analysis was performed to identify factors associated with a common mental disorder. All variables with a *p*-value less than 0.20 in bivariate analysis were entered into the multivariable logistic regression analysis. To estimate the strength of association between an outcome and explanatory variables, an adjusted odds ratio (AOR) with a 95% confidence interval was reported. A *p*-value of less than 0.05 is considered statistically significant. Multicollinearity was assessed by the variance inflation factor (VIF) to see a correlation between independent variables and VIF were less than 5 for all variables, indicating that there was no problem of multicollinearity between the predictor variables. The goodness of model fitness was checked by using the Hosmer-Lemeshow test.

Ethical considerations

Ethical clearance was obtained from the Institutional Health Research Ethics Review Committee (reference number: IHRERC/043/2022) of the College of Health and Medical Sciences of Haramaya University. Then data collection was initiated after a letter of permission was obtained from Haramaya University College of Health and Medical Sciences for each district and Kebeles administrator. Official permission was secured from woreda and the Kebele administrator. Also, informed, voluntary, written and signed consent was obtained from each participant after explaining the purpose and importance of the study before the interviews. Participants were informed about the aim of the study and the advantage of the study; confidentiality, as there was no risk of being participants, and they have full right to halt in the middle of the interview. Written informed consent was taken from each participant before data collection began. Confidentiality was maintained at all levels of the study through anonymous data collection. During data collection, the COVID-19 prevention protocol was kept.

Results

Socio-demographic characteristics of participants

A total of 1,168 participants were included in the study with a response rate of 97.98%. The median age of respondents was 40, with

an interquartile range (IQR, 30–65) years. More than half of the participants, 57.87% (676) were males and around two-third, 64.47% (753) were married. Regarding the educational status of participants 30.65% (358) were able to read and write, the majority of participants 46.49% (543) were Muslim religion followers and nearly three-fourth, 72.43% (846) were urban residents as show in Table 1. Generally, the socio-demographic variations found in Table 1 is the matter of chance and does not reflect the actual population of the study area/region.

Clinical, psychosocial, and substance-related characteristics of respondents

Most of the participants, 97.17% (1135) reported no family history of mental illness. Around half 46.15% (539) of respondents were lifetime substance users and 34.59% (404) were chewing Khat during the last 3 months. But only 1.3% (15) uses hashish/cannabis during the last 3 months. Out of all study respondents, around 27.65% (323) and 33.73% (394) had a comorbid medical illness and moderate social support, respectively, as shown in Table 2.

Prevalence of common mental disorders among adults living in Harari regional state

In this study, participants who scored more than 6 of the 20 questions of SRQ-20 were considered as having common mental disorders. Therefore, using this cut-off point (> 6 of SRQ-20), the prevalence of common mental disorders among adults living in the Harari regional state was 21.3% (95%CI, 18.8–23.6). The prevalence of common mental disorder was higher among female residents (24.79%) than male residents (18.78%), widowed (26.36%) than married (15.94%), among unemployed (38.26) than government employer (18.18), older age of ≥55 years (24.47%) than younger of 15–24 years old (14.50%), current Alcohol users (29.27%) than non-users (20.38%), and among those who had family history of mental illness (45.45%) than who had not it (20.62%). The SRQ-20 responses (yes/No percentages) by the respondents was illustrated in Table 3.

Factors associated with common mental disorders among adults living in the Harari region

In bivariate logistic regression analysis variables like being female, single, divorced, widowed family history of mental illness, current alcohol use in the last 3 months, students, unemployed, age greater or equal to 55 years were significantly associated with common mental disorders. However, in the multivariate logistic regression analysis variables like a female, single, divorced, widowed, family history of mental illness, unemployed, and age greater or equal to 55 years were statistically significantly associated with common mental disorders with a *p*-value less than 0.05.

In this study, the odds of having CMD among respondents with were female were about 1.31 times higher as compared to participants those being male [AOR = 1.31 (95%CI, 1.09–2.09)], and the odds of having common mental disorders among participants who were

TABLE 1 Socio-demographic and economic distributions of study participants in Harari regional state, Eastern Ethiopia ($n = 1,168$).

Variables	Categories	Frequency ($n = 1,168$)	Percentage (%)
Sex	Male	676	57.88
	Female	492	42.12
Age (years)	18–24	131	11.21
	25–34	171	14.64
	35–44	190	16.26
	45–54	153	13.12
	≥55	523	44.77
Marital status	Married	753	64.45
	Single	187	16.01
	Divorced	118	10.1
	Widowed	110	9.42
Religion	Muslim	543	46.49
	Orthodox	401	34.33
	Protestant	121	10.36
	Others ^a	103	8.82
Occupational status	Government worker	319	27.31
	Merchant	269	23.03
	Student	153	13.1
	Farmer	161	13.78
	Daily labor	48	4.11
	Household worker	103	8.82
	Unemployed	115	9.85
Educational status	Unable to read and write	183	15.67
	Able to read and write	358	30.65
	Primary (1–8)	203	17.38
	Secondary (9–12)	221	18.92
	Diploma and above	203	17.38
Residence	Rural	322	27.56
	Urban	846	72.44
Monthly income in Ethiopian Birr	≤1,499	263	22.51
	1,500–2,999	265	22.69
	3,000–4,999	285	24.4
	≥5,000	355	30

^aCatholic, Wakefata, and Adventist.

widowed, single, and divorced were 1.79, 2.03 and 3.06 times higher as compared to respondents who were married with [AOR = 1.79 (95%CI, 1.23–3.26)], [AOR = 2.03 (95%CI, 1.37–3.01), and AOR = 3.06 (95%CI, 1.97–4.76)] respectively.

The odds of having common mental disorders among respondents who had a family history of mental illness were 3.21 times higher as compared to respondents who had no family history

TABLE 2 Clinical, substance use, and psychosocial features of study participants in Harari Regional State, Eastern Ethiopia ($n = 1,168$).

Variables	Categories	Frequency ($n = 1,168$)	Percent (%)
Family history of mental illness	Yes	33	2.83
	No	1,135	97.17
Emotional stress	Yes	219	18.75
	No	949	81.25
Comorbid medical illness	Yes	323	27.65
	No	845	72.35
Lifetime substance use	Yes	539	46.14
	No	639	53.86
Current alcohol use in the last 3 months	Yes	123	10.53
	No	1,045	89.47
Current Khat use in last 3 months	Yes	404	34.58
	No	764	65.42
Current smoking cigarettes in the last 3 months	Yes	175	15
	No	993	85
Current use of cannabis/hashish in the last 3 months	Yes	15	1.28
	No	1,153	98.72
Social support	Poor	397	34
	Moderate	394	34.73
	Strong	377	32.27

of mental illness [AOR = 3.17 (95%CI, 1.54–6.96)] and odds of having common mental disorders among participants who were unemployed was 1.97 times higher as compared to participants who were government employers [AOR = 1.97 (95%CI, 1.18–3.31)]. Besides, the odds of having common mental disorders among participants who were age greater or equal to 55 years was 1.05 times higher as compared to respondents who were found within the age category of 15–24 [AOR = 1.10 (95%CI, 1.69–3.54)] as shown in [Table 4](#).

Discussion

Common mental disorder is a public health problems that cause impact to the individuals, their family and communities in both developed and developing countries (26). The global burden of disease report indicate that CMD accounts around 9.8% of global burden disease (5). But the prevalence and associated factors of common mental disorders are varying among different population. This study showed that using a cut-off point >6 of SRQ-20 questionnaire; the prevalence of common mental disorder among the adult population living in the Harari regional state was 21.3% (95%CI, 18.8–23.6). The current finding was in line with the community based study conducted in Nigeria among 1,105 respondents using the 12-Item General Health Questionnaire (GHQ-12), 21.9% (27), and in Jimma, southwest Ethiopia, utilized self-reporting questionnaire-20 with cut-off point 6 out of 20 items among 1,006 individuals, 22.7% (28).

TABLE 3 Self-reported questions responses of study participants living in Harari region state, Eastern Ethiopia (*n* =1,168).

SRQ-20 questions	Yes/No	Frequency (<i>n</i> =1,168)	Percentage (%)
1. Often have head ache	Yes	284	24.3
	No	884	75.7
2. Have poor appetite	Yes	174	14.9
	No	994	85.1
3. Sleep badly	Yes	199	17.0
	No	969	83.0
4. Easily frightened	Yes	128	11.0
	No	1,040	89.0
5. Have shaking hands	Yes	140	12.0
	No	1,028	88.0
6. Feel nervous, tense, or worried	Yes	164	14.0
	No	1,004	86.0
7. Have poor digestion	Yes	164	14.0
	No	1,004	86.0
8. Have trouble thinking clearly	Yes	145	12.4
	No	1,023	87.6
9. Feeling unhappy	Yes	161	13.8
	No	1,007	86.2
10. Cry more than usual	Yes	146	12.5
	No	1,022	87.5
11. Find difficult to enjoy your daily activities	Yes	150	12.8
	No	1,018	87.2
12. Find it difficult to make decisions	Yes	151	12.9
	No	1,017	87.1
13. Your daily work suffering	Yes	152	13.0
	No	1,016	87.0
14. Unable to play a useful part in life	Yes	151	12.9
	No	1,017	87.1
15. Lost interest in things	Yes	150	12.8
	No	1,018	87.2
16. Feeling as a worthless person	Yes	134	11.5
	No	1,034	88.5
17. Thought of ending your life been on your mind	Yes	133	11.4
	No	1,035	88.6
18. Feeling tired all the time	Yes	155	13.3
	No	1,013	86.7
19. Uncomfortable feelings in your stomach	Yes	104	8.9
	No	1,064	91.1
20. Easily tired	Yes	146	12.5
	No	1,022	87.5

However, the result of this study was lower than another community based study conducted in the United Kingdom among 8,191 residents using the General Health Questionnaire-12 items, 24.6% (29), in Chile Santiago among 3,870 population using the

Clinical Interview Schedule-Revised (CIS-R) tool, 25.5% (30), in South Africa among 209 general population according to cut-off scores of 9 and higher on the 20-item version of the Self Report Questionnaire (SRQ), 27.3% (31, 32), and in Brazil among 3,597

TABLE 4 Factors associated with common mental disorders in multivariate and bivariate logistic regression analysis among study participants living in Harari region state, Eastern Ethiopia ($n = 1,168$).

Explanatory variables	Common mental disorders		COR (95%CI)	AOR (95%CI)
	Yes	No		
Sex				
Female	122	370	1.43 (1.08–1.89)	1.31 (1.09–2.09)*
Male	127	549	1	1
Marital status				
Married	120	633	1	1
Single	56	131	2.25 (1.56–3.26)	2.03 (1.37–3.01)**
Divorced	44	74	3.14 (2.06–4.78)	3.06 (1.97–4.76)**
Widowed	29	81	1.89 (1.18–3.01)	1.79 (1.23–3.26)*
Occupational status				
Government employer	58	261	1	1
Merchants	43	226	0.86 (0.56–1.32)	0.74 (0.45–1.20)
Students	41	121	1.65 (1.04–2.60)	1.48 (0.91–2.41)
Farmer	35	126	1.25 (0.78–2.06)	1.02 (0.61–1.71)
Daily labour	7	41	0.77 (0.33–1.80)	0.62(0.26–1.50)
House wife	21	82	1.15 (0.66–2.01)	0.91 (0.49–1.64)
Unemployed	44	71	2.79 (1.74–4.47)	1.97 (1.18–3.31)*
Age (in years)				
15–24	19	112	1	1
25–34	43	128	1.98 (1.09–3.59)	1.78 (0.08–3.78)
35–44	31	159	1.15 (0.62–2.14)	1.02 (0.68–2.45)
45–54	28	125	1.32 (0.67–2.49)	1.30 (0.69–2.58)
≥55	128	395	1.91 (1.13–3.23)	1.10 (1.69–3.54)*
Current alcohol use				
No	213	832	1	1
Yes	36	87	1.62 (1.07–2.45)	1.42 (0.91–2.09)
Family history of mental illness				
No	234	901	1	1
Yes	15	18	3.21 (1.59–6.46)	3.17 (1.54–6.96)*

* $p < 0.05$ and ** $p < 0.001$. COR, crude odds ratio; AOR, adjusted odds ratio.

individuals using the Self Reporting Questionnaire (SRQ-20) with a cut-off point of seven or more, 29.9% (33). The possible reason for the discrepancy might be the data collection instruments used, this study used the Self-Reporting Questionnaire of 20-Item (SRQ-20) but the study done in South Africa used a Composite international diagnostic interview (CIDI).

On the other hand, the finding of the current study was higher than the study done in rural Kenya among 50,000 population, using the Clinical Interview Schedule-Revised (CIS-R), 10.8% (6), in southern Ethiopia, among 1854 people using Composite International Diagnostic Interview (CIDI), 1.7% (34), in central Ethiopia among 10,203 urban grown-ups using the Self Reporting Questionnaire (SRQ) with a cut-off point of at least 6 out of 20 items, 11.7% (35), and in Eastern Ethiopia, among 968 residents using Self-Reported Questionnaire-20 with a cut-off point score of ≥ 6 , 14.9% (14). As compared with the result of a previous study conducted in the study area, 14.9% (14) the current study result shows that the prevalence of

common mental disorder is sharply increased, 21.3%; there are many possible factors that could increase the prevalence of common mental disorder in the community at the moment like the emerging novel coronavirus pandemic, ethnic war, and related socio-economic crises in Ethiopia like unemployment.

In this study, the odds of having common mental disorders were higher among female participants as compared to males. This result is supported by a study conducted in Kenya (6), South Africa (31), and a previous study done in Ethiopia (28, 35). The possible justification for this association might be due to cultural influence in which females may not discuss their problems with others as males, and it might be due to females having greater vulnerability to other psychosocial stress. The other possible justification might be related to depression in which females are 2 times more likely to have depression as compared with males (36).

Respondents who had a family history of mental illness were 3.17 times more likely to experience common mental disorders as

compared to those who had no family history of mental illness. This finding was supported by a previous study carried out in Addis Ababa, Ethiopia (35). The possible reason might be due to a biological perspective or could be due to non-biological factors like sharing similar family stress and environmental factors. Additionally, as the family data indicated, if one parent has a mood disorder like depression, the child will have a risk to develop it (36).

Regarding marital status, participants who were, widowed, single, and divorced were 1.79, 2.03, and 3.06 times more likely to experience common mental disorders, respectively, as compared to participants who were married. This result was supported by the study done in Kenya (6), Britain (37), and Edmonton (38). The possible justification could be in the fact that divorced/widowed, people might be depressed due to feelings of hopelessness, worthlessness, anxiety, and doubts about solving marital problems. Another possible reason might be depression occurs most often in persons without close interpersonal relationships and in those who are divorced or single (1).

With respect to their occupational status, unemployed respondents were 1.97 times more likely to have common mental disorders as compared to governmental employed participants. This was supported by studies conducted in England (39, 40). The possible reason might be that increased job insecurity has been found to increase the chance of depressive symptoms and unemployment has been found to negatively affect self-esteem and increase feelings of distress (12). With respect to their age, the odds of having common mental disorders among participants who were age greater or equal to 55 years was 1.10 times higher as compared to respondents who were found within the age category of 15–24 years. This finding is in line with the studies in Kenya (6), and Ethiopia (35, 41). This could be due to age increasing the accumulation of stressful life events and biological changes like hormonal changes could increase and affect the emotion of individuals. Again, as age increases, more individuals tend to complain and externalize their emotional feelings (35).

Limitations of the study

This study has some limitations. First, since the study design was cross-sectional, it cannot show the causal relationship. Second, during face-to-face interviewing the effect of the interviewer on the respondent can cause social desirability bias. Third, due to the nature of the data collection tool, recall bias can be considered a limitation. Fourth, the SRQ-20 is a screening instrument and not diagnostic of mental disorders. Fifth, the population studied were not screened for recent stressors, like loss to rule out bereavement as a confounder.

Conclusion

The finding of this study showed that prevalence of common mental disorders was high in the community of Harari region state, Eastern Ethiopia. Being female, single, divorced, widowed, unemployed, having a family history of mental illness, and age were significantly associated with common mental disorders. Focusing on

these identified associated factors, screening, early identification, and development of a program to prevent and provide appropriate home-based interventions for common mental illnesses in the community should be great attention to all stakeholders.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by Institutional Health Research Ethics Review Committee (reference number: IHRERC/043/2022) of the College of Health and Medical Sciences of Haramaya University, eastern Ethiopia. The patients/participants provided their written informed consent to participate in this study.

Author contributions

TA contributed to conceiving the original idea, designing and conducting the study, analyzing the data, preparing, critically reviewing, and approving the manuscript for publication. AB, HK, AA, KeB, KaB, FM, DD, FW, YA, ML, DW, TB, KG, SN, AN, GD, BB, JH, AE, AG, YD, AS, AH, HA, JD, and KN contributed to designing and conducting the study, analyzing the data, and reviewing the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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Resilience and stress as predictors of work engagement: the mediating role of self-efficacy in nurses

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Background: Nurses face high levels of stress and work demands, which can affect their work engagement and psychological well-being. Resilience and self-efficacy have been identified as important resources to improve nurses' adaptation and work engagement.

Objective: This study aimed to evaluate the mediating role of self-efficacy in the relationship between resilience and stress on work engagement in Peruvian nurses.

Methods: A cross-sectional design was used, and data were collected from a sample of 459 nurses. Self-report questionnaires were administered to measure self-efficacy, resilience, stress, and work engagement. SEM analyses were performed to examine the relationship between these variables, and a mediation analysis was conducted to evaluate the role of self-efficacy as a mediator in the relationship between resilience, stress, and work engagement.

Results: The results indicated a positive relationship between resilience, self-efficacy, and work engagement, as well as a negative relationship between stress and work engagement. Additionally, self-efficacy mediated the relationship between resilience and work engagement, as well as the relationship between stress and work engagement in nurses.

Conclusion: Personal resources such as self-efficacy are a key factor in the relationship between resilience (work resources), stress (work demands), and work engagement of Peruvian nurses. Strengthening self-efficacy and resilience can improve work engagement and personal satisfaction of nurses. Hospital administrators and nursing managers should consider the importance of resilience, stress, work engagement, and self-efficacy in registered nurses and develop effective strategies to improve them. This can have a positive impact on the quality of care provided to patients and on the job satisfaction of nurses.

KEYWORDS

resilience, stress, work engagement, self-efficacy, nurses

1. Introduction

Nursing staff shortage is a significant problem that can affect healthcare quality and lead to poor patient care outcomes, ineffective teamwork, and decreased work performance. To address this issue and improve the quality of healthcare services, it is necessary to promote professional commitment, nursing competence maintenance, and self-efficacy enhancement (1, 2). Healthcare organizations seek committed and dedicated employees who can successfully face challenges (3). Work engagement is crucial to achieve effective and efficient healthcare delivery, and nurses, as the backbone of the healthcare system, play an important role in ensuring this (4). However, the stressful nature of nursing work puts nurses at risk of emotional distress, including burnout, depression, anxiety, secondary traumatic stress, and suicide. Nurses are exposed to a wide variety of stressors, including trauma, shift work, workplace violence, and resource insufficiency (5, 6). In the context of mental health, nurses are exposed to unique stressors, such as seeing patients self-harm and caring for patients who may attempt or complete suicide (7). In this context, resilience and stress are important predictors of nurses' work engagement (8). Self-efficacy plays a significant mediating role in this relationship, and future research should examine other factors that may influence nurses' engagement, such as social support and personality. To improve nurses' work engagement, it is necessary to address the challenges they face and promote their resilience and self-efficacy.

The job demands-resources model (JD-R) is an important framework for understanding the relationship between work-related well-being and stress, as well as engagement and performance in nurses (9). This model considers that work resources are the best predictors of individual and organizational engagement and performance through a motivational process (10). It also highlights the role of workers' job resources, such as the positive evaluation or belief of control workers have over their environment, as it is positively related to engagement and performance and also reduces the negative impact of work demands like stress (11). Adequate work resources can effectively balance the various task requirements during work so that individuals can maintain a good work state, leading to high work engagement (9).

In terms of work resources, the literature has emphasized the importance of workers' self-efficacy, that is, their beliefs in their ability to control their own functioning (9). When nurses believe in their abilities to perform clinical tasks skillfully, they tend to perceive work requirements as challenges to overcome rather than threats to avoid (12). Previous studies have shown that high levels of self-efficacy are associated with higher levels of work engagement in nurses (13, 14). Self-efficacy determines the amount of work and effort invested in tasks, and if it is high, nurses dedicate more time and energy to a task, become more involved, and concentrate more easily (15). Therefore, research focuses on finding ways to alleviate the negative impact of interpersonal stressors in the workplace (16–18). The JD-R model suggests the importance of work resources in

combating an exhausting work environment (19). Work resources refer to the psychological capacities that enable individuals to be flexible and adaptable to exhausting resource circumstances (20). Previous research suggests that the extent to which work demands result in emotional exhaustion depends on the amount of personal resources (21). Self-efficacy is an important factor that influences the perception of work demands and, therefore, work engagement in nurses. The higher the self-efficacy, the less they will be affected by stress, and the more likely they are to engage in their work. In addition, resilience also plays an important role in work engagement. Resilience refers to an individual's ability to recover from stressful situations and maintain good work performance. The higher the resilience, the easier it is for nurses to adapt to challenges and maintain high work engagement (22, 23).

Thus, the JD-R model provides a useful framework for understanding the relationship between self-efficacy, resilience, stress, and work engagement in nurses. The literature suggests that work resources, such as self-efficacy and resilience, are important in mitigating the negative impact of stress and improving work engagement. Therefore, the objective of this research is to evaluate the mediating role of self-efficacy in the relationship between resilience, stress, and work engagement.

1.1. Literature review

1.1.1. Work engagement

Work engagement is a crucial aspect for workers' well-being and organizational success. It is a positive and motivating work-related state characterized by vigor, dedication, and absorption (24). It has been extensively studied and shown to be related to positive aspects such as health (25), happiness (26), satisfaction (27), and favorable behaviors for the organization, such as personal initiative (28), active learning (29), and customer satisfaction (30). Work engagement is reflected in a range of positive outcomes for both workers and organizations. It increases job satisfaction (15), decreases psychological strain, and improves performance (31). In the case of nurses, a high level of work engagement has been associated with a decrease in turnover intentions, delays, and absenteeism (32), as well as an improvement in emotional health (33, 34). In addition, work engagement has a positive impact on work efficiency, quality of care, and patient satisfaction, which in turn reflects organizational outcomes (35).

Within the Job Demands-Resources model (JD-R), it has been shown that job resources are positively related to work engagement (36). Self-efficacy, an important personal resource, is also positively related to work engagement (4). Factors influencing nursing competence include effective self-management and professional commitment. Low work engagement results in various organizational outcomes such as high turnover rates, low job satisfaction, and low performance (37, 38).

1.1.2. Stress

Stress is a significant problem in the nursing profession, and it has been identified as a factor contributing to job dissatisfaction and staff turnover (39). Stress is a complex psychobiological process that is experienced when an individual perceives a threat or danger in their environment (40). Nurses face a variety of stressful situations, including the stresses of patients and the demands of their families (41), which can affect their professional performance and lead to burnout (42). Despite the challenges, the nursing profession can also be a source of satisfaction and well-being for workers (43). The JD-R model is a useful framework for assessing the antecedents of work-related stress. Job demands include physical, psychological, social, or organizational aspects that require physical and psychological effort or skills. The JD-R is a balance model, as the perception of the adequacy of job resources acts as a buffer against the negative impacts of job demands perceived as high. This model is relevant for stress management in high-demand environments, such as nursing work (36, 44). The perceptions and attitudes of nurses about their work are crucial because they have a high turnover rate, which can disrupt continuity of care and increase costs. Numerous studies have focused on work-related stress and burnout among nursing staff because they work in high-stress environments. This has detrimental effects on their mental and physical health, productivity, and job effectiveness and can lead to absenteeism (2, 45).

1.1.3. Resilience

Resilience is the ability of an individual to recover from or successfully confront adverse situations (46). Resilience has been described as both a personality trait (47) a dynamic process (48). Resilience is defined as an individual's ability to recover quickly and easily from setbacks that occur in their life (49). Strength is a common theme in various definitions of resilience, and people who are described as resilient are able to persist and overcome challenging obstacles (50). Nurses may be negatively impacted in their resilience due to the emotional labor of suppressing emotions during interactions with patients (51). Moral distress, which occurs when a person is unable to act in accordance with their core values due to internal and external constraints, may contribute to professional burnout (7, 52). The nature of nurses' role, which involves providing continuous care and forming close relationships with patients and families, puts them at greater risk of compassion fatigue and professional burnout (53). However, protective factors have been identified that enable nurses to positively adapt in stressful work situations, such as personal resilience (54, 55). Maintaining psychological well-being and mental health are common indicators of the resilient process after adverse events (56). Most people are exposed to regular stressors and one or more life-threatening experiences throughout their lifetime (57). Understanding what facilitates resilience and positive adaptation can play an important role in improving people's mental health in many contexts. Resilience can be viewed as both a personality trait, a process, and an outcome (58). When considered as a personality trait, resilience is fixed and stable over time, while, when viewed as a dynamic process, resilience can develop throughout life and vary according to context and time (59). Resilience in nurses has been studied from the perspective of the JD-R model. Studies have found that personal resilience can act as a work resource to cope with job demands and reduce the risk of professional burnout and

compassion fatigue (60–62). Additionally, resilience can also help nurses maintain their psychological well-being and mental health in adverse situations, which is a common indicator of the resilient process (56).

1.1.4. Self-efficacy

Workplace self-efficacy is a key component of personal resources, and refers to an individual's beliefs about their competence and ability to perform their job (63). Positive self-efficacy is associated with self-directed motivation, energy, and positive expectations of success, based on the belief in one's competence and ability (64). Employees with strong workplace self-efficacy likely have the motivational and psychological skills to withstand difficult work situations, which would otherwise deplete their emotional resources and energy. These employees may perceive incivility in the workplace as less threatening and feel less emotionally exhausted. The cognitive-social theory defines self-efficacy as the belief in one's own abilities to achieve specific successes in the future (17). Research has shown that positive self-efficacy is a predictor of positive states, such as work engagement, especially in demanding work environments (65). Bandura's social cognitive theory (SCT) (63) asserts that self-efficacy beliefs influence behavior, thought, and feeling. For example, people tend to choose tasks they believe they can do and avoid those they consider too difficult. People with low self-efficacy tend to exaggerate their deficits and produce negative thoughts that lead to stress and hinder their ability to utilize available resources (66). Empirical research has shown that positive self-efficacy is a predictor of positive states such as work engagement through positive spirals, especially in demanding work environments (67, 68).

The Job Demands-Resources (JD-R) model recognizes job demands as aspects of work that require sustained physical and/or psychological effort and are associated with physiological and/or psychological costs (69). This model emphasizes the role of personal resources of workers, such as self-efficacy, in job engagement and performance, as they are positively related and can reduce the negative impact of job demands (9). Self-efficacy is considered a personal resource that can help individuals cope with job demands and enhance their motivation and commitment, as it refers to an individual's belief in their capabilities to control their environment and perform a task or achieve a specific goal (70). Self-efficacy can act as a mediator between job demands and job engagement, buffering the negative impact of demands and enhancing the positive effects of job challenges (14, 71, 72). Initially, job demands were thought to deplete energy and be linked to burnout and exhaustion. However, subsequent studies have identified that job demands can be both negative stressors and positive challenges (73, 74). Nurses with high levels of self-efficacy perceive their work environment as a place where they are capable of effectively facing challenges and feeling more prepared to cope with job demands (39).

Furthermore, professional self-efficacy can help professionals address demanding challenges, creating higher demands on practicing nurses to demonstrate their caregiving skills (75). In this sense, challenging job demands can have a positive impact on self-efficacy and job engagement, thus, job challenges can lead to the development of self-efficacy and achieving successful outcomes. Additionally, self-efficacy can serve as a mediating factor between challenging job demands and job engagement. This implies that individuals who experience and overcome job challenges can develop higher

self-efficacy, which, in turn, can influence their commitment and positive involvement in work (72).

Nurses with high levels of self-efficacy are more guided by their internal goals for their careers than nurses with low levels of self-efficacy (76). They can perform practical skills or tasks more effectively and better understand the reasoning behind their execution (77), which can help hospital administrators retain their nurses (78). When nurses continue to promote their job competence and demonstrate their professional commitment and achievement preferences in their career, their self-evaluation of their nursing careers improves (79). Assessing self-efficacy within the JD-R model will allow for a better understanding of job demands as challenges that can have positive effects on self-efficacy and job engagement.

Based on the arguments presented, the following hypotheses are proposed (Figure 1):

H1: There is a positive relationship between resilience and self-efficacy.

H2: There is a negative relationship between stress and self-efficacy.

H3: There is a relationship between self-efficacy and work engagement.

H4a: Self-efficacy mediates the relationship between resilience and work engagement.

H4b: Self-efficacy mediates the relationship between stress and work engagement.

2. Methods

2.1. Design and participants

A cross-sectional explanatory study was designed, considering latent variables represented by a structural equation model (80). The sample size was evaluated using the effect size through the Soper electronic calculator (81), which takes into account the number of observed and latent variables in the structural equation model (SEM),

the anticipated effect size ($\lambda=0.2$), the desired statistical significance ($\alpha=0.05$), and the level of statistical power ($1 - \beta=0.90$), which indicated a minimum sample size of 434 participants. The population consisted of 700 nurses, and the sample was selected through non-probabilistic sampling. The participants consisted of 459 Peruvian nurses. The mean age was $M=40.12$ years ($SD=10.9$), ranging from 22 to 68 years. Table 1 shows that the majority of nurses were female (62.3%), with a single marital status (34.2%), university education (81.7%), and temporary employment contracts (53.6%).

2.2. Procedure

The project was approved by the Ethics Committee of a Peruvian University (2022-CEUPeU-026). Afterwards, participants were invited to answer a questionnaire that was available online through Google Forms from September 2nd to December 30th, 2022. Before collecting data, confidentiality norms and protocols established in the Declaration of Helsinki were respected. Participants were informed about the research objective and gave their informed consent before starting.

2.2.1. Instruments

2.2.1.1. Work engagement

The Spanish version of the Brief Commitment Scale (UWES-9) was used to evaluate the work engagement of health professionals (82). This scale consists of nine items that are rated on a six-point Likert-type scale, ranging from “never” (0) to “always” (5). The scale focuses on three dimensions: vigor, dedication, and absorption. The internal consistency of the scale was determined using Cronbach's alpha, and a variation from 0.84 to 0.92 was observed for the dimensions. The UWES-9 is a tool that has been adapted to Peruvian Spanish, showing adequate psychometric properties, and the internal consistency reliability measured by McDonald's Omega was appropriate ($\omega=0.85$).

2.2.1.2. Self-efficacy

The Spanish version of the General Self-efficacy Questionnaire (GSQ) (83) was used to measure self-efficacy, which is a simplified version of the General Self-efficacy Model by Schwarzer (84). This scale consists of 10 questions, with a minimum score of 10 points and a maximum of 40 points, which are rated on a Likert-type scale.

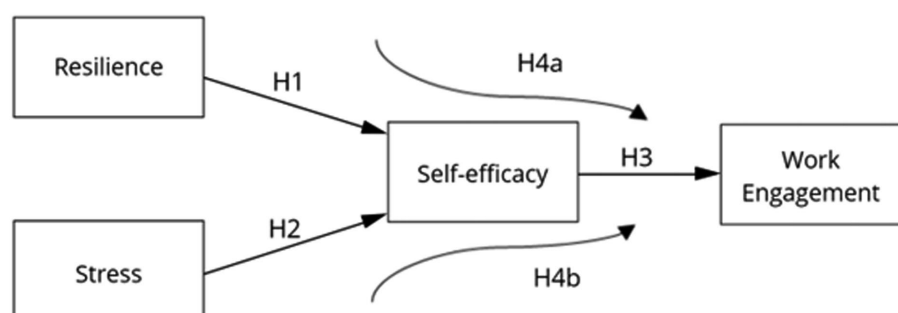


FIGURE 1
Theoretical model.

TABLE 1 Sociodemographic information.

Characteristic		<i>n</i>	%
Sex	Female	286	62.3
	Male	173	37.7
Marital Status	Married	112	24.4
	Living together	138	30.1
	Divorced	38	8.3
	Single	157	34.2
	Widowed	14	3.1
Academic formation	Specialty	44	9.6
	Postgraduate	34	7.4
	Technical	6	1.3
	University degree	375	81.7
Employment status	Indefinite work contract	46	10.0
	Temporary work contract	246	53.6
	Permanent appointment	108	23.5
	Replacement work contract	12	2.6
	Contract with service providers (third parties)	47	10.2

Responses range from “Incorrect” (1 point) to “True” (4 points), depending on the perception of one’s own ability at that moment. The internal consistency of the scale was evaluated using Cronbach’s alpha coefficient, which obtained a value of 0.84, indicating good internal consistency. The GSQ has been adapted to Peruvian Spanish, reporting adequate psychometric properties, and its internal consistency measured by the categorical Omega coefficient was appropriate ($\omega_{\text{categorical}} = 0.79$) (85).

2.2.1.3. Resilience

The Brief Resilient Coping Scale (BRCS) adapted to Spanish in its unidimensional version was used to measure Spanish resilience (86). This scale focuses on the ability to manage stressful factors adaptively and consists of four items that are rated on a Likert-type scale ranging from 1 (not at all describing me) to 5 (describing me very well). Internal consistency was evaluated using the Composite Reliability Index and obtained a result of 0.70. The Peruvian Spanish adapted version was used, and the internal consistency reliability of the scale was estimated at 0.87 (87).

2.2.1.4. Stress

The Perceived Stress Scale (PSS-4) in its Spanish version (88), adapted from the English version (89), was used to evaluate stress. The scale consists of four items, two of which are written positively (1 and 4) and two negatively (2 and 3). The scale is a Likert-type scale ranging from 0 (never) to 4 (very often). Reliability was evaluated using Cronbach’s alpha, which was adequate with a value of 0.74, and the omega coefficient, with a value of 0.78.

2.3. Statistical analysis

An initial analysis of possible common method bias was conducted, which arises due to the use of self-administered questionnaires in data collection. This bias refers to measurement error that can be introduced in the study due to the design of the data collection instrument (90, 91). To mitigate this effect, the statistical strategy of assessing common method variance (CMV) was employed through the Harman’s single-factor test. This method is based on the expectation that if there is common method bias, a single factor will emerge in the principal component analysis, explaining a majority proportion of the variance. In our case, we set the criterion that this factor should not account for more than 50% of the total variance (90).

The theoretical study model was analyzed using structural equation modeling with the MLR estimator, which is appropriate for numerical variables and is robust to deviations from inferential normality (92). Model fit was evaluated using the comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). CFI and TLI values greater than 0.90 (93), RMSEA values <0.08 (94), and SRMR values <0.08 (95) were used as the cutoffs for acceptable fit.

The software used was “R” version 4.1.2 and the “lavaan” library version 06–10 (96) was used.

3. Results

3.1. Common method variance

Table 2 displays that the variance accounted for 45%, indicating that the data set does not exhibit common method variance (CMV) through the Harman’s single-factor test, as the results indicated it was below the threshold (<50%) (90).

3.2. Preliminary analysis

Table 3 shows the descriptive results and the correlation matrix, which shows a high and significant positive correlation between job commitment and self-efficacy ($r = 0.86$, $p < 0.01$), as well as between self-efficacy and resilience ($r = 0.74$, $p < 0.01$). A high and significant positive correlation is also observed between resilience and job commitment ($r = 0.72$, $p < 0.01$). On the other hand, a moderate and significant negative correlation is observed between stress and job commitment ($r = -0.32$, $p < 0.01$), as well as between stress and self-efficacy ($r = -0.30$, $p < 0.01$), and between stress and resilience ($r = -0.29$, $p < 0.01$).

3.3. Analysis of the theoretical model

In the analysis of the theoretical model, an adequate fit was obtained (Figure 2), $\chi^2 = 994.29$, $df = 316$, $p < 0.001$, CFI = 0.92, TLI = 0.91, RMSEA = 0.07 (CI: 0.06–0.07), SRMR = 0.07. With this result, H1 is confirmed regarding the influence of resilience ($\beta = 0.68$, $p < 0.001$) and stress ($\beta = -0.20$, $p < 0.05$) on job satisfaction. Also, the positive relationship between self-efficacy and job engagement is confirmed ($\beta = 0.89$, $p < 0.001$).

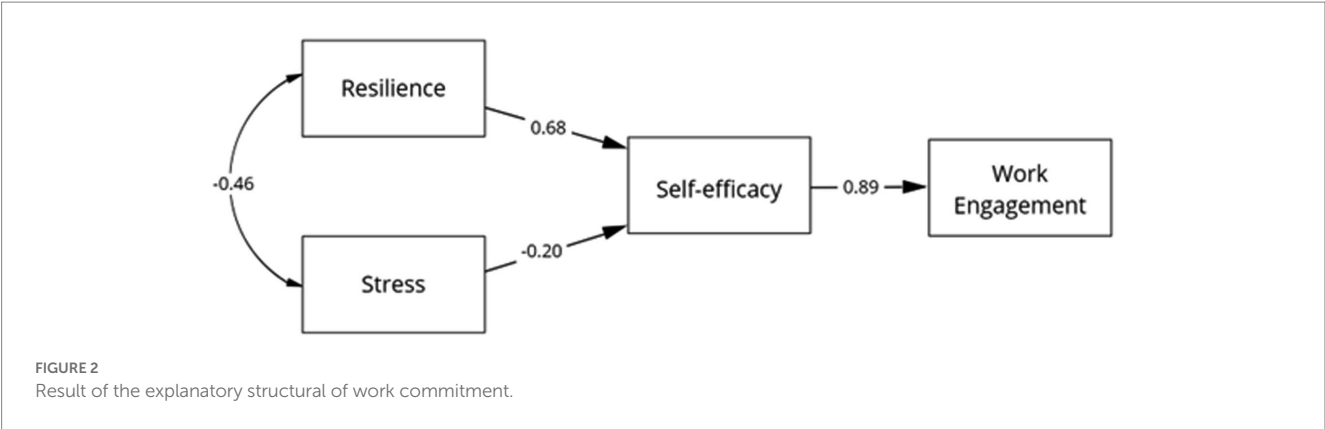


TABLE 2 Common method variance (CMV).

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% Var	Cumulative %	Total	% Var	Cumulative %
1	12.1	0.45	0.45	12.1	0.45	0.45
2	7.41	0.27	0.72			
3	1.96	0.07	0.80			
4	1.49	0.06	0.85			
5	0.78	0.03	0.88			
6	0.40	0.01	0.89			
7	0.37	0.01	0.91			
8	0.31	0.01	0.92			
9	0.25	0.01	0.93			
10	0.24	0.01	0.94			
11	0.21	0.01	0.94			
12	0.18	0.01	0.95			
13	0.16	0.01	0.96			
14	0.15	0.01	0.96			
15	0.13	0.00	0.97			
16	0.12	0.00	0.97			
17	0.11	0.00	0.98			
18	0.10	0.00	0.98			
19	0.09	0.00	0.98			
20	0.08	0.00	0.99			
21	0.08	0.00	0.99			
22	0.07	0.00	0.99			
23	0.06	0.00	0.99			
24	0.05	0.00	1.00			
25	0.04	0.00	1.00			
26	0.04	0.00	1.00			
27	0.03	0.00	1.00			

3.4. Mediation model

For the mediation analysis, bootstrapping with 5,000 iterations was used and the results are shown in Table 4. The mediating role of

self-efficacy in the relationship between resilience and job commitment was confirmed, $\beta = 0.91, p < 0.001$ (H4a). Similarly, the mediating role between stress and job commitment was confirmed, $\beta = -0.66, p = 0.04$ (H4b).

TABLE 3 Descriptive statistics, internal consistencies, and correlations for the study variables.

Variables	<i>M</i>	<i>SD</i>	1	2	3	4
1. Work engagement	32.05	9.88	1			
2. Self-efficacy	25.43	7.31	0.86**	1		
3. Resilience	13.50	3.20	0.72**	0.74**	1	
4. Stress	8.20	2.82	−0.32**	−0.30**	−0.29**	1

M, mean; *SD*, standard deviation. **Indicates $p < 0.01$.

TABLE 4 Research hypotheses on indirect effects and their estimates.

Hypothesis	Path in the model	β	<i>p</i>	95%CI	
				LL	UL
Hypothesis 4a	Resilience → Self-efficacy → Job commitment	0.91	<0.001	0.73	1.05
Hypothesis 4b	Stress → Self-efficacy → Job commitment	−0.66	0.04	−1.53	−1.53

4. Discussion

Work-related self-efficacy is a key aspect of personal resources that is associated with self-directed motivation, positive expectations of success, and a greater capacity to withstand difficult work situations. Self-efficacy is a predictor of positive states such as work engagement, especially in demanding environments, as well as the ability to successfully cope with or recover from adverse circumstances. Additionally, self-efficacy can assist healthcare professionals in addressing challenges and performing their job more effectively. The Job Demands-Resources model emphasizes the role of personal resources in work engagement and performance, and their ability to reduce the negative impact of work demands such as stress. Thus, self-efficacy is an important resource for nurses that can help them feel more capable of facing challenges and improving their professional commitment and self-evaluation of their nursing career. Therefore, the aim of this research is to evaluate the mediating role of self-efficacy in the relationship between resilience, stress, and work engagement.

The present study has demonstrated the existence of a positive influence between resilience and self-efficacy in nurses, which aligns with the Job Demands-Resources (JD-R) model. According to this model, resilience has a significant positive direct effect on nurses' self-efficacy, and in turn, greater self-efficacy contributes to a higher sense of resilience in the workplace (23, 97–99). Self-efficacy helps nurses cope with clinical challenges, which in turn can develop their resilience. This finding is important because resilience is a key factor for nurses to handle stressful situations and prevent emotional exhaustion, mental fatigue, lack of motivation, and intention to leave

(100). Nurses with higher levels of resilience are more likely to use job resources to cope with job stressors and improve their emotional control (60–62). Therefore, it is crucial to understand resilience and provide support to develop programs that help nurses to be and remain resilient (101). Challenging work environments, psychological emptiness, decreased perception of well-being, and dissonance have been identified as factors that contribute to resilience in nurses (50). Different strategies, such as cognitive reframing, hardiness, grounding connections, work-life balance, and reconciliation, have been proposed to promote resilience in this professional group. Additionally, understanding the positive influence between resilience and self-efficacy can be useful in teaching/learning practices that promote nurse retention. Nurses with higher levels of self-efficacy in their early career years, who perceive they can perform well, are more likely to view difficult tasks as something to master rather than avoid (23). Therefore, understanding the relationship between resilience and self-efficacy can be valuable for fostering a positive work environment and retaining nursing professionals.

Furthermore, the negative influence of stress on nurses' self-efficacy has been demonstrated, which is consistent with the JD-R model and the Demand-Resources theory of work. The results indicate that stress increases when the person has less control over the situation and lower self-efficacy (102–105). Although there are studies that show opposite results, where people with higher self-efficacy experience more stress, this result could be explained through the determining role of personality in the relationship between self-efficacy and stress, as several studies have pointed out (106, 107). Therefore, it is recommended to continue researching the role of personality and mood variables in the relationship between self-efficacy and stress. On the other hand, self-efficacy has been identified as a protective factor for nurses experiencing stress during health crises, which reinforces the importance of supporting self-efficacy as a work resource to improve their mental health and well-being (102, 105). Workload, the nature of nursing work, family, expectations, interpersonal relationships, and patient contact are the main sources of stress for nurses (108). Self-efficacy is formed through individual experience, and as a person works more and overcomes severe challenges with persistence and hard work (109). Work stress also affects nurses' resilience, as perceived high levels of stress decrease resilience (98). Therefore, it is important for nurses to learn how to manage their stress and focus on personal and environmental stressors to improve their resilience.

The study also demonstrated a positive influence between self-efficacy and work engagement among nurses. These findings are consistent with the JD-R model and agree with other studies that have found a significant association between self-efficacy and work engagement (31, 110). This is because nurses with high levels of self-efficacy are able to effectively manage their work environment, cope with challenges, and mobilize additional resources if necessary. This results in greater effort, motivation, and persistence at work, which in turn leads to greater dedication, absorption, and vigor, i.e., higher work engagement (13, 24, 32, 111). Thus, when a nurse feels engaged in their work, they experience greater energy and are absorbed in their work. In addition, they feel proud of their work and consider their work to have meaning and are involved in their position. This leads to greater personal and professional satisfaction in their work, resulting in a stronger affective bond with the institution and a lower intention to leave work (13, 112, 113). The

findings suggest that self-efficacy is a valuable work resource to support work engagement among nurses and improve their satisfaction and well-being at work.

Another finding indicated that self-efficacy is an important factor that mediates the relationship between resilience and work engagement in nurses. According to the JD-R model, resilience and self-efficacy are considered as job resources that positively influence work engagement and psychological well-being of nurses (114). Previous studies have found that resilience improves nurses' work engagement and workload can positively predict burnout (60–62, 115). Therefore, it is important to further investigate the mediation of self-efficacy in the relationship between resilience and work engagement to better understand how to improve mental health and well-being of nurses in the work environment. Additionally, the JD-R model highlights the importance of understanding job resources that facilitate resilience and positive adaptation at work to improve the mental health of individuals (58). Therefore, it is necessary to explore the moderating roles of self-efficacy and other factors in the relationship between work engagement and resilience to better understand how to improve mental health and well-being of nurses in the work environment.

Furthermore, the results of this study have confirmed that self-efficacy plays an important role in mediating the relationship between stress and job engagement in nurses. According to the JD-R model, stress is considered a job demand, which can have negative effects on workers' health and well-being (39). However, nurses with high self-efficacy can handle stress more effectively by adopting positive, problem-focused coping strategies (116). As a result, they are able to maintain good job engagement, with higher motivation, dedication, and absorption in their work (24, 32). On the other hand, nurses with low self-efficacy may experience doubts and negative emotions in situations of job stress, which can decrease their job efficiency and reduce their job engagement (117). Therefore, it is important for nurses to strengthen their self-efficacy to improve their ability to handle stress and maintain positive job engagement in their work.

4.1. Implications

Nursing managers and administrators should consider the importance of resilience, stress, job engagement, and self-efficacy in registered nurses during their early career and develop effective strategies to improve them. To increase resilience and self-efficacy, it is necessary to encourage the acquisition or improvement of psychological resources and provide tangible, emotional, informational, or companion support to nurses to reduce stress. Self-efficacy and job engagement are important factors in nurses' affective organizational commitment. Success experiences, overcoming obstacles, verbal persuasion, and good mood are important sources of information on personal effectiveness. Additionally, higher job resources allow for high levels of dedication, vigor, and absorption in nursing staff. Social support and coworker support also play an important role in nurses' resilience, so it is important to improve communication and the work environment to encourage a supportive and collaborative environment.

Hospital administrators can strengthen family and social support for nurses by establishing, for example, a psychological counseling

department. It is also important to note that proper attention to resilience, self-efficacy, job engagement, and stress reduction in nurses also has significant implications for patient care. A nurse with adequate resilience and self-efficacy and high job engagement is more likely to provide quality care and have a lower error rate in their work. Furthermore, a healthy and positive work environment can also improve nurses' motivation and job satisfaction, which in turn can have a positive impact on their performance and the quality of care they provide to patients.

Therefore, it is important for nursing managers and administrators to invest in training and skills development to improve nurses' resilience, self-efficacy, and job engagement. This may include implementing mentoring programs, providing emotional support, and creating opportunities for outdoor activities. Additionally, it is important to establish well-being mechanisms, such as an adequate leave system, to reduce emotional fatigue and stress in nurses.

4.2. Limitations

Despite the valuable findings obtained in this study, there are limitations that should be considered. First, the sample used may not be representative of all nurses in Peru, so it is important to expand the research to a larger sample to confirm the results. In addition, although this study used a quantitative survey, it would be useful to combine quantitative data with qualitative data in future research to obtain a deeper and more reliable understanding of the factors influencing nurses' engagement. The cross-sectional design used in this study does not allow exploration of the trend of variables over time, so it would be justified to use a longitudinal design in future research to investigate the change in nurses. Furthermore, although the study used self-report questionnaires, these questionnaires may be biased, and it would be useful to use more objective measurement tools in future research.

5. Conclusion

In conclusion, self-efficacy is a key factor in the relationship between resilience and stress on nurses' job engagement. High levels of self-efficacy help nurses feel more prepared to cope with job demands and improve their engagement and performance at work. Research has shown that self-efficacy is an important personal resource for the health and well-being of workers and can help prevent burnout and other work-related health problems.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of the Peruvian Union University

(2022-CEUPeU-026). The patients/participants provided their written informed consent to participate in this study.

Author contributions

EC-A, WM-G, and MZ-F participated in the conceptualization of the idea. WM-G, MM-G, and AR-C were in charge of the methodology and software. LS-S, AR-C, and WM-G done the validation, formal analysis, and research. WM-G, EC-A, and MZ-F commissioned the data curation and resources. LS-S, WM-G, EC-A, and MM-G carried out the writing of the first draft, review and editing, visualization and supervision. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

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