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Disparities in mental health

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Disparities in mental health

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Editorial: Disparities in mental health

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Editorial on the Research Topic
Disparities in mental health

Health inequities not only pose an economic burden but also challenge social justice principles. While much of our understanding of health disparities focuses on physical illnesses, mental health is particularly susceptible to discrepancies. Addressing mental health issues requires trust, cultural sensitivity, acceptance, and support from healthcare providers. Individuals facing mental health challenges encounter disparities akin to physical illnesses and additional obstacles like societal stigma and language barriers. Identifying specific areas of mental health inequity, determining affected demographic groups, and assessing policy effectiveness are crucial steps to reduce disparities and promote well-being.

Research Topic of Mental Health Disparities in the Journal of Frontiers in Psychiatry explores various aspects within diverse social groups, aiming to elucidate current discrepancies, identify determinants, and propose mitigation strategies. Disparities manifest in various forms, including race, gender, sexual identity, LGBTQ+ populations, age, disability, socioeconomic status, and geographic location.

This Research Topic aims to inspire, inform, and provide direction and guidance to researchers in this field (Table 1). Each paper specifically addresses a practical point for researchers to consider as they seek to expand their knowledge in the realm of mental health disparities.

Various vulnerable populations are at an increased risk of mental health disorders such as depression and suicide. Particularly concerning suicide, it stands as the second leading cause of death for U.S. adolescents, with those in the juvenile legal system (JLS) being up to three times more susceptible. This crisis disproportionately affects Black and Latinx youth. A comprehensive approach involves diverting individuals to community treatment, preventing mental health deterioration during detention, supporting reentry post-detention, and assisting youth with mental health needs to prevent violations and new

TABLE 1 Articles in the Research Topic of disparities in mental health.

Authors	Title	Country of Origin	Aim/Purpose	Study	Number of Participants	Summary of Result	Interpretation
Amirova et al.	Perceived discrimination in middle-aged and older adults: Comparison between England and the United States	UK	Examination of differences in perceived discrimination across multiple characteristics in England and the United States in middle- and older-aged adults.	Cohort (Longitudinal study)	$N_{1\ (UK)} = 8671$ (ELSA), $N_{2\ (US)} = 7927$ (HRS), Total = 16598	In England, perceived discrimination related to financial status and sexual orientation was more common, whereas in the US, more women perceived sex discrimination.	Country-specific and socioeconomic factors influence perceived discrimination prevalence, which are crucial for designing interventions to reduce such discrimination.
Meza et al.	Equitable suicide prevention for youth impacted by the juvenile legal system	USA	Provision of recommendations of priorities to promote health equity in suicide prevention for ethnoracially minoritized youth impacted by the juvenile legal system (JLS).	Review (perspective article)	Not applicable to the study.	Various touchpoints for suicide prevention care exist, and the Sequential Intercept Model, outlining community-based responses to individuals with mental and substance use disorders in the criminal justice system, can serve as a strategic planning tool. It helps outline equitable interventions across these touchpoints.	Addressing structural determinants of health is essential to prevent widening suicide disparities, moving beyond individual-level interventions.
Carlos et al.	Behavioral and psychosocial factors related to mental distress among medical students	USA	A comprehensive exploration on depression and suicidality in early-stage medical students, including an examination of suicidal history and the consideration of financial distress as a potential risk factor during medical school.	Cross-sectional	N = 134	Various individual-level and potentially modifiable risk factors were associated with higher scores on assessments of depressive symptoms and suicidal thoughts and behaviors.	The results underscore the critical need to implement tailored screening and offer resources for the well-being of the medical community.
Kleineberg-Massuthe et al.	Milieu-specific differences in symptom severity and treatment outcome in psychosomatic rehabilitation in Germany	Germany	Investigation of the association between social milieu and the severity of psychological symptoms, psychosocial impairments and symptom improvement over the course of rehabilitation.	Cross-sectional (Survey)	N = 2000	Patients from different backgrounds show notable variations in both BDI-II (depressive symptoms) and HEALTH-49 (assessment of impairments in specific areas).	Social milieu influences symptom severity, treatment access, and outcomes in psychosomatic rehabilitation. Considering milieu-specific sociocultural habits and therapeutic needs is crucial for planning and implementing therapy, enhancing equal access, quality, and effectiveness.
Mendes et al.	The psychological impact of Early Pregnancy Loss in Portugal: incidence and the effect on psychological morbidity	Portugal	Characterizing the psychological repercussions of early pregnancy loss (EPL) in relation to potential comorbidities, including complicated grief, depression, anxiety, and	Cross-sectional (Survey)	N = 873 (women suffered a spontaneous loss)	Women who experienced loss within a month showed a higher proportion of comorbidity symptoms, with a significant gradual decrease over time in	Monitoring potential complex responses to the event of EPL is crucial to offer timely and suitable interventions for women requiring assistance.

(Continued)

TABLE 1 Continued

Authors	Title	Country of Origin	Aim/Purpose	Study	Number of Participants	Summary of Result	Interpretation
			Post-Traumatic Stress Disorder (PTSD).			scores and proportion of clinical perinatal grief and PTSD.	
Tseng et al.	Sex difference in the associations among risk factors with depression in a large Taiwanese population study	Taiwan	Investigation of the factors associated with depression and sex differences in a large Taiwanese population.	Cross-sectional	N = 121601	Women show a significant association with depression compared to men, and there are sex differences in the associated risk factors.	Early identification of factors linked to depression is crucial, but establishing causal relationships with risk factors remains inconclusive. Longitudinal studies are necessary to explore sex differences and incident depression.
Shang et al.	The relationship between alexithymia, depression, anxiety, and stress in elderly with multiple chronic conditions in China: a network analysis	China	Development of a network structure to investigate the connections between alexithymia, depression, anxiety, and stress in Chinese older adults with multiple chronic conditions.	Cross-sectional (survey)	N = 662	Difficulty Identifying Feelings ("DIF") is a key element in the network of older adults with multiple chronic conditions (MCC), suggesting its importance for psychological interventions.	Healthcare professionals need to prioritize intervention for the psychological issues of older adults with alexithymia compared to those without alexithymia.
Garcia Nuñez et al.	Quality of life and associated factors in Swiss trans people: a cross-sectional study	Switzerland	Evaluation of trans people's mental health, health-related QoL, psychological distress, self-esteem and the impact of life events occurred in the last six months on participants.	Cross-sectional (survey)	N = 30	The study found a negative correlation between life events' impact and mental QoL, as well as between psychological distress and mental QoL. Additionally, a positive correlation was identified between self-esteem and mental QoL, with psychological distress and self-esteem serving as independent predictors of mental QoL.	Medical transition must not be viewed in isolation but must be embedded in the framework of integrative psychosocial support.
Mai et al.	The association between socioeconomic status and health-related quality of life among young and middle-aged maintenance hemodialysis patients: multiple mediation modeling	China	Study on the correlation between socioeconomic status (SES), illness perception, social functioning, and health-related quality of life (HRQoL) in young and middle-aged maintenance hemodialysis (MHD) patients.	Cross-sectional	N = 332 (young and middle-aged MHD)	Illness perception and social functioning mediate the SES-HRQoL association independently and cumulatively. SES correlates positively with HRQoL, while illness perception shows a positive correlation with social functioning.	Nurses should consider developing individual intervention program for young and middle-aged MHD patients with low SES, focusing on establishing targeted counseling and health education strategies corresponding to illness perception and social functioning to help patients improve their HRQoL.

(Continued)

TABLE 1 Continued

Authors	Title	Country of Origin	Aim/Purpose	Study	Number of Participants	Summary of Result	Interpretation
Hu et al.	Decomposition and comparative analysis of depressive symptoms between older adults living alone and with others in China	China	Investigating and measuring the contributing factors that impact depression in older adults living alone vs. those living not alone.	Cross-sectional	N = 12197	Older adults living alone exhibit higher depressive symptom rates, primarily due to differences in socioeconomic status, education, income, sleep, and health status.	Addressing factors in the elderly living alone, could help developing precise intervention strategies to enhance the mental well-being of high-risk older adults.
Cogley et al.	Improving kidney care for people with severe mental health difficulties: a thematic analysis of twenty-two healthcare providers' perspectives	Ireland	Investigating the barriers and facilitators to effective kidney care for people with severe mental health difficulties (SMHDs).	Qualitative (Semi-structured interviews with twenty-two healthcare professionals)	$N_1 = 14$ (Physical) Professionals), $N_2 = 8$ (mental professionals) Total N=22	Understanding individual challenges is crucial for supporting people with both SMHDs and kidney disease, enabling positive outcomes despite significant impairments and complex presentations.	Renal departments require multidisciplinary care, involving psychiatry, psychology, social work, and clinical nurse specialists. Coordination between renal and mental healthcare providers is vital for the safe and effective treatment of individuals with SMHDs.
Chen et al.	Disparities in the unmet mental health needs between LGBTQ+ and non-LGBTQ+ populations during COVID-19 in the United States from 21 July 2021 to 9 May 2022	USA	Evaluating the difference in UMHN between LGBTQ+ and non-LGBTQ+ during COVID-19.	Cross-sectional	$N_{1\,=}$ 81267 (LGBTQ+), $N_{2\,=}$ 722638 (non-LGBTQ+)	During COVID-19, LGBTQ+ faced increased UMHN risk. Disparities were noted across age groups, LGBTQ+ subtypes, and regions.	Tailored programs are crucial to address mental health vulnerabilities in diverse LGBTQ+ subgroups, with state-specific interventions. More research is needed on predictors and consequences of work alienation among nurses, requiring qualitative and quantitative studies to explore their understanding and experiences, enhancing knowledge for effective interventions.
You et al.	Status of work alienation among nurses in China: A systematic review	China	Systematically evaluating the status and distribution characteristics of work alienation among nurses.	Systematic Review and meta-analysis	Total of 12 studies with N (nurses) = 7265	Chinese nurses had moderate work alienation, particularly in specific categories.	Tailored programs are crucial to address mental health vulnerabilities in diverse LGBTQ+ subgroups, with state-specific interventions. More research is needed on predictors and consequences of work alienation among nurses, requiring qualitative and quantitative studies to explore their understanding and experiences, enhancing knowledge for effective interventions.

(Continued)

TABLE 1 Continued

Authors	Title	Country of Origin	Aim/Purpose	Study	Number of Participants	Summary of Result	Interpretation
Mishu et al.	Exploring the contextual factors, behavior change techniques, barriers and facilitators of interventions to improve oral health in people with severe mental illness: A qualitative study	UK	To explore barriers and facilitators of oral health interventions to identify drivers of behavior change (capability, motivation, and opportunity).	Qualitative study (interview)	N = 12 (Intervention details were extracted from 12 intervention studies identified from a previous systematic review), Total 17 one-to-one interviews.	Individuals with SMI encounter obstacles in accessing dental care. The study explores barriers and facilitators for oral health interventions from the perspectives of people with SMI, caregivers, and service providers.	Comprehensive interventions are needed to improve oral health outcomes for individuals with SMI by addressing barriers and enhancing facilitators across various levels.

ELSA, English Longitudinal Study of Aging; HRS, US-based Health and Retirement Study; JLS, juvenile legal system; BDI-II, Beck Depression Inventory; HEALTH-49, Hamburg Modules for the Assessment of Psychosocial Health in Clinical Practice; MHD, maintenance hemodialysis; SES, socioeconomic status; HRQoL, health-related quality of life; SMHD, severe mental health difficulties; UMHNs, unmet mental health needs; SMI severe mental illness.

offenses. Addressing these intercepts is crucial for mitigating suicide risks in this vulnerable group (Meza et al.).

Contrary to the beliefs of the general population, physicians, also considered a vulnerable population, face an elevated risk of depression and suicide, a risk that becomes evident during medical school. Medical students exhibit higher rates of depression and suicidal thoughts than peers in other disciplines. Carlos et al. investigated mental distress and risk factors among US medical students, identifying poor sleep quality, impostor feelings, stress, and financial distress as key factors. Besides physicians, You et al. reported that Chinese nurses experience a moderate level of work alienation, marked by detachment from work due to infection risk, heavy workload, and persistent stress with consequences for both the individual and the organization. Recognizing this extent helps raise awareness among healthcare managers about the prevalent issue of work alienation among nurses and ensures the right for medical students to receive care for treatable mental health conditions.

Sex-specific differences, and disadvantaged sociocultural and economic status correlates with a higher prevalence of mental health issues including depression. Sex-specific differences are evident in depression, impacting clinical presentation, disease progression, and treatment response. Depression, affecting about 5% of adults globally, emerges as a common psychiatric issue. Associations between depression and risk factors vary by gender (Tseng et al.). When it comes to depression in the elderly, Hu et al. conducted a study in China to measure socioeconomic factors influencing depression in older adults living alone versus those living with others. The data revealed a higher prevalence of depressive symptoms in older adults living alone, primarily due to differences in socioeconomic status, marital status, years of school, self-reported local income, sleep, and health. Addressing these factors is crucial for developing targeted intervention strategies to improve the mental well-being of older adults at higher risk.

Moreover, disadvantaged sociocultural and economic status can impact mental illness treatment, particularly the psychosomatic rehabilitation sector, dedicated to preventing, treating, and compensating for chronic mental disorders. To detail inequalities in German psychosomatic rehabilitation, Kleineberg-Massuthe et al.'s study reveals variations among patients from different social milieus concerning psychological symptom severity, psychosocial impairments, and treatment outcomes. Alongside structural care improvements, adapting and communicating services in ways more appealing to individuals from diverse social environments may be essential.

Targeted and customized mental health interventions are crucial for specific populations, aiming to enhance both their medical and psychiatric well-being. One such group facing notable health disparities is individuals with severe mental illness (SMI), leading to inferior outcomes and reduced life expectancy. Their oral health is notably worse, with a 3.4 times higher likelihood of complete tooth loss than the general population. While behavioral support interventions are generally effective in improving oral health behaviors, interventions for those with SMI encounter various challenges. Mishu et al.'s study explores barriers and facilitators to oral health intervention engagement from the perspectives of people with SMI, caregivers, and service providers.

Turning attention to another demographic, it's noteworthy that up to 25% of recognized pregnancies culminate in Early Pregnancy Loss, commonly referred to as miscarriage. This often precipitates enduring negative mental health responses, encompassing depression, anxiety, and Post-Traumatic Stress Disorder. Mendes et al.'s study pointed out that while clinical perinatal grief and PTSD scores significantly declined, a substantial number of women still experienced persistent clinical morbidities three years or more after the loss. Hence, timely monitoring and persistent intervention are crucial for those in need.

In a related context, approximately 4 million people with end-stage renal disease (ESRD) rely on renal replacement therapy, predominantly through maintenance hemodialysis (MHD). Studies highlight that socio-environmental, psycho-spiritual, and clinically relevant factors contribute to diminished health-related quality of life (HRQoL) in young and middle-aged MHD individuals. Nurses should develop tailored intervention programs, focusing on targeted counseling and health education strategies to address these factors and improve HRQoL (Mai et al.).

Another crucial aspect highlighted in the literature is the exploration of the connection between chronic conditions and mental health disorders. In this context, approximately 80% of individuals over 65 years old affected by multiple chronic conditions (MCC) experience impacted physical well-being, increased treatment costs, and are prone to psychological challenges such as depression, anxiety, and stress. Also, they exhibit a higher prevalence of alexithymia, affecting communication, disease management, recovery, and overall quality of life. Shang et al.'s study emphasizes Difficulty Identifying Feelings (DIF) as a significant psychological challenge, with the highest centrality and predictability across various alexithymia levels. Addressing the DIF tendency in older adults with MCC may improve other dimensions of alexithymia and alleviate symptoms of depression and anxiety in such communities.

In the realm of kidney care, individuals with severe mental health disorders (SMHDs) such as schizophrenia, bipolar disorder, and major depression face increased challenges. Cogley et al. brought to light additional barriers to kidney care for those with SMHDs, encompassing mental health challenges, motivation issues, cognitive difficulties, and mistrust of the healthcare system. Achieving effective kidney care requires an integrated "whole person" approach addressing the interplay between kidney disease and mental health.

Last not least there are papers investigating potential impacts of global trends and demographic shifts including COVID-19 pandemics, aging and the LGBTQ community, on mental health conditions. Chen et al.'s US study during COVID-19 reveals a 2.27 times higher risk of unmet mental health needs (UMHNs) in LGBTQ+ individuals compared to non-LGBTQ+. Additionally, concerning associated socioeconomic factors, LGBTQ+ individuals are more likely to be younger ($p < 0.001$), unmarried, non-White, have lower education, lower household income, financial difficulties, and lack public and private insurance.

In parallel, another research study addressed the affected quality of life (QoL) due to life events during gender transition in transgender individuals. Garcia Nuñez et al.'s study on 30 transgender individuals highlighted significant mental health challenges, with psychological distress double that of cisgender norms. Trans individuals showed mental domain impairments in QoL, correlated negatively with life event impacts and psychological distress. Therefore, an integrative psychosocial support framework is essential, emphasizing that medical transition should not be isolated but considered holistically.

Finally, aging, as a global demographic challenge, can be associated with various cognitive and psychiatric disorders such as dementia, depression and suicides. Globally, the aging population is on the rise, with projections indicating that by 2050, individuals aged 65 and over will make up 24% and 21.4% of the UK and US populations, respectively. The health and well-being of older adults are significant policy priorities, and perceived discrimination is increasingly recognized as a risk factor for compromised healthy aging (Amirova et al.).

Studies presented here are of 14 published studies of Frontiers in the Research Topic of "*Disparities in Mental Health*". It is to be hoped that many interesting scientific results will be reflected in mental health disparities worldwide.

Author contributions

MM: Validation, Writing – original draft, Writing – review & editing, Investigation. HKo: Project administration, Supervision, Validation, Writing – review & editing. FM: Conceptualization, Data curation, Methodology, Supervision, Validation, Writing – review & editing. HKa: Writing – review & editing. LH: Supervision, Writing – review & 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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Exploring the contextual factors, behaviour change techniques, barriers and facilitators of interventions to improve oral health in people with severe mental illness: A qualitative study

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People with severe mental illness (SMI) have significantly poorer oral health compared to people without SMI and interventions targetted to improve oral health in this population failed to show any long-term improvement. Interventions are influenced by many contextual factors ranging from individual to systems level. This study aimed to understand the contextual factors, behaviour change techniques of the available oral health interventions and explore the barriers to and facilitators for engagement with these interventions from the perspectives of people with SMI (service users) and related service providers. Intervention details were extracted from 12 intervention studies identified from a previous systematic review using the template for intervention description and replication checklist (TIDieR) and behaviour change techniques (BCTs) were coded using the behaviour change technique taxonomy v1. Sixteen individual BCTs were identified and out of which *"4.1 instructions on how to perform the behaviour"* (*n* = 9) and *"6.1 demonstration of behaviour"* (*n* = 6) were most frequently used BCTs. Video vignettes prepared from the different intervention components identified from existing studies were shown to service users and service providers in dyadic or one-to-one interview format to elicit their views on barriers and facilitators for engagement with the intervention components. Interviews were analysed using Framework analysis and were guided by theoretical domains framework (TDF); and capability, opportunity and motivation (COM-B) model of behaviour change. Main facilitators identified to increase capability, opportunity and motivation of service users were the involvement of carers/care coordinators and integration of dental and mental health care, provision of oral health/hygiene information/products at an appropriate level and provision of tailored support according to individual needs and preferences. Barriers identified were related to lack of communication skills of the service providers, provision of coordinated care, lack of support in visiting a dentist and navigating the payment system and long follow up times. Appropriate training was considered as a facilitator, and staff turnovers and workload were considered as main barriers by the service providers. The findings suggest that comprehensive interventions that target barriers and enhance facilitators from individual to systems level are needed to improve oral health outcomes of people with SMI.

KEYWORDS

severe mental illness, oral health intervention, contextual factors, barriers and facilitators, qualitative study, behaviour change techniques

Introduction

People with severe mental illness (SMI) comprise between 2 and 4% of the population (1). This population group face significant health inequalities, having poorer health outcomes and a lower life expectancy compared to people without SMI (2). People with SMI also have poorer oral health, for example those with SMI have 3.4 times the odds of having lost all their teeth than the general population. They also have, on average, 6.2 more decayed teeth than those without SMI (3, 4).

Poor oral health has a profound effect on general health and quality of life, and can have an impact on social life, self-esteem and social interactions (5). Oral-health-related quality of life (OHRQoL) is also affected in people with SMI, due to worse oral health outcomes in this population (6). Furthermore, oral diseases are associated with other physical health conditions such as diabetes (7) and coronary heart diseases (8, 9). To tackle this inequality, an effective intervention to improve oral health among people with SMI is essential, and to date, several interventions have been tried for this population.

A Cochrane systematic review exploring the effectiveness of oral health interventions in people with SMI, suggested that an oral health education intervention led to better oral hygiene, but its clinical significance was unclear (10). Furthermore, a recent systematic review investigating such interventions included 12 studies (11) and identified five broad categories of intervention: dental education, motivational interviewing, dental checklist, dietary change and incentives. Despite statistically significant short-term changes in plaque indices and oral health behaviours as a result of interventions using dental education, motivational interviewing and incentives, it is unclear if these changes led to clinically meaningful improvements. Clinically relevant outcomes like “tooth loss” and “oral health related quality of life” (12) were not assessed in these studies. Overall, the review found that most of the interventions were designed to improve oral health via individual level behavioural change. Furthermore, there is a paucity of information on the patient, carer, and service/healthcare level factors that influence oral health improvement in people with SMI. In a narrative review, Slack et al. aimed to identify individual, organisational and systemic levels barriers (13). However, the system and policy factors were not covered in depth in the review partly due to fewer studies focussing on more upstream approaches to improving oral health outcomes in this group. To improve the oral health of people with SMI, it is important to develop and implement effective interventions that are tailored to meet their needs, address specific barriers, focussing not only on individual level behaviour change but also on change at institutional levels. Thus, creating the opportunity and motivation to achieve and maintain good oral health in this population.

In general, evidence suggests that behavioural support interventions are effective in improving oral health-related behaviours (14). However, interventions to improve oral health in people with SMI are influenced by many factors. A theoretical examination of the factors that impede and enhance these interventions is necessary for developing future intervention to improve oral health for this population. Theoretical Domains Framework (TDF), an integrative framework that synthesises over eighty constructs across 33 psychological theories in order to understand influences on behaviour more broadly, was developed and validated by Michie and colleagues (15, 16). The TDF has been successfully applied in many settings to identify influences on a variety of behaviours (17). The TDF is a refined version of the Capability Opportunity Motivation-Behaviour (COM-B) model, an evidence-based model based on three key sources: capability, opportunity, and motivation that influence behaviour. The COM-B model can be linked to a practical intervention design tool called the Behaviour Change Wheel framework (BCW) (18) to guide researchers in the selection of theory, intervention functions, policy categories, and behaviour change techniques (BCTs) for intervention design and delivery. As a result, the TDF is one of few frameworks linked to a comprehensive method for intervention design. BCTs can be numbered based on the Theory and Technique Tool and mapped with the potential mechanism of action of the key intervention components in the intervention package and mapped on to different theory of behaviour change model (19). This study used the Theoretical TDF to map components of the interventions targetted to improve oral health in people with SMI.

As no oral health interventions so far showed any clinically meaningful long-term effectiveness to improve oral health in this population, effective interventions and services need to be developed or adapted by understanding the context, mechanisms and population-specific barriers and facilitators. In developing an effective oral health intervention, it is vital to identify the active ingredients or BCTs used in oral health interventions tested in this population and the contextual features and barriers and facilitators of these interventions. To our knowledge, no studies have explored this and examined barriers and facilitators of different interventions targetted to improve dental health among people with SMI considering the perspectives of both mental health care service users and different service providers. Our aim was to understand the contextual factors, behaviour change techniques of the available oral health interventions and explore the barriers to and facilitators for engagement with these interventions from the perspectives of people with SMI (service users) and related service providers.

Objectives

1. To understand and map the contextual factors and BCTs underpinning existing oral health interventions for people with SMI.
2. To explore barriers and facilitators to engagement with oral health interventions from the perspective of people with SMI, their carers and health professionals.
3. Map the barriers and facilitators to TDF and COM-B model in order to identify the capability, opportunity and motivation drivers for oral health, at the individual, inter-personal and systems level.

Materials and methods

Ethical approval was granted by University of York Health Sciences Research and Governance Committee.

Addressing the first study objective

Firstly, to understand the contextual factors of the existing oral health interventions for people with SMI of the 12 studies identified from the systematic review by Macnamara et al. (11), intervention details such as study setting, population, intervention timing, frequency and duration were extracted using the template for intervention description and replication (TIDieR) (20). TIDieR is helpful to systematically collect information on interventions. This was done individually by two reviewers (AM and MPM).

Secondly, to map the behaviour change techniques (BCTs) underpinning existing oral health interventions, two coders (MPM and MRF) coded the intervention descriptions for their individual BCTs using the behaviour change technique taxonomy version 1 (BCTT v1) (19).

Addressing the second and third study objective

The intervention details identified were used to develop the video vignettes which were used at the next stage of the study to conduct in-depth interview with the service users and service providers. Prior to participating in the study, written informed consent was obtained from all the participants.

Participants and setting

The study employed a convenience sampling technique to recruit participants. Inclusion criteria for the study was as follows for the service users recruited: people aged over 18 years, living in the UK and with a self-reported diagnosis of SMI such as schizophrenia, schizoaffective disorder or bipolar disorder, who were currently in a stable condition and had the ability to provide informed consent. Health professionals and informal carers with experience of providing health services to people with SMI were recruited as service providers. Participant recruitment took place through "Involvement@York" which is the patient and public involvement network and resource co-ordinated by the University of York (21). Participants were also recruited through social media posts and use of current contacts to spread the word about the study. Eligible participants and those who expressed interest to participate were invited by email. The invitation email contained participant information pack and consent form, and an introductory video of the project (22) which was created to provide an overview of the research to aid with recruitment. Once signed consent forms were received, a convenient date and time was scheduled for the interviews.

Data collection

For practical reasons of time and participant availability, the format of the in-depth interviews was based on one-to-one or dyadic interviewing style which involves interviewing two participants simultaneously. Similar to one-to-one interviews, the dyadic interviews provide an opportunity to collect more individual data from each of the participants, which is not always possible with focus groups (23). Keeping in line with COVID related social distancing measures, all interviews were conducted remotely via Zoom online meeting platform (Zoom.us) (24). The interviews were co-facilitated by MRF and MPM.

The interviews were structured using bespoke video vignettes (*n* = 4) that were professionally created (25). The data related to the intervention were extracted using the TIDieR checklist and the individual BCTs that were coded as intervention components, were used to develop the four video vignettes. Each scenario showed a different setting such as: early intervention in psychosis (EIP) setting, in-patient, community out-patient setting and an integrated care model with mental and dental health services under one roof based on four studies to capture different settings and interventions (26–29). These videos were used to present the various intervention scenarios and the intervention components (use of dental checklist, provision of oral health education, brushing demonstration and practice, motivational interviewing, use of different reminders for brushing, involvement of carers, etc.) used in previous studies to improve oral health in people with SMI. The total duration of the video was seven minutes and after showing each video vignette to the participant, their views were explored in terms of acceptability, practicality and effectiveness of the intervention techniques used.

A Zoom meeting link was emailed to the participants two days prior to the meeting along with a reminder to attend the meeting. Participants' consent was once again sought prior to initiating the recording of the zoom interviews. All participants were offered a £20 Amazon e-voucher as a token of appreciation for their time. Interviewers wrote down their reflections immediately after the interviews. The video files were deleted upon completion of each interview. The audio recordings transcribed verbatim, and transcripts pseudonymised along with removal of any identifying information. In addition, we conducted 11 one-to-one stakeholder consultations with a diverse range of stakeholders to discuss the intervention specific emerging themes on barriers and facilitators, data synthesis plan and future recommendations in order to obtain validation of our study findings. The details of the stakeholders and zoom interviews could be found elsewhere (30).

Data analysis

To address the second study objective, the interview data were analysed to identify the barriers and facilitators for each video vignette of oral health intervention scenario, from the perspective of service users and service providers. Two reviewers (MRF and MPM) read the transcripts and discussed them along with their individual reflections and coded individually and discussed further to ensure clarity and agreement. Once initial codes were agreed on, they were then collated to form categories and sub-themes. Drawing on Braun and Clarke reflections on the use of thematic analysis in health research (31), themes were created by compiling the sub-themes for both service users and the service providers to identify each scenario specific barriers and facilitators.

To address the third study objective, the interview data were analysed based on framework qualitative analysis guided by the TDF and the COM-B model of behaviour change to identify the barriers and facilitators for engagement by people with SMI with various intervention components through the perspective of both service users and the service providers.

Framework analysis developed by Ritchie and Spencer and is a method that allows summarisation of the qualitative data through the use of a coding matrix (32) to produce structured outputs (33). In the first step of familiarisation, as mentioned above the transcripts were read by two reviewers (MRF and MPM) followed by a discussion about their individual reflections. In the second step of identifying a thematic framework, the two reviewers individually performed the coding of the transcripts which was then discussed to ensure clarity and agreement. In the third and fourth steps, once initial codes were agreed on, they were then applied to the subsequent transcripts in the process called indexing. This was followed by charting data according to the framework matrix in order to summarise the data whilst maintaining the essence of what was said during the interviews. The fifth and final step involved interpretation of data and presentation of the findings. NVivo version 12 Pro was used for analysing the data (34).

Rigour for the qualitative study process was supported through interviewers' recording their reflections during or after the interviews, having regular discussions during the data analysis process and through constant comparison between the accounts of the participants to reduce analysis bias (35).

Results

The TIDieR checklist was applied for the 12 intervention studies identified in the systematic review by Macnamara et al. (11) to extract intervention details (26–29, 36–43) (**Supplementary Files**). While most of the studies reported the setting and the core intervention, the information on tailoring (if the intervention was planned to be personalised, or adapted), modification, intervention adherence or fidelity elements were not sufficiently reported in most of the studies.

Several BCTs were identified from the coding of intervention descriptions (**Table 1**). The commonly used BCTs included were related to use of dental health education (*n* = 9); toothbrushing demonstrations (*n* = 6), practice (*n* = 3), and monitoring (*n* = 5); provision of toothbrushes (manual

TABLE 1 Type and frequency of behaviour change techniques used in oral health interventions for people with SMI.

Behaviour change technique	Frequency of use in interventions	Category
1.4 Action Planning	1	1. Goals and Planning
2.1 Monitoring of behaviour by others without feedback	2	2. Feedback and monitoring
2.2 Feedback on behaviour	3	
2.3 Self-monitoring of behaviour	2	
3.1 Social support (unspecified)	1	3. Social support
4.1 Instruction on how to perform the behaviour	9	4. Shaping knowledge
5.1 Information about health consequences	5	5. Natural consequences
5.3 Information about social and environmental consequences	1	
6.1 Demonstration of behaviour	6	6. Comparison of behaviour
7.1 Prompts/cues	3	7. Associations
8.1 Behavioural practice/rehearsal	3	8. Repetition and substitution
9.1 Credible source	3	9. Comparison of outcomes
10.1 Material incentive (behaviour)	1	10. Reward and threat
10.2 Material reward (behaviour)	2	
10.4 Social reward	1	
12.5 Adding objects to the environment	5	12. Antecedents

and powered) and/or toothpastes ($n = 4$); text/call reminders ($n = 3$); maintaining a toothbrushing log such as through the use of printed calendar or sticky notes ($n = 2$).

In total 17 dyadic and one-to-one interviews were conducted between July and September 2021. participant details are reported in Table 2. Interviews lasted 120 min on average and allowed for in-depth exploration of the views of both the service users and the service providers regarding each scenario of the video and barriers and facilitators related to engaging with the intervention considering acceptability, practicality, and effectiveness. The barriers and facilitators identified for each of the intervention scenario are reported in Table 3. Interventions that include involvement of carers, integrated care between mental and dental services, short and supportive oral hygiene demonstrations and provision of a toothbrush were considered as facilitators to engaging with the interventions by the service users interviewed. The preference of frequency and format of a reminder system and reinforcement via phone call or text message varied in different participants. Incorporation of a dental checklist and signposting to a dentist alone was not considered sufficient unless further support is provided in accessing to dental care are following completion of the checklist. Opportunity for appropriate training and opportunity of provision of integrated care system for collaborative work of both mental and dental health care staff was considered as facilitator to engage by the service providers. However, increased workload was considered as a barrier by service providers.

To address the third study objective, the grouping of the barriers and facilitators were reported under the TDF domains. Further grouping of the barriers and facilitators under the TDF domains according to the COM-B model provided an insight into the capability, opportunity and motivation drivers of behaviour change that can be tapped into to enable development of interventions that provide integrated support to people with SMI. The barriers (B) and facilitators (F) reported by the service users and service providers on three main themes according to the COM-B model are presented in Figures 1, 2, respectively. An overview of the three main themes according to the COM-B model, sub-themes according to the TDF and barriers (B) and facilitators (F) is provided in Table 4 and significant findings are reported below.

Theme 1: Capability

Sub-theme: Knowledge and skills

The service users felt that oral health education was an important aspect of an intervention to increase their knowledge and toothbrushing demonstrations were helpful to provide them with necessary skills. However, how the narrative was framed was important. A ‘paternalistic’ approach was reported as a significant barrier.

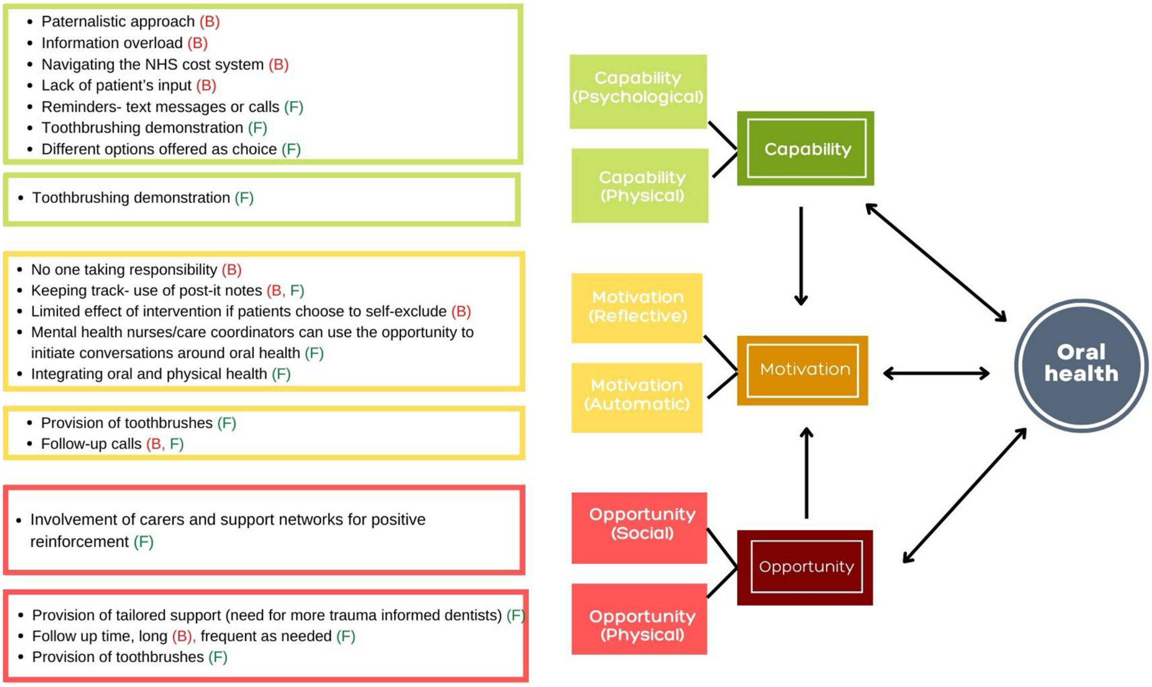
> *“it’s you know it’s infantilizing what’s going on there now. As a reframing of that it could be that actually maybe we need to go in at that sort of level to establish effective new ways of you know it’s when we’re facilitating the change. . ..it depends who’s watching yeah and then how they approach it, you know it’s not about ooh that’s right, that’s wrong, its all about using motivational interviewing skills.”* (Service user-J-04 with diagnosis of bipolar disorder).

Lack of training of staff involved in provision of care to people with SMI was identified as a barrier. Both the dental and mental service providers agreed that there is a need for training staff in ways that they communicate with their

TABLE 2 Demographics of the study participants.

ID	Participant group	Age (years)	Gender	Diagnosis/Profession
1	Service user	31–40	M	Schizophrenia
2	Service user	>60	F	Schizophrenia
3	Service user	31–40	F	Schizophrenia
4	Service user	41–50	M	Schizophrenia
5	Service user	41–50	M	Bipolar disorder
6	Service user	>60	F	Bipolar disorder
7	Service user	41–50	F	Bipolar disorder
8	Health professional	31–40	F	Community service dentist
9	Health professional	31–40	F	High street dentist
10	Health professional	31–40	F	Dental hygienist
11	Health professional	31–40	M	Special care dentist
12	Carer	51–60	F	Caring for person with schizophrenia
13	Health professional	31–40	M	Occupational therapist
14	Health professional	31–40	M	Clinical psychologist
15	Health professional	31–40	F	Mental health nurse
16	Health professional	41–50	F	Mental health nurse
17	Health professional	31–40	M	Special care dentist

M, male; F, female.



- Paternalistic approach (B)
- Information overload (B)
- Navigating the NHS cost system (B)
- Lack of patient's input (B)
- Reminders- text messages or calls (F)
- Toothbrushing demonstration (F)
- Different options offered as choice (F)

- Toothbrushing demonstration (F)

- No one taking responsibility (B)
- Keeping track- use of post-it notes (B, F)
- Limited effect of intervention if patients choose to self-exclude (B)
- Mental health nurses/care coordinators can use the opportunity to initiate conversations around oral health (F)
- Integrating oral and physical health (F)

- Provision of toothbrushes (F)
- Follow-up calls (B, F)

- Involvement of carers and support networks for positive reinforcement (F)

- Provision of tailored support (need for more trauma informed dentists) (F)
- Follow up time, long (B), frequent as needed (F)
- Provision of toothbrushes (F)

FIGURE 1
The barriers (B) and facilitators (F) reported by the service users on three main themes according to the COM-B model.

patients regarding oral health and mental illness. These include training in softer communication skills and also providing more information around discussing possible side effects of anti-psychotic medications on their oral health.

> *"I would say so [there is a need for training]. Just language used and what sorts of things to expect and not be surprised by them."* (Service provider- S-08, worked as mental health nurse for 23 years).

TABLE 3 Intervention Scenario specific barriers and facilitators.

Intervention scenarios	Barriers/Facilitators	Service users perspective	Service providers perspective
1. Early Intervention in Psychosis (EIP) setting: use of dental checklist by care coordinators (mostly mental health nurses) to monitor oral health status and behaviours, sign posting to dentist	Barriers	1. Need for practical help with finding/setting up an appointment with the dentist 2. Lack of availability of trauma informed dentists 3. Long follow up time of 12 months	1. Need for training around oral health 2. Increased workloads of the mental health nurses
	Facilitators	Involvement of the care coordinator	Use of checklist fits well with their current work routine
2. Community mental health (in-patient) setting: Oral hygienist delivering oral hygiene instructions to patients and training to mental health nurses	Barriers	1. In acute crisis stage of an inpatient setting just getting through the day is the top priority not oral health 2. Trust issue with someone new coming in to talk about oral health. 3. Lack of support after being discharged 4. Stable mental health does not necessarily mean being fit to visit a dentist unsupported. 5. Lack of coordination between mental, physical and oral health services- (who takes the responsibility for the person?)	Need for training around mental health and side effects of psychotropic medication
	Facilitators	Provision of toothbrush and toothpaste	Short training session (20 mins)
3. Community mental health (out-patient) setting Dental hygienist provides dental education, patient is given sticky notes as reminder system and also receives weekly calls for 4 weeks for positive reinforcement	Barriers	1. Long oral health education sessions are difficult to follow. 2. Costs of maintaining electric toothbrush. 3. Lack of involvement of any carer 4. Post it notes can trigger obsessive behaviours 5. Weekly call seems intrusive	Need for training around mental health
	Facilitators	1. Use of post-it notes simple than keeping a diary/log. 2. Electric toothbrush can make cleaning easier 3. Good follow up	Weekly phone calls can be managed
4. Integrated care model (with mental and dental health services under one roof) setting: involvement of carer during provision of dental education	Barriers		1. Lack of availability of such integrated care model in UK 2. Funding/commissioning issues
	Facilitators	1. Good model of getting services easily. 2. Involvement of carer 3. Use of video demonstrations 4. Short follow up	

> *"For the education for the nurse is under the kind of the knowing about how psychotropic medications are going to affect oral hygiene and things like that, I think that sounded perfect because that's certainly an area that we're lacking in."* (Service provider- M-09, working as a mental health nurse).

Sub-theme: Memory, attention and decision processes, and behaviour regulation

Although the service users expressed a desire to be more involved in provision of their care, they felt that it needed to be done in a way that did not entail overloading them with information which would otherwise be just another barrier.

> *"So I think that's all I can say with that scenario (Scenario 3) overall that too much information, and how suitable is the information to the patient? Okay, it's a learning opportunity around the patient learning, and having the ability to learn and take their own choices and decisions around oral health hygiene, but I think it could work against the patient because too much knowledge, too much learning."* (Service user- S-01 with diagnosis of schizophrenia).

Facilitators included provision of more practical help such as reminder texts or calls depending on the individual person's preference and help with navigating the NHS cost system were spoken about as something in which provision of support was welcome.

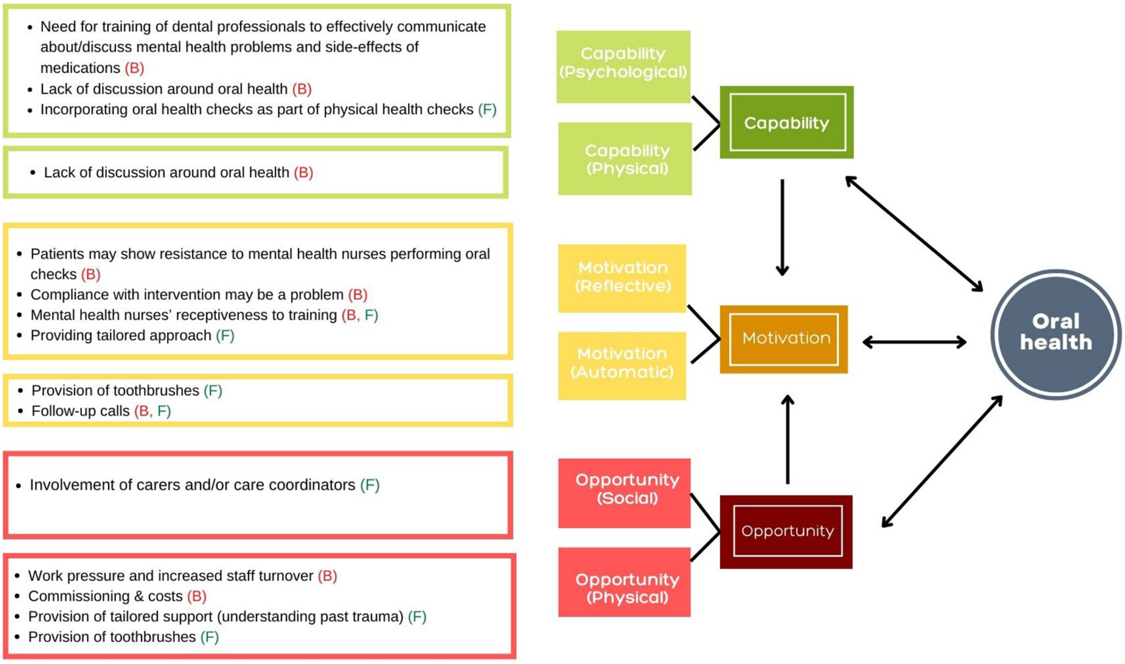


FIGURE 2
The barriers (B) and facilitators (F) reported by the service providers on three main themes according to the COM-B model.

> *"Oh yeah be great option yeah especially text messages I don't know about other people. . .and don't make it a voice call you know when you leave a voice message, I never open mine. I can't cope with the idea of somebody leaving a message on the phone." (Service user- J-06, with diagnosis of bipolar disorder).*

Lack of discussion around oral health by the health professionals was attributed to factors such as not being trained enough to initiate conversations on the topic. The dental professionals also stated that high caseloads meant that there was only a limited time allocated for each patient and this precluded the possibility of having detailed conversations with their patients. The option of mental health nurses incorporating oral health checks through a checklist as part of their patient's routine physical examination received a mixed response and was identified both as a barrier and a facilitator, both by the service providers and the service users. The views expressed were that although it has potential to work because mental health service users already have trusting relationship with their care coordinators, the whole idea should not be limited to 'just another piece of paperwork' but taken forward as an opportunity to initiate conversations around oral health.

> *"Opening up a conversation about teeth and oral health and there is some records and then there's obviously, a point where you can then revisit it so you know that there is a benchmark that you're laying down a year before, and it will obviously, depending on how much details within, it will give you some idea of what the population need is, and I suppose an understanding as to how many of those patients do regularly see a dentist because some of them will have dentists, and some of them wont. . .. I suppose it will vary, and that will give you a lot of interesting information but I think you're in respects to it's opening up a conversation and giving somebody to support and in regards to trying to find a dentist and but I'm just not sure whether it goes far enough."* (Service provider- C-01 working as special care dentist).

Theme 2: Opportunity

Sub-theme: Social influences

Both the service users and the service providers were of the opinion that the involvement of carers such as informal carers (family and friends) or formal carers such as care coordinators or mental health nurses was a pivotal point in the intervention scenarios. Carers can help provide people with SMI the motivation to engage in healthy oral health behaviours by providing practical support such as helping them brush their teeth, accompanying them to visit the dentist, etc.

TABLE 4 Barriers and facilitators under the TDF domains and mapped to the COM-B model.

COM-B component	Theoretical domains framework	Barriers and facilitators (identified through the interviews)	
		Service users	**Service providers**
Capability (Psychological)	Knowledge Skills Memory, attention and decision processes Behavioural regulation	Paternalistic approach often used (B) Toothbrushing demonstration (F) Information overload (B) Navigating the NHS cost system (B) Reminders- text messages or calls (F) Lack of patient's input (B) Different options offered as choice (F)	Need for training of dental professionals to effectively communicate about/discuss mental health problems and side-effects of medications (B) Lack of discussion around oral health (B) Incorporating oral health checks as part of physical health checks (F)
Capability (Physical)	Skills	Toothbrushing demonstration (F)	Lack of discussion around oral health (B)
Opportunity (Social)	Social Influences	Involvement of carers and support networks for positive reinforcement (F)	Involvement of carers and/or care coordinators (F)
Opportunity (Physical)	Environmental context and resources	Provision of tailored support (need for more trauma informed dentists (F) Follow up time, long (B), frequent (F) Provision of toothbrushes (F)	Provision of tailored support (understanding past trauma) (F) Increased staff turnover (B) Commissioning & costs (B) Provision of toothbrushes (F)
Motivation (Reflective)	Social and Professional role & identity Beliefs about capabilities Beliefs about consequences	Mental health nurses/care coordinators can use the opportunity to initiate conversations around oral health (F) Integrating oral and physical health (F) No one taking responsibility (B) Keeping track- use of post-it notes (B, F) If patients choose to self-exclude themselves, intervention will not have much affect (B)	Mental health nurses' receptiveness to training (B, F) Patients may show resistance to mental health nurses performing oral checks (B) Providing tailored approach (F) Compliance with intervention may be a problem (B)
Motivation (Automatic)	Reinforcement	Provision of toothbrushes (F) Follow-up calls (B, F)	Provision of toothbrushes (F) Follow-up calls (B, F)

B, barriers; F, facilitators.

> *"I'd like to see the emphasis on the importance of having somebody with them all the way through the videos (scenario 4) not you know sat in front of that professional with a flip chart you know, in the hospital with the loved one beside them. . . .you know you will learn the carer will learn something about the loved one they didn't and vice versa, and it's a bonding experience. But also, it can be that can be equal benefit to a professional that supports you as well, they might get to learn a bit more about you know it's that togetherness stronger together, you know, rather than you."* (Service user-K-05 with diagnosis of Schizophrenia).

> "*Yeah I think the it definitely varies too, I think, for some people that's enough [signposting to find a dentist], some people already probably attending the dentist or the people would need to be probably with the care coordinators to call up on their behalf, and to provide some kind of active encouragement for them to go and some of our best care coordinators, the ones who would maybe push a bit hard, there'd be quite encouraging for people to go to that first appointment and helping them kind of overcome their fears." (Service provider- C-05 working as clinical psychologist).*

Sub-theme: Environmental context and resources

Regarding interventions related to visiting the dentist, lack of tailored support was highlighted as a major barrier both by the service users and the service providers. Utilising this opportunity to provide tailored support to people with SMI such as availability of trauma informed dentists and shorter follow ups can go a long way to support this population in their oral health needs.

> *"For me, trauma is another barrier so had really bad experiences as a kid with dentist or dentistry and then as an adult more recently about seven years ago, I had a really bad experience with a dentist he wasn't trauma informed."* (Service user-K-05 with diagnosis of schizophrenia).

> "*Yeah, I mean for dental we normally use NICE guidance, but what we found is you know a number of patients with mental problems that normally require quite, most of them, not all of them require more frequent follow up just because depending on the condition and their oral health condition they may need kind of more frequent follow-up. But I think once they're seen by a dental practitioner, then that can be discussed with the care coordinator, and then they can kind of maybe agree on a time scale for review." (Service provider-H-04 working as special care dentist).*

The service providers also spoke about the system level barriers such as the way dental commissioning works, dental treatment costs, and staff turnovers that can prove to be a barrier in provision of an adequate level of care to people with SMI. For example, the need to meet a certain threshold of severity of mental illness before being referred to community dental services which are better equipped to deal with their dental treatment needs, and thus having to utilise the services of a high street dentist. However, consecutive missed appointments due to mental ill health can leads to being removed from a dental surgery's patient list.

> *"I often feel, they are left in limbo in these cases, so like the actual care pathway doesn't take into account their needs... I would like to see them every day when they want to come in, but obviously we have to you know comply with any NHS rules and it's like if you don't attend twice you are normally struck off from the treatment pathway, and you have to start from scratch. Often they're de-registered from the practice and then these days it's really hard to find a dentist like recently, one of my patients were struck off from that list because she didn't attend three one hour appointments with me, so the practice deregistered her, and I know that she's suffered from mental health so we can't see her anymore so sometimes it's a bit of beaurocratic decisions as well that come in the way between dentist and the patient, I guess, in these cases." (Service provider- E-02 working as a high street dentist).*

Provision of toothbrushes whether manual or powered depending on patient's preference was identified as a facilitator by both the service users and the service providers, with participants believing that a new toothbrush helped increase motivation to engage in regular toothbrushing behaviours.

> "*yeah I like that element [provision of toothbrushes] you know, again, the link between people suffering and poverty is probably something that not many people have access to and just the notion of being given something valuable, I think, can make people feel valued and again that notion that like someone cares about you and your team yeah and the novelty of having it. I think that people would use it and so yeah I definitely support that.* (Service user- S-07 with diagnosis of schizophrenia).

Theme 3: Motivation

Sub-theme: Social and professional role and identity

Service users felt that care-coordinators were a good resource to initiate conversations around oral health as they have established rapport and a trusting relationship with them. In particular they discussed the provision of more practical support such as finding a dentist, setting up an appointment etc. rather than just ticking boxes on a checklist.

> *"I guess it would just be that alongside the checklist if in conversation that the patient and care coordinator had concerns I say it was flagged that they weren't registered with a dentist and didn't feel able to do that, that wasn't the end of the conversation that there was like the capacity to follow up an office support for that and like literally the big thing that made the difference for me was just someone else making that first phone call and contacting the dentist and then it all sort of went from there, which isn't a massive things I wouldn't be overly concerned that it was going to be hugely time consuming, but I just think it's just the checklist on its own there's a chance that that can increase the sense of shame, but not actually lead to anything being done differently."* (Service user-Sa-07 with diagnosis of Schizophrenia).

Although health professionals agreed with this idea of involving mental health nurses in provision of oral health support, some shared their concerns regarding the barriers related to capacity and willingness of mental health nurses to be involved in provision of oral health support in the face heavy caseloads and with most of the services stretched to the limit due to high staff turnovers. Furthermore, the service providers also felt that another barrier could be the possibility of service users not willing or feeling comfortable for non-dental personnel to perform oral health checks (such as taking a quick look in the mouth to identify any problems) even if they are trained to do so.

> *"I think, where the difficulty is the high turnover of staff. Sometimes capturing on staff to do that and honestly trying to ensure that that's kind of carried out by the staff, because I think there's other priorities with the patient. They have to look at it as something that can be done within their kind of shift, with all the other kind of requirement for them to do as*

> *well yeah and I think it'd be good if implemented."* (Service provider-H-04 working as special care dentist).

Nevertheless, intervention related to an integrated model of care where health professionals who are involved in a patient's physical (including oral health) and those involved in their mental health work together to provide integrated care was spoken about as a way forward to ensure oral health moves from 'nobody's business' to 'everyone's business'.

> *"You know if that consistent support and making every contact count does that make sense, and also that it's if you make it one person's business and responsibility quite quickly becomes nobody's business or responsibility."* (Service user-K-05 with diagnosis of Schizophrenia).

Sub-theme: Beliefs about capabilities and beliefs about consequences

The intervention elements that required keeping a record of daily toothbrushing elicited a mixed response from service users. Techniques such as use of toothbrushing activity calendars or pulling out a sticky note every time an individual brushed their teeth were felt by some to have the tendency of provoking their obsessive compulsiveness. On the other hand, other service users felt that marking on a calendar or pulling out a sticky note was better way of keeping a track and needed little input compared to maintaining a diary.

> *"I would really like it yeah because, to be honest, the other thing about it is they give us so many things that you have to tick a box with and it just you know, in the end you just get fed up so it's something different, something new and something that you don't actually have to do anything about apart from pull and plop do you know what I mean yeah no I think that's really good."* (Service user-J-06 with diagnosis of bipolar disorder).

Furthermore, it was highlighted that even if the problem could be solved by providing the service users a choice over the method of record keeping, a person's non-compliance or lack of engagement with the techniques can still prove to be barrier.

> *"One thing is like you're probably having to think about two areas of compliance and cooperation, so one of them is the actual brushing but then one of them is putting the sticky note in the box...but possibly if the count is lower, I'll be careful about understanding is the count because they didn't brush their teeth or is the count because they forgot they brushed their teeth, or they forgot to put the slip in so that's probably one of the sensitivities to be aware of."* (Service provider- B-10 working as special care dentist).

Sub-theme: Reinforcement

Provision of follow-up calls or texts were discussed as a facilitator for providing positive reinforcement to the service users to encourage them to maintain their oral hygiene. The overall consensus was to offer this support as a choice to people with SMI as the willingness to engage may vary depending on the person and on the day for example on a bad day it could prove to be an overwhelming task.

> "*I think it's one of these things that all sizes don't fit all isn't it, you know people are going to react differently, to telephone interventions, some are going to see it as really helpful and keeping in touch with somebody from the outside world but the more introverted patient might not welcome it quite as much.*" (Service user- M-02 with diagnosis of schizophrenia).

While discussing the initial findings and recommendations of the study with the stakeholders, they agreed with the overall study findings and recommendations. However, stakeholders' consultation revealed that due to lack of system level integration between mental and dental healthcare services and work load of the related healthcare staff and with the current commissioning system, it might be challenging to incorporate some of the interventions. Careful consideration is needed to develop a system level intervention and evaluation of the effectiveness and cost-effectiveness and sustainability of the intervention.

Discussion

The study aimed to explore the barriers and facilitators of oral health interventions and their components to identify the capability, motivation and opportunity drivers of behaviour change.

This study reports on analysis of contextual factors, BCTs and mechanisms used in previously tested interventions for improvement of oral health in people with SMI. There were 16 individual BCTs identified from the description of previously tested interventions for oral health improvement in people with SMI. The most commonly used BCTs were "*4.1 instructions on how to perform the behaviour*" and "*6.1 demonstration of behaviour*" pertaining to toothbrushing practice. It was noticeable that social support in terms of "*3.1 social support (unspecified)"* and "*3.2 social support (practical)"* were not some of the frequently used BCTs. Though dental education and oral hygiene instructions along with provision of toothbrush showed some short-term effectiveness and seemed to be viable in psychiatric outpatient settings (28), given the barriers that people with SMI face for finding a dentist, setting up an appointment and attending one, there needs to be provision of more tailored support in terms of their oral and dental care.

The study also reports a qualitative exploration of barriers and facilitators for engagement with oral health interventions through the perspectives of people with SMI (service users), carers, and the service providers. In the current study, an integrated care model that was tested by Agarwal and colleagues was identified as the best kind of service that can be offered to people with SMI for their oral and physical health needs (29). This indicated the need to consider oral health very much a part of the general health and wellbeing. Furthermore, involvement of service users in their care planning in conjunction with their carers, be it formal carers (such as care coordinators) or informal carers (family members) can have a positive influence in improving patient compliance through provision of tailored services and reinforcement of messages.

Training of mental health care nurses around oral health was identified as a facilitator in this study. From the findings of a qualitative study exploring the views of mental health nurses in Australia regarding dental access and dental ill health of people with SMI (44), it can be deduced that given the salience of concern nurses have for the dental health of people with SMI, mental health nurses may offer an important route for service users to access dental health care through providing advice and facilitating referrals. Adams et al. in their study on monitoring oral health in people with SMI in the UK reported that while a simple nurse led checklist to monitor oral health did not demonstrate any improvement (26), it did help highlight the oral health needs of people with SMI. Although mental health nurses who are closest to the patients in provision of care, can help initiate conversations related to oral health, high staff turnover and huge workload is a barrier that needs to be considered in planning of related oral health interventions. Almomani et al. discusses the need for special training for dentist and dental hygienists in working with people with SMI along with improving the knowledge of oral care in nursing staff (28). Furthermore, De May et al. concluded that 'oral health of SMI patients can improve significantly with basic oral health interventions carried out by collaborating oral hygienists and mental health nurses' (27).

The strengths of this study include the fact that a systematic approach was used to extract intervention study related information using the standardised checklists such as TIDieR checklist and BCTTv1. The use of theoretical frameworks such as TDF and COM-B model allowed the exploration of the barriers and facilitators at personal/individual level, interpersonal/service user-service provider level and environmental/systems level and based on these, explore the capability, opportunity and motivational drivers for promoting oral health in people with SMI.

Use of video vignettes enhanced the participant's understanding of different intervention scenarios and is a unique way of engaging participants in the thought and discussion process especially when conducting research from a distance. Furthermore, consultations with a diverse range of stakeholders helped to obtain validation of our study findings and recommendations. The study has some limitations that warrant mentioning. The sample size was small and was based on the number of people with SMI who agreed to participate within the data collection period. Secondly, incorporation of a wider range of ethnic groups could have provided additional insights. However, within the constraints of time and resources, we conducted a good quality but modestly sized study and tried to bring to light of this often-neglected area of improving oral health in people with SMI.

To our knowledge, this is the first study to explore the barriers and facilitators for engagement with oral health interventions, from the perspectives of people with SMI, their carers and different professionals involved in their care. We included mental health care service users, male and female from different age groups, with different diagnoses of severe mental illness. Assessing service users' and providers' perceptions of barriers and facilitators to oral health interventions will help to design future interventions to improve oral health in people with SMI. The implications of the study go beyond oral health and the context of the UK setting due to the applicability of recommendations to other health promotion delivery across the world (exercise, diet, smoking cessation etc.). Paternalistic ways of offering advice and information overload can be a barrier to acceptability in any health promotion activity.

Recommendations

More understanding and awareness of trauma-informed dental practice is needed for this vulnerable group. Employing standard principles of Sensitive Practice from the framework of The Umbrella of Safety would facilitate feelings of safety for the service users (45). Furthermore, future interventions, in addition to provision of oral hygiene instructions, should focus on the provision of more practical support in terms of accessing dental services, such as support with finding and attending a dentist.

The British Society of Disability and Oral Health guidelines published in 2000 made a number of recommendations for oral health care for people with mental health problems, including providing oral health advice, support, promotion and education addressing the oral health needs of clients (46). Providing advice and education (diet advice for reducing frequency of sugar intake and tooth brushing advice on the correct techniques and duration of brushing) are not sufficient to ensure improvement in oral health. It is imperative that compliance and stability in oral health following education and advice is monitored and reinforced as necessary until stabilisation is achieved (47). Therefore, future work should focus on co-producing an intervention (48) to improve oral health in people with SMI and related training materials as it increases the relevance of research by ensuring that it reflects the needs, values and interests of patients and improves the quality of research through broadening the range of expert input.

People with SMI are not a homogenous group (49, 50) and face unique barriers to maintaining good oral health (30, 51) that the interventions rarely considered. Therefore, a patient-centred approach to oral health promotion (46) should be followed as use of person-centred care in mental health treatment models has promising outcomes for engagement (52).

Although an integrated care model at the study setting (29) was mostly preferred service by the service users as identified in this study, integration between dental, mental health, and other health services is currently lacking. Therefore, an important element of any future guidance should consider how dental care can be integrated in mental health care services (53, 54). The recommendations could be applicable to other health concerns in this population as the integration of physical (including dental) health care with mental health care and support of mental health workers and care coordinators would be beneficial for people with SMI. We acknowledge that the context and specifically the health care service delivery system varies across different countries. However, considering the health inequalities of people with SMI both in developing and developed countries, an integrated model approach would be beneficial. The model whereby the dental service sits under the same roof of mental health care (29) was identified by service users as the optimum care offered to people with SMI for their oral health needs. Health professionals who are involved in mental health, oral health, and physical health care need to work together with good communication channels between various services and with the service user to optimise their health care including oral health.

Conclusion

The findings of the present study suggest that the oral health needs of people with SMI continue to be unmet. Interventions that additionally focus on inter-personal and system levels barriers have the potential to be beneficial for improving the oral health of this vulnerable group of people. The results of this study will inform the development of a fit-for-purpose system level oral health intervention to improve oral health of people with SMI.

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

This study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Health Sciences Research Governance Committee of the University of York (protocol code: HSRGC/2021/438/C and date of approval: 19 March 2021). The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

MM and LG: conceptualisation and supervision. MM, MF, LN, and LG: methodology. MM and MF: investigation, data curation, formal analysis, visualisation, writing—original draft preparation, and project administration. SG, LG, EP, and MM: resources and funding acquisition. All authors: writing—review and editing.

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Conflict of interest

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

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2022.971328/full#supplementary-material

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Equitable suicide prevention for youth impacted by the juvenile legal system

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Suicide is the second leading cause of death for adolescents in the United States. Despite the already alarmingly high rates of suicide attempts among adolescents, youth involved in the juvenile legal system (JLS) are up to three times more likely to have suicide attempts than their peers not impacted by the JLS. This public health crisis is also a matter of health equity, knowing that ethnoracially minoritized youth, mainly Black and Latinx youth, have disproportionate contact with the JLS. In order to disrupt the current elevated rates of suicide among Black and Latinx youth involved in the JLS, there needs to be more concerted efforts to improve assessment and suicide prevention efforts in the JLS. There are various potential touch points of care for suicide prevention and the Sequential Intercept Model (SIM), which outlines community-based responses to the involvement of people with mental and substance use disorders in the criminal justice system, can be used as a strategic planning tool to outline possible equitable interventions across these various touch points. Our purpose is to provide a comprehensive picture of gaps and equitable opportunities for suicide prevention across each intercept of the SIM. We provide recommendations of priorities to promote health equity in suicide prevention for ethnoracially minoritized youth impacted by the JLS.

KEYWORDS

suicide, juvenile legal system, equity, adolescents, Sequential Intercept Model, suicide prevention and intervention, ethnoracially minoritized youth

Introduction

Suicide is the second leading cause of death for adolescents in the U.S. (1). Historically, White youth have higher rates of death by suicide, when compared to Black and Latinx youth. However, these rates do not consider the rapid increase in suicide deaths and elevated rates of suicide attempts for Black and Latinx youth. Recent data suggests that Black and Latinx adolescent girls have the highest rates of suicide attempts (15.9 and 11.9%, respectively), compared to 9.4% of non-Hispanic White adolescent girls (2). When considering the different social systems in where Black and Latinx adolescents are disproportionately embedded in, youth in the juvenile legal system (JLS) are at even greater risk of suicide. Indeed, suicide rates are up to three times higher for youth impacted by the JLS than youth in the general population (3–5), and risk for suicide increases with greater involvement in the JLS (6).

The Sequential Intercept Model (SIM) was developed to describe various points in the criminal justice process at which individuals with mental illnesses could be diverted to alternative rehabilitative services and treatment (7). Heilbrun et al. (8) applied the SIM to the JLS and outline intercepts as (1) the first contact with either emergency services, (2) initial hearings and detention post-arrest, (3) jails and courts, (4) re-entry, and (5) community corrections. We expand this to include an intercept zero "Prevention," separated court processes from confinement, and redefine confinement to include the juvenile-specific types of juvenile detention and long-term placements (either structured residential or psychiatric residential treatment centers). Our iteration of the SIM views the intercepts from a clinical perspective as various touchpoints for culturally responsive, trauma-informed suicide prevention.

We illustrate disparities/inequities and opportunities for equitable suicide prevention across the SIM for youth impacted by the JLS (see **Figure 1**) using a Structural Racism and Suicide Prevention Systems Framework (9), which posits that youth are embedded across multiple ecological systems that illustrate how individual, interpersonal, community, and societal factors intercept and influence each other over time and have an impact on suicide risk. Additionally, given that childhood trauma is a significant risk factor for suicide attempts (10) and that ethnoracially minoritized youth are more likely to experience potentially traumatic events (11, 12), we will pay particular attention to efforts disrupting the pathway from trauma to suicidal risk. Within these frameworks, we contend that inequities are compounded across the SIM, and to truly address inequities through culturally and trauma responsive care, we must evolve from individual to structural targets in suicide prevention efforts (9).

Intercept 0: Prevention

Intercept 0 encompasses prevention of JLS involvement, which in turn, can decrease suicide risk. Equitable prevention should disrupt community and system level pipelines, e.g., school and child welfare, that target and propel ethnoracially minoritized youth into the JLS. School has been a child serving system that can impact both legal system involvement and suicidality. For example, school resource officer programs are related to increased arrests for non-serious violent crimes (e.g., truancy and curfew violations), and higher, disproportionate rates of suspensions and expulsions specifically for ethnoracially minoritized youth (13, 14). Such disciplinary action can lead to school disengagement, a precursor to JLS involvement (15). Additionally, school suspensions/expulsions limit youth from receiving school-based mental health prevention services that can decrease risk factors for suicidality. If youth do receive services, they are frequently related to disruptive behaviors seen outside the context of trauma-related issues, depression, or anxiety (16, 17). School-based mental health services often include universal, selective, and indicated prevention interventions for suicide. Universal prevention programs focus on reducing stigma about suicide and mental health and increase student help-seeking behavior (18). The most common form of suicide prevention in schools, selective prevention, trains peers, teachers, and school staff to identify and intervene in a suicidal crisis (19). Finally, indicated prevention programs target high-risk students focused on reducing suicidal thoughts and behaviors (20). However, if students of color are consistently absent from school, it decreases the likelihood that they will be identified and receive these services. The combination of disproportionate discipline and prevention of mental health service access in schools fails ethnoracially minoritized youth in that it creates a direct pipeline to JLS involvement and reduces their likelihood to access suicide prevention services.

To address the challenges in disrupting these system-level pipelines to JLS involvement, a trauma-informed and trauma-responsive care model has been proposed. This addresses macro level change, e.g., anti-racist school organizational and policy changes, and practice related changes, e.g., screening for potentially traumatic events and connecting families to appropriate resources (17). This culturally appropriate care should also address racism and discrimination related to trauma for ethnoracially minoritized youth (21). Yet, more research is needed on how to disrupt child serving system pipelines through partnering with key stakeholders in the community and working across systems to adopt a unified framework for working with ethnoracially minoritized youth.

Intercept 1: Law enforcement

Intercept 1 involves diversion performed by law enforcement and other emergency service providers to treatment in the community instead of being arrested or detained. Such diversion is urgently needed, given that youth with high-risk for suicide are more likely to have legal stressors. In a study of youth that died by suicide, an alarming 63% had a JLS referral and 80% of those under 18 had previous JLS contact (22). Police officers have significant potential "therapeutic contact," given their high contact with youth that are at high risk for suicide, with recent surveys indicating that 84% of police officers encounter an individual with suicide risk as part of their job (23). This suggests that police officers are not only first-responders but also are gatekeepers/crisis liaisons that can divert youth at risk for suicide from the JLS to evidence-based care in the community.

Unfortunately, police officers often do not receive adequate training for detection of youth suicide risk, with data showing that approximately one in four police officers have not received any training in the management or intervention of suicide (23). Some states still do not require the training in suicide protocols. Despite very few studies documenting this phenomenon, the criminalization of suicide by police officers (i.e., perceiving suicidal behaviors as aggressive) is a significant barrier for adequate links to suicide prevention services (24). In order to address these inequities, future research should prioritize the examination of potential biases in policing associated with Black and Latinx suicidal youth.

To address the challenges within this intercept, we recommend compulsory trauma-informed training for all first responders/mobile crises teams that target racial bias. Concerted efforts need to be made to reduce officer stress that activates heuristics that can lead to racist policing practices (25). In addition, we recommend the training of police officers in suicide prevention gatekeeper training, as there is a positive relationship between receiving evidence-based training and outcomes in knowledge, attitudes, self-efficacy, and use of intervention behavior by police officers (23). This can be done through the development of protocols that are mandatory and systematically implemented throughout states. Lastly, in efforts to de-police crisis responses to suicide, a new three-digit dialing code [988] (available July 16, 2022) will connect all callers to trained counselors. Taken together, these strategies prevent law enforcement from providing suicide care without proper training and also highlight community responses to crises.

Intercept 2: Courts

Intercept 2 involves judicial proceedings within the court. Most JLS involvement tends to end here (26), which may explain why the court system has often been overlooked in suicide prevention. Currently, courts are being empirically evaluated as a place to screen, intervene, and refer to appropriate services for suicidality (27–29). Currently, the MAYSI-2, a screening tool validated within the JLS population, is used to assess suicide risk and triggers further suicide assessment from a mental health worker (28), however, there has been concern with racial/ethnic and gender differential item functioning with the Suicide Ideation and Traumatic Experiences subscales (30). While the procedure to screen, conduct a safety plan intervention, and refer to community-based mental health services has been deemed both feasible and acceptable (28), there are several inequities that come with suicide prevention in the court setting.

Courts are not designed as mental health service facilities, where there can be a lack of privacy for youth in completing screening, treatment, and referral services. Being in the court may pose additional stress and impact reliable screening. Timing of screening is important; if the youth is about to enter the courtroom or recently received an unfavorable sentence, their ability to report relevant risk factors, including hopelessness, is compromised. This is especially relevant for ethnoracially minoritized youth given that they are more likely to receive harsher sentences than their White peers (31). Relatedly, training for the mental health providers conducting the screening and safety plan requires appropriate time, resources, and finances (27). Training should include uniform risk categories or ways to determine which youth are referred to which services (i.e., at what risk level are youth referred to immediate hospitalization or outpatient services) to reduce bias from the assessor. The risk-needs-responsivity model (32) emphasizes the importance of matching intervention with risk level.

Universal screening, along with appropriate risk mapping and referral systems, is a priority. To do this, courts should provide private and safe spaces to youth to complete their screening, ensure their staff has appropriate training to provide equitable administering, scoring, and responding to the risk assessment screening tool. Courts should be active partners with community mental health agencies to ensure timely response to referrals and open communication between parties involved in the youth's case. Such practice efforts should be continued to be empirically validated as a location for risk assessment and intervention with our present charge to ensure equitable implementation.

Intercept 3: Confinement

Intercept 3 considers the services needed to prevent the worsening of mental wellness of youth while they are detained awaiting disposition or receiving services in long-term rehabilitative facilities. In juvenile detention, suicide risk screening is common practice at admission, though there is variance in implementation (33). After admissions screening, it is unclear what follow up intervention occurs apart from making an environment safe (e.g., removing sheets from a room and increasing staff observation). Few evidence-based interventions exist for incarcerated adolescents (34), though there has been successful implementation of the CSSR-S and Safety Planning Intervention in secure detention facilities (35). Challenges to suicide prevention in juvenile detention include lack of guidelines to specify evidence-based practice use and staffing capacity of qualified individuals in facilities to do suicide risk screening (36).

We recommend researchers examine implementation factors related to suicide prevention and investigate longitudinal impact of prevention measures post-release (36, 37). More robust reporting guidelines that go beyond self-report and limited institutional data can clearly delineate factors that could influence disparities in care (37). We recommend the implementation of trauma-informed suicide screening and

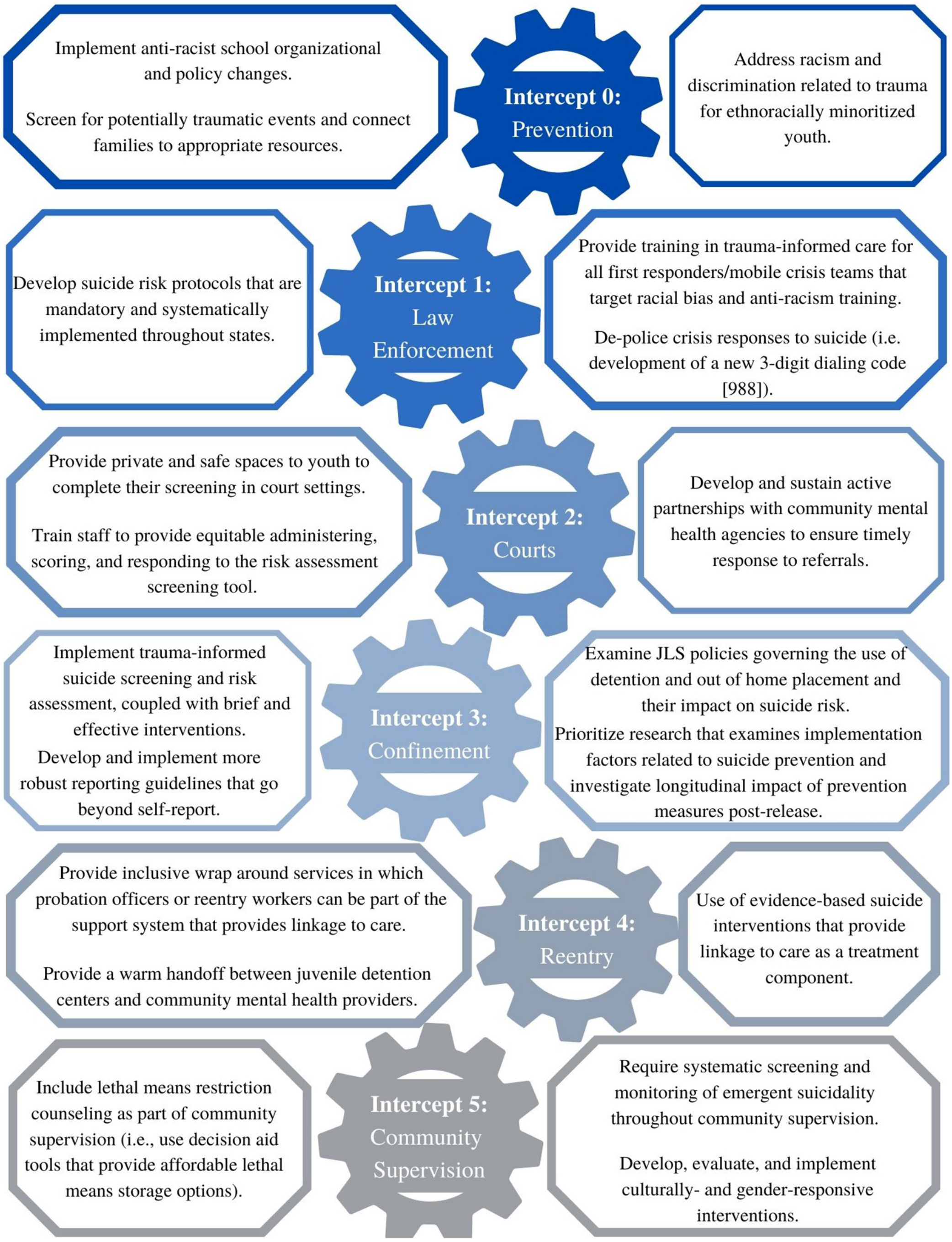

FIGURE 1
Equitable suicide prevention strategies across the Sequential Intercept Model.

risk assessment, coupled with brief and effective interventions like the Safety Planning Intervention or SAFETY (38). These practices can be implemented by clinical staff and task-shifting strategies can be an implementation strategy to increase capacity of detention staff for suicide screening and intervention. A key component of prevention includes parental/caregiver involvement in care and being intentional about caregiver engagement in treatment (e.g., using family visits as a way for integration).

Diversion from detention is the most upstream, impactful approach to suicide prevention. JLS should examine their policies governing the use of detention and out of home placement, as such placements drastically increase the risk of suicidality (39). Standardized instruments to divert youth from detention may help, although there are risks of inequitable implementation through a process called judicial override, where a judge can detain the youth despite the risk assessment recommending diversion. Bias can factor into such overrides. For instance, if a judge weighs school attendance more than other factors, something not favorable for non-White youth (40), the override can create inequitable detainment for non-White youth.

Intercept 4: Reentry

Intercept 4, supports reentry back into the community after detention/confinement to increase linkages to care and reduce further JLS involvement through use of reentry coordinators, peer support staff, or community partners. Current barriers to equitable suicide prevention in the reentry period include the challenges with sharing information and coordinating aftercare, a task that is further compounded with the complication of pre-trial status (i.e., multiple probation officers and court staff). From our collective clinical experience, we have noted that the stress of community reentry is a precipitator for emotional distress and suicide risk. In fact, studies indicate that 40–70% of youth recidivate within 1 year (and Black male youth with behavioral problems have a risk for shorter recidivism time) and recidivism is a perpetuating barrier to receiving appropriate suicide treatment (41). In a large study of adolescents, being placed on suicide precaution in confinement was associated with increased recidivism (41).

A significant barrier to suicide prevention during this intercept is the involvement of parents into the care of youth as they transition back home. Parental involvement is a major common treatment element of effective suicide interventions for youth, however, many parents/caregivers report feeling "out of the loop," regarding their youth's mental health during reentry which results in difficulty in accessing and utilizing mental health care. Another potential barrier to parental/caregiver involvement in care, is that many youth that are incarcerated also have a parent that is incarcerated. Similarly, long wait periods between detention release and initial contact with court or probation officers is associated with decreased motivation for youth to seek care (42). Mental health treatment seeking during reentry is even lower among Black and Latinx youth (43).

To address current barriers and disparities for suicide during reentry, we propose the provision of inclusive wrap around services in which probation officers or reentry workers can be part of the support system that provides linkage to care. We also propose the warm handoff between juvenile detention centers and community mental health providers and the use of evidence-based interventions that provide linkage to care [e.g., SAFETY; (38)]. An important area for future research that needs to be prioritized is the development and evaluation of culturally responsive suicide interventions for youth and families involved in the JLS as they transition back to their community.

Intercept 5: Community supervision

Intercept 5 aims to support youth with mental health needs to limit community supervision violations and prevent new offenses. Juvenile probation officers are charged with administering rehabilitation risk/needs assessments, connecting youth to resources related to identified needs, and ensuring compliance with the terms of court orders. While cases on supervision have decreased in response to the decrease in juvenile arrests, those who are on probation have higher risk profiles including trauma histories and suicide risk (44). Despite this increased risk, data shows that only 20% of court, and probation staff screen for suicide (45). This gap may be attitudinal (e.g., "that's not my job"), limited capacity for training, or logistical, related to limited referral networks.

An integrated screening and referral program that maps risk to the appropriate level of service is needed; however, accessibility remains a challenge, with up to 80% of youth with mental health needs going without receiving appropriate mental health care (46). Care access is an even greater barrier for ethnoracially minoritized youth that live in areas far from community clinics and oftentimes lack the financial resources (and time) for transportation. Clinics themselves may lack resources for evidence-based care [e.g., Dialectical Behavior Therapy (DBT)]. Care coordination may be difficult across systems, as there may be interorganizational confusion (47) in terms of who is responsible for what aspects of a youth's rehabilitation across different service systems. For instance, with youth that are screened but are placed in shelter care, there is a tenfold increased risk in suicide attempts, highlighting problems with care coordination with multiple systems of care (39).

Our recommendations center on systematic screening and monitoring for emergent suicidality throughout community supervision. We also echo (48) who articulate that cultural and gender specific interventions are warranted especially when suicide risk is viewed through a social determinants of health lens. A research and related practice gap includes understanding the needs of gang involved youth on supervision, as these youth may have intensive probation for violence or gun-related charges and are seven times more likely to have suicide attempts than non-violent-offense youth (39). Such supervision should include restricting access to lethal means as also related to suicide risk.

Discussion and conclusion

Suicide inequities/disparities will continue to widen if we do not disrupt our current approach to suicide prevention that targets individual level factors with approaches addressing structural determinants of health. Structural racism not only has an impact on prevention of JLS involvement, but it also can perpetuate JLS involvement through unnecessarily long community supervision. Our discussion of the SIM as a way to map suicide prevention/intervention resources aligns with the prevention strategies outlined by Centers for Disease Control and Prevention (49), in which they call for multipronged approach to suicide prevention. The outlined approaches include the strengthening of economic supports, strengthening access and delivery of suicide care, creating protective environments, promoting connectedness, teaching coping and problem-solving skills, identifying and supporting people at risk, using trauma-informed and culturally responsive suicide prevention strategies, and lessening harms and prevention of future risk. This approach underscores a structural response to structural inequities for JLS youth and serves to protect youth from suicide to keep them out of hospitals and the JLS.

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.

Author contributions

All authors participated in the conceptualization, writing, and editing process of this manuscript and 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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Disparities in the unmet mental health needs between LGBTQ+ and non-LGBTQ+ populations during COVID-19 in the United States from 21 July 2021 to 9 May 2022

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Background: Evidence highlighted the likelihood of unmet mental health needs (UMHNs) among LGBTQ+ than non-LGBTQ+ populations during COVID-19. However, there lacks evidence to accurately answer to what extent the gap was in UMHN between LGBTQ+ and non-LGBTQ+ populations. We aim to evaluate the difference in UMHN between LGBTQ+ and non-LGBTQ+ during COVID-19.

Methods: Cross-sectional data from Household Pulse Survey between 21 July 2021 and 9 May 2022 were analyzed. LGBTQ+ was defined based on self-reported sex at birth, gender, and sexual orientation identity. UMHN was assessed by a self-reported question. Multivariable logistic regressions generated adjusted odds ratios (AODs) of UMHN, both on overall and subgroups, controlling for a variety of socio-demographic and economic-affordability confounders.

Findings: 81267 LGBTQ+ and 722638 non-LGBTQ+ were studied. The difference in UMHN between LGBTQ+ and non-LGBTQ+ (as reference) varied from 4.9% (95% CI 1.2–8.7%) in Hawaii to 16.0% (95% CI 12.2–19.7%) in Utah. In multivariable models, compared with non-LGBTQ+ populations, LGBTQ+ had a higher likelihood to report UMHN (AOR = 2.27, 95% CI 2.18–2.39), with the highest likelihood identified in transgender (AOR = 3.63, 95% CI 2.97–4.39); compared with LGBTQ+ aged 65+, LGBTQ+ aged 18–25 had a higher likelihood to report UMHN (AOR = 1.34, 95% CI 1.03–1.75);

compared with White LGBTQ+ populations, Black and Hispanic LGBTQ+ had a lower likelihood to report UMHN (AOR = 0.72, 95% CI 0.63−0.82; AOR = 0.85, 95% CI 0.75−0.97, respectively).

Interpretation: During the COVID-19, LGBTQ+ had a substantial additional risk of UMHN than non-LGBTQ+. Disparities among age groups, subtypes of LGBTQ+, and geographic variance were also identified.

KEYWORDS

unmet mental health needs, LGBTQ+, COVID-19, US, disparity

Introduction

The COVID-19 crisis has disrupted the mental health services when such services are needed more than ever, with marginalized members of society disproportionately influenced (1, 2). A rising worry argued that most of our attention had been placed on visible marginalized groups (like ethnic minorities). However, less visible groups, such as people from communities of lesbian, gay, bisexual, transgender, queer, and other people of diverse sexual orientation and gender identity (LGBTQ+), have received relatively less attention (3–5).

Prior to the emergence of COVID-19, LGBTQ+ populations had experienced greater mental health problems and unmet mental health needs (UMHN) than non-LGBTQ+ populations, because of stigma, discrimination, economic vulnerabilities, and less availability of identity-affirming services (5–10). The COVID-19 crisis has led to negative impacts on the lives of many, but its effects are further exacerbating the aforementioned existing risks and barriers among LGBTQ+ populations. A survey based on 1,000 adults in the United States found that during the COVID-19 crisis, about 40% of LGBTQ+ households experienced barriers to medical care, compared with 19% of non-LGBTQ+ households (11). Similar findings were identified from other groups of vulnerable populations and countries. Studies from the United States indicated that people with disabilities experienced significant delays in medical care, because of severe disruptions in access to accessible transportation (12), non-emergency medical services (13), and personal assistance services and home healthcare (14, 15). A study based on 26 countries in Europe indicated that unmet healthcare needs were primarily induced by having pre-scheduled care postponed (accounting for 25%), forgoing care for fear of contracting COVID-19 (accounting for 12%), and being unable to obtain medical appointments or treatments when needed (accounting for 5%) (16). Extensive literature indicated that the COVID-19 pandemic has increased mental health needs (17, 18). Superimposed with the aforementioned barriers also incurred by COVID-19, the UMHN could be worse.

The COVID-19 crisis also had impacts on the LGBTQ+ community in a unique manner. There have been documented cancelations and delays in gender-affirming surgeries, which were associated with negative mental health consequences (2). Furthermore, LGBTQ+ with intersecting marginalized identities (like LGBTQ+ people of color and young LGBTQ+) could be more vulnerable during the COVID-19 crisis. A survey based on 4,000 adults in the United States found that during the COVID-19 crisis, 22% of LGBTQ+ people of color became unemployed, compared to 14% of white LGBTQ+ people and 13% of the general population (19). The shutdown of schools or universities that could provide a gateway to mental health services further compounded the mental health burden in young LGBTQ+ individuals (5).

The available evidence highlighted the substantial additional likelihood of UMHN among LGBTQ+ than non-LGBTQ+ populations. However, there is still a lack of evidence to accurately answer: during COVID-19, to what extent the mental health needs of LGBTQ+ were met or to what extent the gap was in UMHN between LGBTQ+ and non-LGBTQ+ populations. In this study, we evaluated the UMHN gap between LGBTQ+ and non-LGBTQ+ populations, with focuses on age and race/ethnicity disparities.

Materials and methods

Data source and participants

Data are from the Household Pulse Survey (HPS), which is a nationally representative survey of adults (age = 18) measuring the impact of the COVID-19 pandemic and was conducted by the US Census Bureau in partnership with the Centers for Disease Control and Prevention (20). The HPS used the US Census Bureau's Master Address File as the source of sampled housing units. The sample design was a systematic sample of all eligible housing units, with adjustments applied to the sampling intervals to select a large enough sample to create representative estimates at the national, state, and metropolitan area levels.

Technical details are available on the Census Bureau website (21). HPS was administered online and collected information on demographic, socioeconomic, and health status. We utilized HPS data spanning 21 July 2021 through 9 May 2022, as this period has data collected on both UMHN and gender identity and sexual orientation identity.

The data are publicly available. The use of secondary de-identified data makes this study exempt from institutional review board review. This study follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline (22).

Outcome and measures

Unmet mental health needs was assessed by the question "At any time in the last 4 weeks, did you need counseling or therapy from a mental health professional, but did not get it for any reason," with the response yes or no.

LGBTQ+ status was defined by self-reported sex at birth (male or female), gender identity (male, female, transgender, or none of these), and sexual orientation identity (gay/lesbian, straight, bisexual, something else, or don't know). Non-LGBTQ+ populations were defined as those who are heterosexual and have the same birth sex and gender identity. The remaining populations were grouped as LGBTQ+. Subtypes of LGBTQ+ were also separated: Lesbian was defined as those who had the female birth sex and had the answer "gay/lesbian" for sexual orientation; gay was defined as those who had the male birth sex and had the answer "gay/lesbian" for sexual orientation; bisexual was defined as those who had bisexual sexual orientation; transgender was defined as those who had transgender gender identity; remaining populations from LGBTQ+ was categorized into queer and other people of diverse sexual orientation and gender identity (queer+).

Covariates

We examined the following socio-demographic variables: age (18–25, 26–49, 50–64, vs. 65+), race/ethnicity (White, Black, Hispanic, vs. Asian and others), marital status (married, cohabiting or civil partnership, never married, vs. widowed/divorced/separated), and education attained (less than high school, some high school, high school graduate or equivalent, some college but degree not received or is in progress, associate's degree, bachelor's degree, vs. graduate degree). We also investigated the affordability of mental health service, reflected by total household income before taxes ($0–$34,999, $35,000–$49,999, $50,000–$74,999, $75,000–$99,999, vs. $100,000 +), difficulty with expenses (yes or no), availability of public health insurance (yes or no), and availability of private health insurance (yes or no). Difficulty with expenses was assessed by the question "In the last 7 days, how difficult has it been for your household to pay for usual household expenses, including but not limited to food, rent or mortgage, car payments, medical expenses, student loans, and so on?" with the response not at all difficult, a little difficult, somewhat difficult, and very difficult. Responses with somewhat difficult and very difficult were recorded as "Yes." People were regarded as "has public insurance" if they had any one of the following types of insurance: (a) Medicare; (b) Medicaid, Medical Assistance, or any kind of government-assistance plan for those with low incomes or a disability; (c) VA (including those who have ever used or enrolled for VA healthcare). People were regarded as "has private insurance" if they had any one of the following types of insurance: (a) Insurance through a current or former employer or union (through yourself or another family member); (b) Insurance purchased directly from an insurance company, including marketplace coverage (through yourself or another family member); (c) TRICARE or other military healthcare.

State-level measures

We extracted state-level measures in the United States from the National Mental Health Services Survey (N-MHSS). N-MHSS is a survey that collects data on the services and characteristics of all known mental health treatment facilities in the 50 states, the District of Columbia, and the U.S. territories and jurisdictions and is the only source of state-level data on the mental health service delivery system reported by both public and private specialty mental health treatment facilities (23). The data collected by N-MHSS included but were not limited to the following: what treatment was offered in the facility, how the treatment was offered, what kinds of age groups were targeted, what types of payments were accepted, and whether the facility was issued a license/certification. We extracted 131 state-level measures collected by N-MHSSS in 2020. The full list of these 131 state-level measures and their explanation can be found in the **Supplementary Table 1**. Following the suggestion of a previous study (24), state-level densities of corresponding measures were calculated as the proportion of each state's total number of facilities (taking facility offering mental health diagnostic evaluation as an example, we calculated the proportion of facility which offers mental health diagnostic evaluation out of the total number of facilities in each state).

Statistical analysis

Descriptive statistics (counts and percentage) were reported by the LGBTQ+ status (yes vs. no) and were tested by chi-squared tests.

Unmet mental health needs between LGBTQ+ and non-LGBTQ+ populations were compared using logistic regression models with LGBTQ+ (yes vs. no) as the key predictor. The results were reported as both unadjusted and adjusted odds ratios (AORs). For adjusted ORs, the controlled covariates included socio-demographics (age, race/ethnicity, marital status, and educational attainment), affordability (household income, difficulty with expenses, availability of public health insurance, and availability of private health insurance), and state of residence. Survey weights were used to account for sampling design (including the unequal probability of selection, clustering, and stratification) and generate representative estimates. The weight values were provided directly in the HRS datasets. The details of how the weights were calculated can be found elsewhere (25). Multicollinearity was tested using variance inflation factor (VIF). VIF = 10 indicates a sign of severe or serious multicollinearity (26). In this study, all models have a maximum VIF of 1.31 suggesting a negligible amount of multicollinearity.

To estimate age and race/ethnicity disparities, we also fitted similar weighted multivariable logistic regressions but added an interaction between the interested subgroup factor and LGBTQ+ status.

To show the geographic variation in the difference of UMHN between LGBTQ+ and non-LGBTQ+, we repeated the above weighted multivariable logistic regression for each state, controlling for the same socio-demographic and affordability factors. The results from the state-specific logistic regressions were used to appropriately estimate the adjusted risk difference (ARDs). The ARDs were used to graphically show the geographic variation in the difference of UMHN between LGBTQ+ and non-LGBTQ+.

We explored further the association of the above adjusted risk difference (ARD) with 131 state-level factors relating to the characteristics of mental health facilities. We used linear regression with the ARDs as the outcome and these country-level factors as predictors. Because there is a strong correlation between state-level variables, and the number of state-level variables to be fitted is much larger than the number of states, we only include one variable at a time when exploring state-level associations.

All the above analyses were repeated by subtype of LGBTQ+.

All analyses were performed using R, version 3.6.0. We report two-sided *P*-values and 95% CIs throughout. $P < 0.05$ was considered to be statistically significant.

Results

81,267 LGBTQ+ and 722,638 non-LGBTQ+ were interviewed across 51 states. Compared with non-LGBTQ+, LGBTQ+ populations were more likely to be younger ($p < 0.001$), to be never married ($p < 0.001$), to be non-White ($p < 0.001$), to have low education ($p < 0.001$), to have low household income ($p < 0.001$), to have difficulty with expenses ($p < 0.001$), to have no public insurance ($p < 0.001$), and to have no private insurance ($p < 0.001$) (Table 1).

The overall weighted prevalence of UMHN among LGBTQ+ was 20.0% (95% CI 19.5–20.6%), significantly higher than that among non-LGBTQ+ (7.8% [95% CI 7.7–8.0%]) ($p < 0.001$). After adjusting for socio-demographics and affordability,

TABLE 1 Characteristics of participants in the United States from 21 July 2021 to 9 May 2022.

	Non-LGBTQ+ (*N* = 722,638)^{a}	**LGBTQ+ (*N* = 81,267)^{a}**	***P***
Outcome			
Unmet mental health needs (=Yes)	58586 (8.1%)	16135 (19.9%)	<0.001
Covariates			
Age			
18–25	19536 (2.7%)	8678 (10.7%)	< 0.001
26–49	264544 (36.6%)	41087 (50.6%)	
50–64	220340 (30.5%)	19002 (23.4%)	
65+	218218 (30.2%)	12500 (15.4%)	
Race/ethnicity			
White	541228 (74.9%)	56683 (69.7%)	< 0.001
Black	55782 (7.7%)	5422 (6.7%)	
Hispanic	64607 (8.9%)	10718 (13.2%)	
Asian and others	61021 (8.4%)	8444 (10.4%)	
Marital status			
Married	430889 (59.6%)	29446 (36.2%)	<0.001
Never married	119781 (16.6%)	36653 (45.1%)	
Widowed/divorced /separated	171968 (23.8%)	15168 (18.7%)	
Total household income before taxes			
\$0–\$34999	139668 (19.3%)	23408 (28.8%)	<0.001
\$35,000–\$49,999	77518 (10.7%)	10073 (12.4%)	
\$50,000–\$74,999	123144 (17%)	13821 (17%)	
\$75,000–\$99,999	103687 (14.3%)	10388 (12.8%)	
\$100,000+	278621 (38.6%)	23577 (29%)	
Education attained			
Less than high school	4133 (0.6%)	1256 (1.5%)	< 0.001
Some high school	9645 (1.3%)	1667 (2.1%)	
High school graduate or equivalent	85609 (11.8%)	8651 (10.6%)	
Some college, but degree not received or is in progress	150482 (20.8%)	18842 (23.2%)	
Associate's degree	76669 (10.6%)	7485 (9.2%)	
Bachelor's degree	207606 (28.7%)	23167 (28.5%)	
Graduate degree	188494 (26.1%)	20199 (24.9%)	
Difficulty with expenses (=Yes)	156256 (21.6%)	25387 (31.2%)	<0.001
Has public health insurance (=Yes)	253914 (35.1%)	22299 (27.4%)	<0.001
Has private health insurance (=Yes)	489758 (67.8%)	52295 (64.3%)	<0.001

Data were presented as number (percentage). *P*-values were extracted from chi-square tests.

compared with non-LGBTQ+ populations, LGBTQ+ had 2.27 times likelihood to report UMHN (AOR = 2.27, 95% CI 2.18–2.39) (Table 2, model 3). Specifically, this likelihood was 2.27 times among lesbian (AOR = 2.27, 95% CI 2.01–2.59), 1.75 times among gay (AOR = 1.75, 95% CI 1.51–2.03), 2.80 times among bisexual (AOR = 2.80, 95% CI 2.69–2.92), 3.63 times among transgender (AOR = 3.63, 95% CI 2.97–4.39), and 1.99 times among queer+ (AOR = 1.99, 95% CI 1.84–2.16) (Supplementary Table 2).

Compared with LGBTQ+ who aged 65+, LGBTQ+ aged 18–25 had 1.34 times likelihood to report UMHN (AOR = 1.34, 95% CI 1.03–1.75), while no significant difference was identified in LGBTQ+ aged 26–49 (AOR = 1.02, 95% CI 0.83–1.26) and in LGBTQ+ aged 50–64 (AOR = 0.84, 95% CI 0.66–1.06) (Table 2, model 4). This higher risk of those aged 18–25 was specifically identified among lesbians (AOR = 2.29, 95% CI 1.46–3.56), but not in gay, bisexual, transgender, and queer+ (Supplementary Table 3).

Compared with White LGBTQ+ populations, Black and Hispanic LGBTQ+ had a lower likelihood to report UMHN (AOR = 0.72, 95% CI 0.63–0.82; AOR = 0.85, 95% CI 0.75–0.97, respectively), while no significant association was identified in Asian and other ethnic LGBTQ+ (AOR = 1.07, 95% CI 0.97–1.17) (Table 2, model 5). Similar associations were identified among lesbians, bisexuals, and queer+, but not among gay and transgender.

The difference in UMHN between LGBTQ+ and non-LGBTQ+ (as reference) varied substantially across states, ranging from 4.9% (95% CI 1.2–8.7%) in Hawaii to 16.0% (12.2–19.7%) in Utah (Figure 1). This substantial geographic variation primarily existed in LGBTQ+ aged 18–25 and non-White LGBTQ+ (Figure 2). The above geographic disparity was also identified in subtypes of LGBTQ+ but more obvious in transgender (Supplementary Figures 1–5).

Discussion

Statement of principal findings

Based on a national representative data, we identified a substantial additional risk of UMHN (2.27-time) among LGBTQ+ than non-LGBTQ+ during COVID-19 in the United States. This additional risk of UMHN was consistent in the subtypes of LGBTQ+, but highest in transgender. We also found that LGBTQ+ aged 18–25 (specifically among lesbians) was more vulnerable in terms of UMHN, while the race/ethnicity disparity was relatively small. There were wide variations across states in the risk of UMHN among LGBTQ+ as compared to non-LGBTQ+, especially among transgender individuals, LGBTQ+ aged 18–25, and non-White LGBTQ+.

Possible explanations and comparison with other studies

The identified significant additional risk of UMHN among LGBTQ+ in comparison with non-LGBTQ+ is to some extent consistent with what the LGBTQ+ community encountered during COVID-19. During the COVID-19 crisis in the United States, LGBTQ+ populations experienced higher rates of job loss, wage reduction, and food insecurity than general populations (2, 27). These experiences of reduced resources and economic instability can be contributing factors to the disparities in UMHN identified in the study. Our supplement analysis (Supplementary Table 4) to some extent supports this point and indicates that those LGBTQ+ who have difficulty with expenses had a 1.1-time higher likelihood of reporting UMHN (AOR = 1.11, 95% CI 1.03–1.20). Our Supplementary Table 4 also highlights that the impact of job loss and wage reduction was stronger among LGBTQ+ who were relatively rich, as compared to LGBTQ+ with total household income $0–$34999, LGBTQ+ with total household income $50,000–$74,999 or $100,000+ had a higher likelihood of reporting UMHN (AOR = 1.16, 95% CI 1.04–1.28; AOR = 1.19, 95% CI 1.07–1.32, respectively). The long-lasting societal stigmatization, institutional discrimination, lack of identity-affirming mental health services, and negative personal experiences with mental health services could also contribute to the additional risk of UMHN among LGBTQ+ we found (3, 4, 11, 28–30). The identified additional risk of UMHN among LGBTQ+ during the COVID-19 crisis also keeps in line with the evidence in medical care overall. A survey from the United States also reported that a higher proportion of LGBTQ+ Americans reported difficulties accessing medical care and missing regular medical appointments than general populations (27). Our Supplementary Table 4 indicates that those LGBTQ + who had private insurance had more likelihood of reporting UMHN (AOR = 1.11, 95% CI 1.04–1.17), which may imply an unjustified attitude toward LGBTQ+ from private healthcare providers during COVID-19. To be noted, the identified gap in UMHN between LGBTQ+ and non-LGBTQ+ could be wider if considering the fact that the prevalence of mental health problems is usually higher in LGBTQ+ populations, especially the disproportionate influence on the LGBTQ+ community from COVID-19 crisis (3, 5, 6).

We also found that transgender had the highest risk of UMHN than other subtypes of LGBTQ+. This finding, to some extent, keeps in line with a study conducted in Canada, which found that after adjusting for socioeconomic variables and age, compared to cisgender heterosexual people, only the transgender but no other types of LGBTQ+ had a significant additional risk of UMHN (7). Our findings on transgender also corroborate previous studies, which concluded that compared

TABLE 2 Association between LGBTQ+ status and unmet mental health needs, as well as age and race/ethnicity disparities, from 21 July 2021 to 9 May 2022.

	Model 1	Model 2	Model 3	Model 4	Model 5
LGBTQ+ (=Yes)	2.94 (2.75–3.16)***	2.32 (2.20–2.44)***	2.27 (2.18–2.39)***	2.41 (1.86–3.13)***	2.41 (2.32–2.53)***
Socio-demographics					
Age					
18–25	–	3.32 (2.97–3.67)***	4.22 (3.78–4.71)***	3.82 (3.35–4.31)***	4.18 (3.74–4.71)***
26–49	–	3.71 (3.46–3.97)***	4.26 (3.94–4.57)***	4.31 (3.94–4.71)***	4.22 (3.94–4.57)***
50–64	–	2.34 (2.18–2.48)***	2.61 (2.44–2.83)***	2.72 (2.46–2.97)***	2.61 (2.41–2.80)***
65+	–	References	References	References	References
Race/ethnicity					
White	–	References	References		
Black	–	0.86 (0.79–0.93)***	0.79 (0.73–0.86)***	0.79 (0.73–0.86)***	0.84 (0.76–0.91)***
Hispanic	–	0.83 (0.79–0.86)***	0.82 (0.78–0.86)***	0.83 (0.79–0.86)***	0.85 (0.79–0.92)***
Asian and others	–	0.76 (0.70–0.83)***	0.74 (0.68–0.80)***	0.74 (0.68–0.80)***	0.73 (0.67–0.78)***
Marital status					
Married	–	References	References	References	References
Never married	–	1.22 (1.16–1.30)***	1.31 (1.23–1.39)***	1.32 (1.25–1.40)***	1.31 (1.23–1.39)***
Widowed/divorced/separated	–	1.46 (1.40–1.52)***	1.45 (1.39–1.51)***	1.45 (1.39–1.51)***	1.45 (1.39–1.51)***
Education attained					
Less than high school	–	References	References	References	References
Some high school	–	0.90 (0.78–1.02).	0.84 (0.73–0.96)*	0.84 (0.72–0.96)*	0.83 (0.72–0.95)*
High school graduate or equivalent	–	1.02 (0.88–1.19)	0.93 (0.80–1.09)	0.93 (0.80–1.08)	0.93 (0.79–1.08)
Some college, but degree not received or is in progress	–	1.67 (1.42–1.95)***	1.49 (1.27–1.75)***	1.49 (1.27–1.75)***	1.49 (1.26–1.75)***
Associate's degree	–	1.58 (1.31–1.92)***	1.42 (1.17–1.70)***	1.42 (1.17–1.70)***	1.40 (1.16–1.70)***
Bachelor's degree	–	1.63 (1.39–1.90)***	1.57 (1.35–1.82)***	1.57 (1.35–1.82)***	1.55 (1.34–1.80)***
Graduate degree	–	1.72 (1.43–2.05)***	1.67 (1.39–1.99)***	1.67 (1.39–1.99)***	1.65 (1.38–1.97)***
Affordability					
Total household income before taxes					
$0–$34,999	–	References	References	References	References
$35,000–$49,999	–	0.83 (0.79–0.87)***	0.90 (0.85–0.95)***	0.90 (0.84–0.95)***	0.90 (0.84–0.95)***
$50,000–$74,999	–	0.76 (0.72–0.81)***	0.90 (0.84–0.94)***	0.90 (0.84–0.94)***	0.90 (0.84–0.94)***
$75,000–$99,999	–	0.68 (0.65–0.72)***	0.86 (0.83–0.90)***	0.86 (0.82–0.90)***	0.86 (0.83–0.90)***
$100,000+	–	0.49 (0.46–0.53)***	0.70 (0.66–0.73)***	0.70 (0.66–0.73)***	0.70 (0.66–0.74)***
Difficulty with expenses (=Yes)	–	–	2.59 (2.51–2.66)***	2.59 (2.51–2.66)***	2.59 (2.51–2.66)***
Has public health insurance (=Yes)	–	–	1.77 (1.70–1.84)***	1.77 (1.70–1.86)***	1.77 (1.70–1.84)***
Has private health insurance (=Yes)	–	–	0.86 (0.81–0.90)***	0.85 (0.81–0.90)***	0.85 (0.81–0.90)***
Interactions					
LGBTQ+ (=Yes) x age (=65+)	–	–	–	References	–
LGBTQ+ (=Yes) x age (=18–25)	–	–	–	1.34 (1.03–1.75)*	–
LGBTQ+ (=Yes) x age (=26–49)	–	–	–	1.02 (0.83–1.26)	–
LGBTQ+ (= Yes) x age (= 50–64)	–	–	–	0.84 (0.66–1.06)	–
LGBTQ+ (= Yes) x race/ethnicity (=White)	–	–	–	–	References
LGBTQ+ (=Yes) x race/ethnicity (=Black)	–	–	–	–	0.72 (0.63–0.82)***
LGBTQ+ (=Yes) x race/ethnicity (=Hispanic)	–	–	–	–	0.85 (0.75–0.97)*
LGBTQ+ (=Yes) x race/ethnicity (=Asian and others)	–	–	–	–	1.07 (0.97–1.17)

Data were presented as unadjusted or adjusted odds ratios (95% confidence intervals), which were extracted from weighted logistic regression. "–" Means the corresponding covariate was not included in the regression. Besides the listed covariates, models 3, 4, and 5 also controlled state of residence. *$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$.

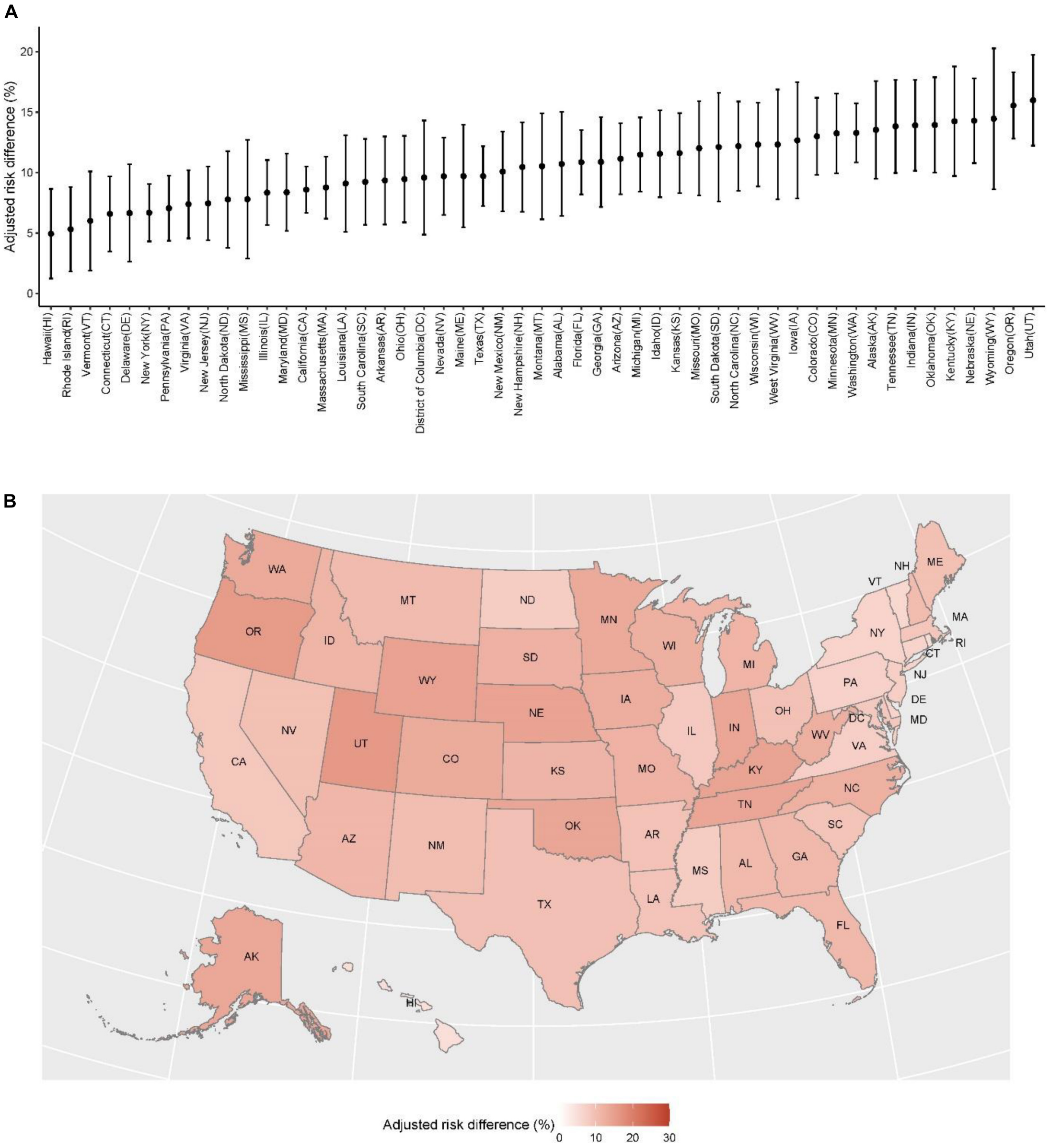

FIGURE 1
Geographic variation in the difference in unmet mental health needs between LGBTQ+ and non-LGBTQ+ (as reference) by states from 21 July 2021 to 9 May 2022. **(A)** The point presents the adjusted risk differences and the vertical line presents the 95% confidence interval, both of which were extracted from multivariable logistic regression models with LGBTQ+ status (yes vs. no) as the key predictor, controlling for socio-demographics (age, race/ethnicity, marital status, and educational attainment), and affordability (household income, difficulty with expenses, availability of public health insurance, and availability of private health insurance). **(B)** Color presents the values of adjusted risk differences, the same as those in panel **(A)**.

to other subtypes of LGBTQ+, transgender people faced additional minority stressors because of their potentially visible gender expression (28, 31, 32). Our supplement analysis (**Supplementary Table 4**) confirms this point to some extent and indicated that those transgender people who never married had a 1.28-time likelihood of reporting UMHN (AOR = 1.28, 95% CI 1.11–1.49). During the COVID-19 crisis, the gender-affirming resources (like hormone therapy) needed by many transgender people were postponed or inaccessible, which could worsen the mental outcomes among transgender (2, 5, 33). In addition, mental health practitioners may especially express negative reactions to and reject transgender patients due to a lack of adequate training and skills toward transgender issues (30).

We further explored the UMHN among LGBTQ+ with intersecting marginalized identities and found that LGBTQ+

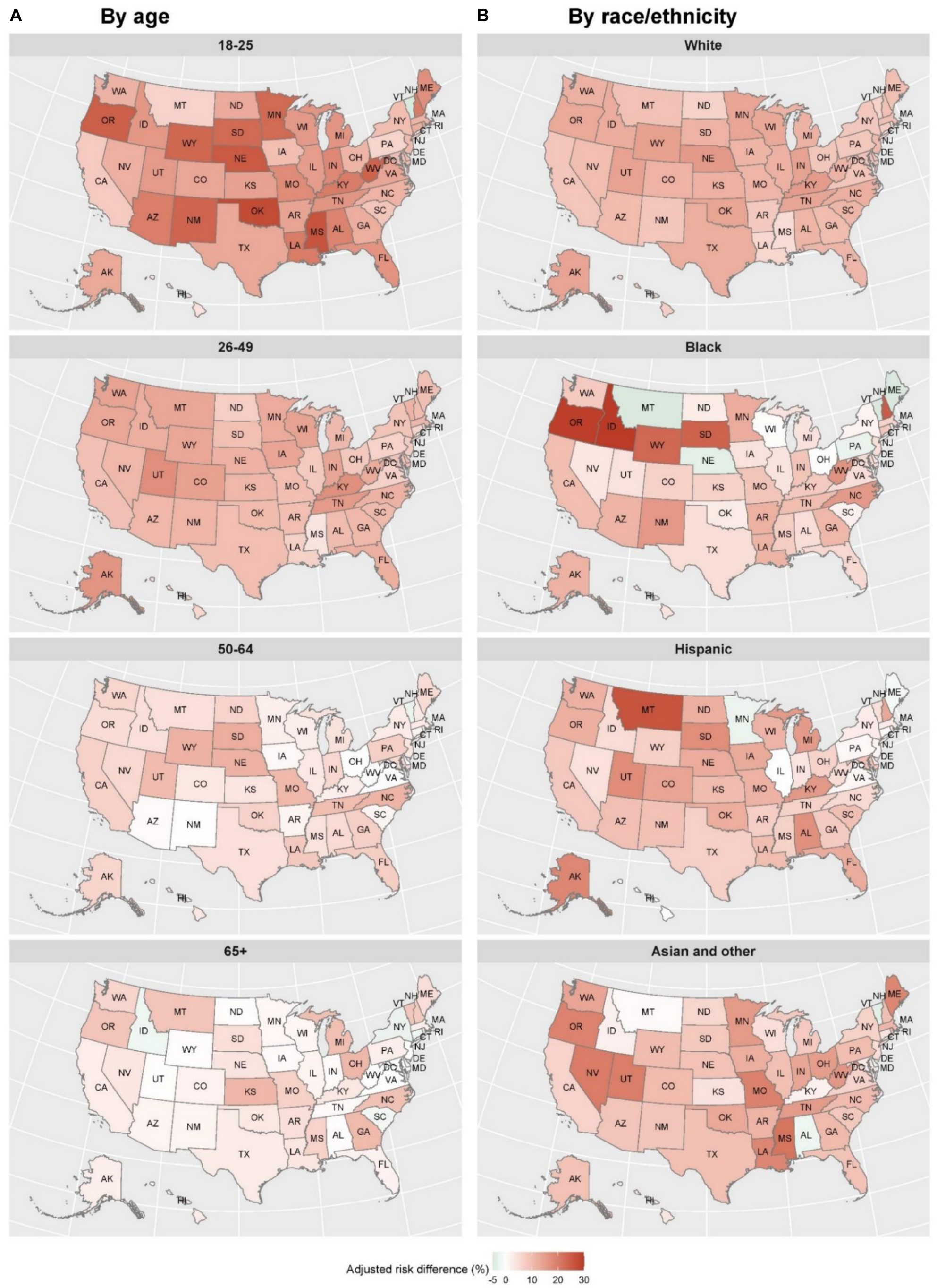

FIGURE 2
Geographic variation in the difference in unmet mental health needs between LGBTQ+ and non-LGBTQ+ (as reference) by states, age, and race/ethnicity, from 21 July 2021 to 9 May 2022. Color presents the values of adjusted risk differences. In **(A)**, the results were extracted from multivariable logistic regression models for each age group, with LGBTQ+ status (yes vs. no) as the key predictor, controlling for other covariates. In **(B)**, the results were extracted from multivariable logistic regression models for each race/ethnicity, with LGBTQ+ status (yes vs. no) as the key predictor, controlling for other covariates.

aged 18–25 was more vulnerable in UMHN. This could be due to that young people have relatively limited resources to enable them to overcome the barriers which adults also encounter (3, 34); the shutdown of schools or universities closed the possible gateway for young LGBTQ+ to find the mental health services they needed (11); stay-at-home and shift-to-online counseling could magnify young LGBTQ+'s concerns of “don't want parents to know” (34, 35). Our supplement analysis

(**Supplementary Table 5**) highlights that these limited resources owned by LGBTQ+ aged 18–25 themselves or concerns of "don't want parents to know" may be worse among families with high household income, as **Supplementary Table 5** indicates that among the group of people aged 18–25, compared to LGBTQ+ with a total household income $0–$34,999, LGBTQ+ with total household income $100,000+ had a 1.35-time likelihood of reporting UMHN (AOR = 1.35, 95% CI 1.07–1.72). However, the additional risk of UMHN among those aged 18–25 was only identified among lesbians, but not other types of LGBTQ+. No study has provided a possible explanation for this finding, as well as our supplement analysis in **Supplementary Table 5**. It needs more focus in future studies.

We also further explored the UMHN among LGBTQ+ with intersecting marginalized identities with a focus on people of color and found that there was a significantly lower risk of UMHN among LGBTQ+ people of color than white LGBTQ+. This finding is to some extent not consistent with a survey conducted in the United States in 2015, which found that transgender of color was less likely to have access to gender-affirming mental healthcare than White transgender (32); and a survey conducted in the United States during COVID-19, which demonstrated that the COVID-19 crisis disproportionally worsened the economic conditions on LGBTQ+ communities of color (19). The possible reason is that different from the overall results in **Supplementary Table 4** and subgroup analysis of ages 18–25 (**Supplementary Table 5**), a higher degree of education and higher household income among people of color were associated with a lower risk of UMHN (**Supplementary Tables 6**, **7**). The possible explanation could also be that the disproportionate higher deaths occurred in the LGBTQ+ people of color prevented them from being sampled by the survey (19), and more corresponding studies are needed.

The difference in UMHN between LGBTQ+ and non-LGBTQ+ had a wide variation across states. This geographic variation may to some extent be because of unevenly distributed LGBTQ-specific mental health services (24, 28) and different COVID-19 containment policies (like social distance rules and vaccination mandates) adopted by states (36, 37). Our state-level analysis indicated that for bisexual, states have a higher proportion of facility providing mental health treatment in a partial hospitalization/day treatment setting, offering dedicated mental health treatment program for persons with HIV or AIDS, offering vocational rehabilitation services, offering nicotine replacement therapy, offering non-nicotine smoking/tobacco cessation medications, or offering antipsychotics for the treatment of serious mental illness (SMI), was associated with a lower risk difference in reporting UMHN between bisexual and non-LGBTQ+ (**Supplementary Table 8**); for gay, states have a higher proportion of facility providing administrative or operational services for mental health treatment, offering vocational rehabilitation services, offering dedicated mental health treatment program for persons aged 18 years and older with SMI, or offering illness management and recovery (IMR) services, was associated with a lower risk difference in reporting UMHN between gay and non-LGBTQ+ (**Supplementary Table 8**); for queer, states have higher proportion of facility providing group therapy, offering mobile/off-site psychiatric crisis services, or offering antipsychotics for the treatment of SMI, was associated with a lower risk difference in reporting UMHN between queer and non-LGBTQ+ (**Supplementary Table 8**). We further found that the identified substantial geographic variation primarily existed among transgender individuals, LGBTQ+ aged 18–25, and LGBTQ+ people of color. Our state-level analysis indicated that among people aged 18–25, states have a higher proportion of facility providing vocational rehabilitation services, which was associated with a lower risk difference in reporting UMHN between LGBTQ+ and non-LGBTQ+ (**Supplementary Table 9**); among Hispanic people, states have a higher proportion of facility accepting young adults (aged 18–25 years old) for treatment, offering offers dedicated mental health treatment program for persons with HIV or AIDS, or offering dedicated mental health treatment program for LGBTQ+, was associated with lower risk difference on reporting UMHN between LGBTQ+ and non-LGBTQ+ (**Supplementary Table 11**). These findings highlight the necessity to put target-specific and state-specific attention or intervention on these groups.

Strengths and limitations

To our knowledge, this is the first study to quantitatively assess the UMHN among LGBTQ+ during the COVID-19 using a national representative data. A strength of this study is the sampling of large number of participants without using sexual behavior, sexual orientation, and gender identity as sampling strategy, which could reduce the potential systematic response bias compared with research utilizing more targeted sampling methods. Moreover, the large number of participants enabled us to disaggregate LGBTQ+ participants, allowing us to provide more nuanced and practical evidence of this population. Our study is also strengthened by the inclusion of participants with a broad spectrum of intersected marginalized identities (young LGBTQ+ and LGBTQ+ people of color), thus extending our findings beyond the limited scope of most studies on LGBTQ+. Finally, our study is strengthened by the state-specific analysis, allowing for a state-specific customization of potential interventions.

The primary limitation of this study is the absence of pre-COVID data, which precluded any causal inference on how much of the identified UMHN is a result of the COVID-19 pandemic. However, this limitation can be weakened by comparing with the evidence from pre-COVID. For instance, compared to non-LGBTQ+ people, the identified risk of UMHN among LGBTQ+ people in our study is 2.27 times (AOR = 2.27, 95% CI 2.18–2.39), higher than that (AOR = 1.57; 95% CI 1.20–1.93, which was meta from ORs for transgender, bisexual, and LGQ reported in a cross-sectional based on 704 individuals in Canada in 2017 (7); compared to non-LGBTQ+ people, the identified risk of UMHN among transgender in our study is 3.63 (AOR = 3.63, 95% CI 2.97–4.39), higher than that (AOR = 2.1, 95% CI 1.3–3.3) reported in a cross-sectional study based on 704 individuals in Canada in 2017 (7).

Second, as our data are not a specific survey data on LGBTQ+, possible confounders cannot be fully controlled. For instance, the experience of stigma and discrimination, availability of identity-affirming mental health services, and availability of social support, all of which have documented impacts on access to mental health services, were not controlled and explored in this study (38–40). In addition, the HPS has no data on the reasons for UMHN; therefore, our results can only be interpreted as associations instead of causal inferences. Both limitations disable us to give strong recommendations on targeted interventions.

Third, our data are lack of clinical confirmation as data were drawn from a large-scale population survey using self-administered instruments. The existence of self-assessed-as-unnecessary will lead to some participants being grouped into no UMHN and then an inaccurate estimation of the gap in UMHN (41). In addition, lack of clinical confirmation also disabled us from distinguishing the types of needed professional mental health services (like professional mental health services from GP or specialists).

Fourth, counseling or therapy from a mental health professional is an important aspect, yet not the entirety of mental health use. Utilization of other types of mental health services, such as medication, social prescription, and other complementary and alternative treatments, could also lead to an inaccurate estimation of the gap in UMHN.

Fifth, the above three limitations disable us to put specific attention to actual needs of mental health and further disable us to explore the reasons for the gap between perceived UMHN and actual UMHN. Data collection on actual UMHN is needed in future.

Sixth, the study primarily used an Internet-based sampling strategy, which may have led to the underrepresentation of those with stronger UMHN, for example, those without permanent accommodation and people of color. A survey conducted in early of 2021 indicated that Black and Hispanic adults in the United States remain less likely than White adults to own a computer at home (42).

Generalizability, implications, and conclusion

This study measured the additional risk of UMHN among LGBTQ+ populations than non-LGBTQ+. Subgroup evidence by age, race/ethnicity, the subtype of LGBTQ+, and states were also provided. Our evidence highlights that tailored services are needed to address specific mental vulnerabilities of different subgroups of LGBTQ+, instead of conflating sex orientation and gender identity. In addition, taking LGBTQ+ socio-demographic characteristics into consideration to reduce mental health service disparities is also necessary. Mental healthcare systems could use our evidence to ensure accessibility to professional services among LGBTQ+ populations, by customizing target-specific and state-specific interventions.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: https://www.census.gov/data/experimental-data-products/household-pulse-survey.html.

Ethics statement

The studies involving human participants were reviewed and approved by the Office of Management and Budget (approval number: 0607-1013). The patients/participants provided their written informed consent to participate in this study.

Author contributions

SC: full access to all of the data in the study, responsibility for the integrity of the data and the accuracy of the data analysis, concept, and design. SC, YW, RS, PQ, and W-KM: acquisition, analysis, or interpretation of data. SC and YW: drafting of the manuscript, statistical analysis, administrative, technical, or material support, and supervision. SC, YW, RS, PQ, and W-KM: critical revision of the manuscript for important intellectual content. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fmed.2022.995466/full#supplementary-material

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Status of work alienation among nurses in China: A systematic review

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Background: Work alienation is a common feeling of estrangement from the work and its context. Nurses are prone to feel alienated due to the high risk of infection, heavy workload, and the persistence of stress at high levels. Work alienation has serious negative outcomes, organizationally as well as personally. In recent years, the issue of work alienation among nurses has received considerable attention in China, but no systematic reviews have yet been published and its epidemiological status among Chinese nurses remains unclear.

Objective: To systematically evaluate the status and distribution characteristics of work alienation among nurses in China.

Methods: CINAHL, Embase, Web of Science, PubMed, CENTRAL, Wanfang, SinoMed, CNKI, and VIP were searched for cross-sectional studies before 10 January 2022 on the current status of work alienation among nurses. Two investigators independently screened the articles, extracted the data, and evaluated the risk of literature bias. Stata16.0 software was used for analysis.

Results: A total of 12 studies were included, with 7,265 nurses involved. Meta-analysis results showed that the score of work alienation was 35.43 [95%*CI* (31.82, 39.04)]. Subgroup analysis showed that the scores of male and female nurses were 37.62 and 35.79 respectively; the scores of junior, undergraduate, and graduate nurses were 34.90, 37.15, and 40.02 respectively; the scores of primary, intermediate, and senior nurses were 36.95, 35.38, and 33.11 respectively; the scores of unmarried and married nurses were 38.59 and 36.70 respectively; the scores of nurses who had worked for 1∼ <6 years, 6∼10 years, and more than 10 years were 37.46, 36.69, and 32.89 respectively; the scores of nurses with salary <5,000 yuan, 5,000∼10,000 yuan, and more than 10,000 yuan were 40.25, 37.19 and 34.52 respectively; and the scores of nurses in emergency department and intensive care units, internal medicine, surgery, and pediatrics were 37.25, 38.73, 36.28, and 31.98 respectively.

Conclusion: Chinese nurses had a moderate level of work alienation. The scores of nurses in the following categories were quite high: male, higher education levels, low-professional titles, unmarried, shorter clinical working time, lower income, working in internal medicine, and working in the emergency department and intensive care units. Managers should take effective measures as soon as possible to reduce the occurrence of nurses' sense of work alienation.

Systematic review registration: https://www.crd.york.ac.uk/PROSPERO/, identifier CRD42022298746.

KEYWORDS

work alienation, nurse, systematic review, turnover, China

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Introduction

Work alienation, a common phenomenon among employees, is defined as employees' feelings of estrangement from the work and its context (1). Among quick-service restaurant managers, 15.4% of them felt alienated (2). Similarly, one in five information technology professionals felt alienated (3). Work alienation has been evidenced as a negative state and related to negative repercussions such as absenteeism, anti-productivity behavior, organizational citizenship behavior, and neglect in pursuing common goals of the organization (4). It exerts a negative effect on both the organization and the individuals, disharmonizing interpersonal relationships and impeding knowledge sharing and learning (5). What's more, employees may suffer from distress and anxiety, and over time psychological problems arise.

Health sector employees feel alienated more easily, with nursing professionals being one of the most vulnerable populations to this psychological state due to the predominance of shift work, high risk of infection, heavy workloads and litigation, and high-stress levels. A previous study indicated that 87.3% of nurses experience a moderate level of workplace alienation (6). A recent study further suggested that for Chinese nurses, the status of work alienation was at a medium-high level (7). In recent years, the issue of work alienation among nurses has received considerable attention, as the growing evidence suggested that it can result in serious physical, psychological, and occupational consequences. For example, work alienation is related to low productivity, low motivation, poor performance (8), low commitment (9), low job satisfaction (10), substance use (11), and turnover intention (12). This negative state may further result in disharmonizing the nurse-patient relationship, the occurrence of missed nursing, declining patient safety and satisfaction, and finally affecting the quality of nursing care (13). Furthermore, job dissatisfaction and turnover intentions accordingly increase, which leads to the shortage of nurses, a vicious circle that work alienation has made (14). Given these findings, appropriate measures should be taken to alleviate work alienation for the sake of nursing staff, patients, and healthcare organizations.

Despite work alienation being a common feeling among nurses, healthcare managers frequently overlook the issue and its related factors, which may be attributed to the wide variation of work alienation among nurses on the one hand (7), and the lack of recognition of this psychological state on the other. Therefore, healthcare managers should improve their understanding of work alienation and its significance among nurses.

The wide variation in the status of work alienation among nurses may also be a key factor explaining the lack of attention in hospitals (7). The ignorance of work alienation may be attributed to the lack of recognition of this psychological state. By improving the understanding of the status of work alienation among nurses, healthcare managers may increase awareness of its significance.

Compared with other countries, work alienation among nurses is gaining increasing attention in China, with the body of research on work alienation among nurses growing rapidly. However, conclusions about the status of work alienation among nurses in China have been inconsistent. Some studies have reported that the status of work alienation among nurses was at a medium-high level (15), while other studies have reached different conclusions. For example, Chen et al. (16) surveyed 196 nurses in an infectious disease hospital in Nanjing, and the results showed that work alienation among nurses was at a low level. Discrepancies between studies possibly result from differences in survey time, sample size, study regions, and other factors. Moreover, no systematic review has so far been conducted on the status of work alienation among nurses in China. This review is aimed to fill the gap in our knowledge about work alienation and provide a Chinese perspective on the management of nurses around the world. Therefore, a systematical evaluation of the current status of work alienation among Chinese nurses was carried out, to provide a scientific basis for more targeted interventions to alleviate work alienation among nurses.

In essence, this study has made several important theoretical contributions. To begin with, it is the first systematic review to analyze the status of work alienation among nurses in China, which will enhance a theoretical understanding of work alienation among nurses. Second, our research is evidence-based which puts forward the concept of work alienation and treats it as a crucial aspect of the workplace that may bring negative organizational outcomes as well as personal outcomes, thus filling the gap of ignorance of work alienation (17). Third, practical recommendations are made for reference by healthcare management in our study to reduce the turnover of nursing professionals since it is tricky for managers to identify and handle work alienation, as employees usually do not share their feelings with colleagues and managers (18).

Methods

This study aims to estimate the status of work alienation among Chinese nurses. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) was used to report the study. The study protocol was registered under PROSPERO (Ref: CRD42022298746).

Search strategy

Comprehensive research on PubMed, Embase, CENTRAL, Web of Science, and four Chinese databases [National

Knowledge Infrastructure (CNKI), Chinese Biomedical Literatures database (SinoMed), Wanfang Digital Periodicals (WANFANG), and Chinese Science and Technology Periodicals (VIP)] were conducted to identify the status of work alienation among Chinese nurses. The following search terms and logic were used: alienation ('alienation' OR 'work alienation'). They were combined with title/abstract words related to nursing ('nurs*' OR 'health occupations' OR 'health personnel' OR 'health facilities' OR 'healthcare worker') through the Boolean operator AND. This search strategy was implemented in each of the databases mentioned above. There were no restrictions on the date, publication status, or year of publication, but the languages were confined to English and Chinese.

Inclusion and exclusion criteria

The inclusion criteria were as follows: (1) cross-sectional studies; (2) Chinese nurses; (3) a scale compiled by Chinese scholar Ren was adopted, which includes twelve items and three dimensions of helplessness, powerlessness, and meaninglessness, giving a total score ranging from 12 to 60 points, in which a greater score means a high level of work alienation (19). This scale has been adopted by many scholars in China and showed good reliability and validity (20). (4) the research variable is work alienation. No limitation was exerted on gender, race, or educational status. The exclusion criteria were: (1) the studies not in English or Chinese language; (2) duplicate studies; and (3) no eligible data for extraction.

Data extraction

Once the search was completed, the next step in data extraction was to screen the articles. Two researchers (YQ and BDX) screened the obtained literature based on the inclusion and exclusion criteria. They extracted the data, discussed it, or deliberated it with another researcher independently (WCX) when there was no agreement. The data extraction content included the research title, the first author, year of research publication, region, department, sample size, age, gender, and the total score of work alienation.

Quality assessment

The tool of the National Center for Biotechnology Information (US) recommended by the Agency for Healthcare Research and Quality (AHRQ) was used to evaluate the quality of included studies by two reviewers (YQ and WCX) independently. Discrepancies relating to the quality of studies were resolved by a third reviewer (BDX or GJ). The AHRQ tool includes a total of 11 items with the options of "Yes (1 point)", "No (0 points)", and "I don't know (0 points)". According to the score, 0–3 points are regarded as low quality, 4–7 points as medium quality, and 8–11 points as high quality (21).

Statistical analysis

Stata 15.0 software was used for data analysis and calculating the pooled scores (using the metan command). The heterogeneity of the included studies was judged by the Q test (P-value) and I^2. If $P \leq 0.1$ or $I^2 \geq 50\%$, it means there is statistical heterogeneity between the studies, and the random effects model is to be applied. If not, the fixed effects model would be applied for the meta-analysis. Based on gender, education, professional title, marital status, working years, salary, and department, subgroup analysis was conducted to explore the source of heterogeneity. Meanwhile, one-by-one elimination of included studies through sensitivity analysis was used to detect the stability of results and Begg's test was used to detect publication bias.

Results

Study search

A total of 169 articles were identified following our search strategy (four from PubMed, two from Embase, 20 from Web of Science, three from CENTRAL, 41 from CINAHL, 26 from CNKI, 20 from SinoMed, 32 from Wanfang, and 21 from VIP). Finally, 12 articles were included after screening (Figure 1).

Study characteristics and risk of bias assessment results

This systematic review included 12 articles with a total of 7,265 nurses. The included articles were all of medium and high-quality–four high-quality articles and eight medium-quality articles. The basic characteristics of the included studies and the evaluation of the risk of bias are presented in Table 1.

Results of the meta-analysis

The score of work alienation

The total score of work alienation of 7, 265 nurses were extracted from the 12 finally selected articles. The quantitative evaluation results showed that the included studies had high heterogeneity ($I^2 = 99.7\%$, $P < 0.001$), so a random effect model was used for meta-analysis. The total score of nurses' work alienation was 35.43 [95%*CI* (31.827, 39.040)], which was in the middle level (Figure 2). The source of heterogeneity through

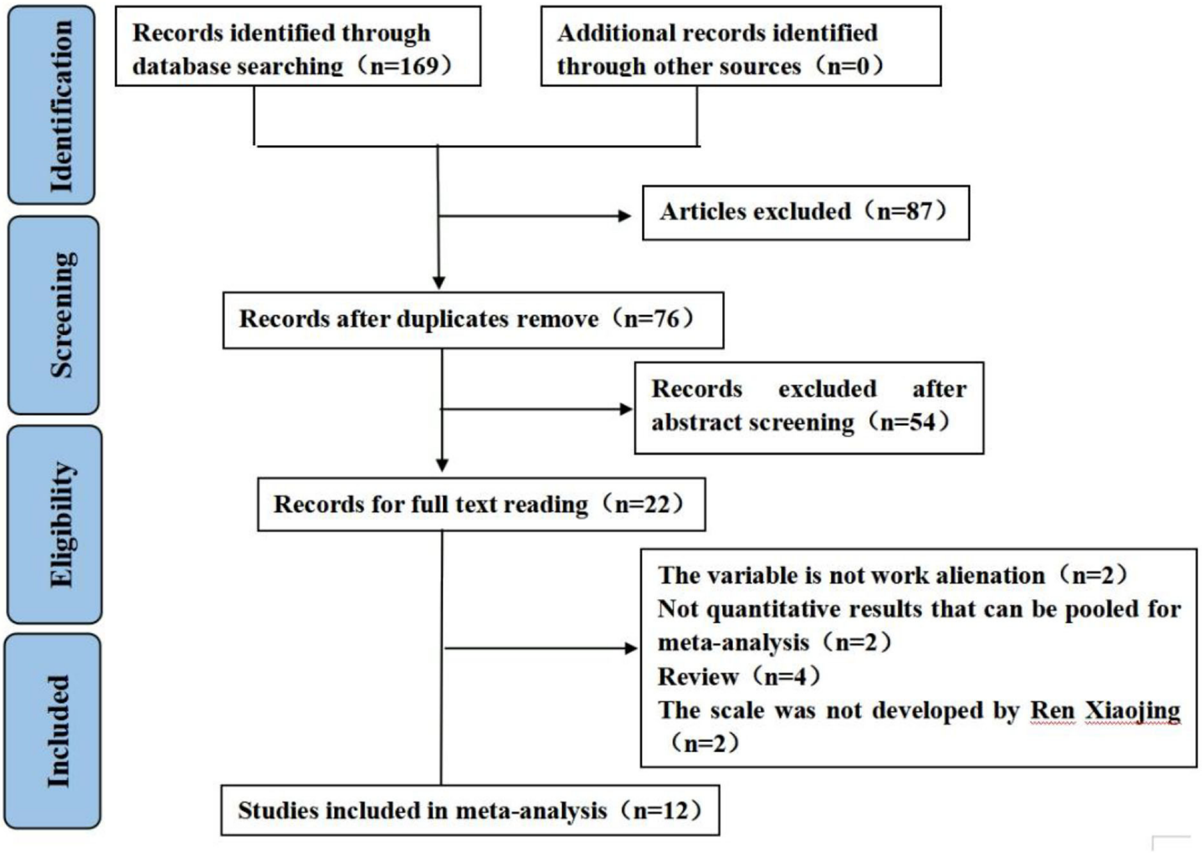

FIGURE 1
Flowchart of included studies (PRISMA-2009-Flow-Diagram). From Page et al. (22). For more information, visit: http://www.prisma-statement.org/.

subgroup analysis had not been identified and a further review of the literature suggested that the generation of heterogeneity may be related to factors such as sample size, sampling method, and sampling area.

Subgroup analysis results

Subgroup analysis was conducted on gender, education background, professional title, marital status, clinical working time, salary, and department. The results showed that the score of work alienation was quite high (Table 2).

Sensitivity analysis/ risk of bias

A sensitivity analysis was performed, and the results were not significantly different from the total combined estimated value, which suggested that the meta-analysis results were relatively stable and reliable (Figure 3). Begg's test was used to evaluate publication bias, and a score of ($Z = 0.945$) suggested that the risk of publication bias in this study was low.

Discussion

The Newcastle-Ottawa scale (NOS) score ranged from 6 to 8 points, indicating that the quality of the included studies was high. The results of the meta-analysis showed that the score of Chinese nurses' work alienation was 35.43 [95%*CI* (31.88, 39.04)], which was at a moderate level. However, this score was higher than Turkish nurses (15) and Dutch midwives (9), but lower than Pakistani middle managers (5) and Iranian workers (34). The reasons for this difference may be related to occupation, national policies, and varying medical and health service systems.

Male nurses had a higher level of work alienation than female nurses, and the result was consistent with the finding of Hu (23). Male nurses are under greater work pressure due to their lower social acceptance in China. They have a

TABLE 1 Characteristics of the included studies.

First author (year)	Region	Department	Sample size			Age	Education			Professional qualifications			Score	Quality
			M	W	Total		Junior college	Undergraduate college	Postgraduate and above	Primary	Middle	High		
Hu et al. (23)	He Nan	Pediatrics	7	226	233	≥20	71	146	16	215	15	3	35.02	High
Ling et al. (24)	Zhe Jiang	ICU	46	188	234	≥22	70	132	32	89	119	26	30.66	Middle
Zhang et al. (25)	Zhe Jiang	Emergency	56	231	287	-	56	209	22	166	95	26	45.49	Middle
Zhong et al. (26)	Guang Dong	Obstetrics, gynecology, emergency, operating room, internal medicine, surgery	26	577	603	≥20	232	366	5	510	84	9	35.00	High
Zhu et al. (27)	Zhe Jiang	Emergency	20	232	252	≥22	97	136	19	84	123	45	45.12	Middle
Xiao et al. (28)	Hu Bei	Internal Medicine, Surgery, Emergency, ICU	0	438	438	≥20	132	306		278	136	24	34.22	Middle
Bai et al. (29)	Zhe Jiang	Pediatrics	0	138	138	-	32	87	19	78	49	11	28.90	High
Chen et al. (20)	Zhe Jiang	Internal medicine, operating room	222	3,462	3,684	-	1,328	2,227	129	2,012	1,507	165	43.69	High
Zhao et al. (30)	Xin Jiang	Internal Medicine, Surgery, Emergency, Obstetrics, Pediatrics, ICU	19	748	767	≥20	377	390		616	116	35	30.18	Middle
Lu et al. (31)	Liao Ning	operating room	8	194	202	≥25	70	132	0	56	107	39	31.70	Middle
Xiao et al. (32)	Guang Dong	Emergency, ICU	29	316	345	-	113	230	2	239	96	10	35.91	Middle
Jiang et al. (33)	Zhe Jiang	Dialysis department	2	80	82	≥22	57	25		59	23	-		Middle

Means not reported. M/W, Men/Women; ICU, intensive care unit.

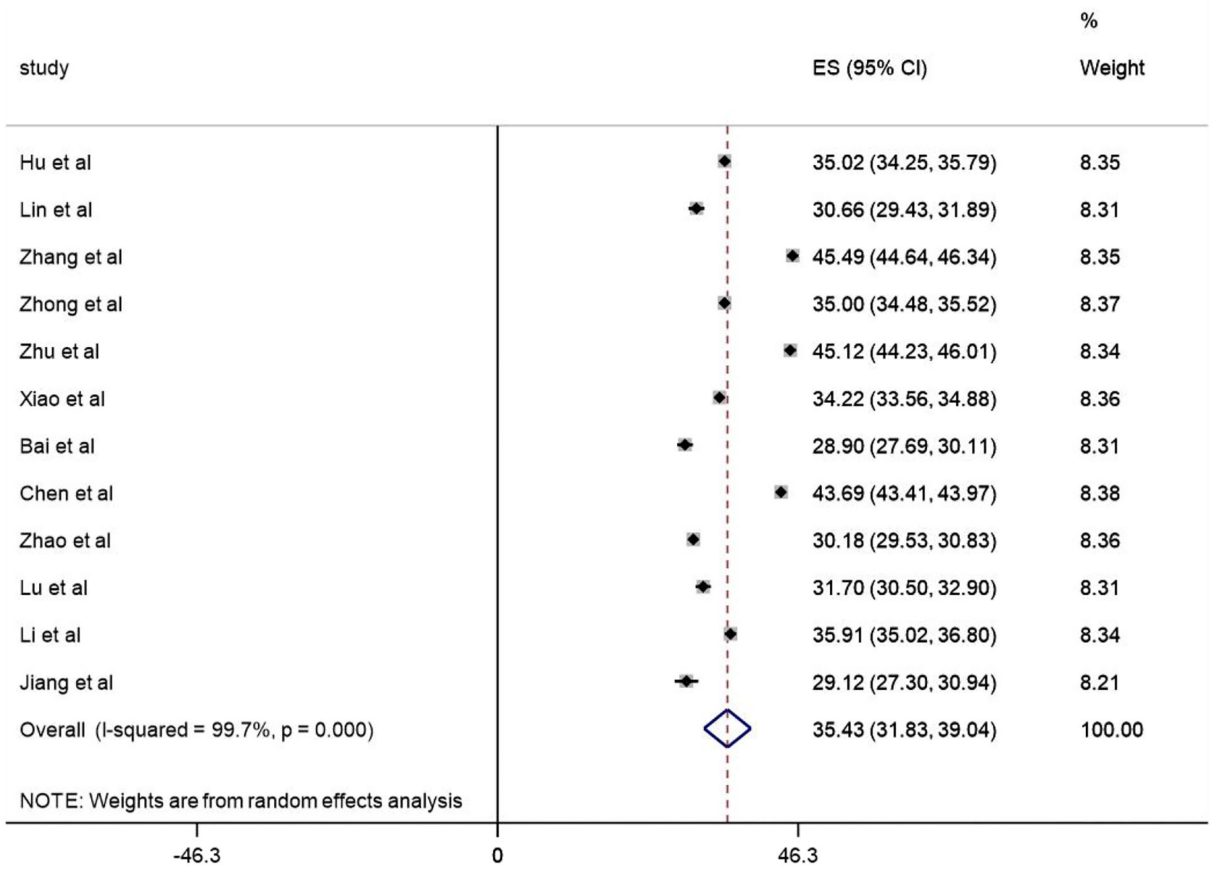

FIGURE 2
Forest plot of prevalence of PDF.

poorer sense of group belonging, lower professional identity, and a stronger willingness to resign, so the level of work alienation is relatively higher among men (35, 36). Therefore, managers should assign male nurses responsibilities that are in accordance with their logical thinking ability and calmness in case of trouble so as to maximize their potential; on the other hand, professional training for male nurses in the department should be implemented regularly, and timely encouragement and support should be given to increase their professional identity and sense of group belonging, thereby reducing male nurses' sense of work alienation.

The results of this study showed that with higher salaries, nurses' work alienation score gradually decreases, which was consistent with the findings of Tummers (9). Half of the nurses in China are dissatisfied with their income, which, to some extent, reflects the inability to fully fulfill the professional value of nurses (37). Nurses with higher incomes have higher job satisfaction and professional identity. They can be intrinsically motivated in the process of career development and have the enthusiasm to actively participate in the work, so the level of work alienation is lower (38). Flodgren et al. (39) believed that the compensation incentives for medical staff were conducive to motivating medical staff to change their behaviors in decision-making, improve patient prognosis, and thus improve the quality of care. Therefore, hospitals should appropriately increase nurses' remuneration and benefits, establish reasonable internal and external incentive mechanisms, and reduce the level of nurses' work alienation, which is of great significance to stabilizing the nursing team, promoting their work enthusiasm (40), and reducing the turnover rate of nurses.

Nurses with higher education levels had higher levels of work alienation, which was inconsistent with the finding of Wei (41). Wei pointed out that people with high education levels establish flexible work arrangements at work because of the advantages brought by their academic qualifications, abilities, and learning patterns, and they can arrange work more flexibly and have greater autonomy in work (41). According to our study, nurses with higher education levels are usually engaged in clinical nursing as well as scientific research work. Such overloaded work reduces their professional identity and job satisfaction (42), which results in a sense of work alienation. Therefore, department managers should formulate training

TABLE 2 Subgroup analyses of the PDF.

Subgroup	Number of studies	Sample size	Results of heterogeneity		Effect model	Results of meta-analysis
			I^2(%)	P		Score(95%CI)
Gender						
Men	4	335	97.2	<0.05	Random	37.62[31.16,44.11]
Women	6	4,651	99.7	<0.05	Random	35.79[30.39,41.20]
Education background						
Junior college	6	1,727	98.5	<0.05	Random	34.90[30.96,38.83]
Undergraduate	5	2,837	99.4	<0.05	Random	37.15[32.31,41.99]
Postgraduate and above	4	199	96.6	<0.05	Random	40.02[34.78,45.26]
Professional qualifications						
Primary	6	2,679	99.1	<0.05	Random	36.95[32.80,41.11]
Middle	7	2,129	99.4	<0.05	Random	35.38[29.37,41.40]
High	7	326	97.8	<0.05	Random	33.11[26.77,39.44]
Marital status						
Unmarried	5	1,713	98.8	<0.05	Random	38.59[33.53,43.65]
Married	5	3,022	99.6	<0.05	Random	36.70[30.77, 42.64]
Divorced/widowed	2	110	0	>0.05	Fixed	44.14[42.86,45.44]
Years of working						
1∼ <6	3	303	96.2	<0.05	Random	37.46[32.77,42.15]
6∼10	3	318	99.1	<0.05	Random	36.69[28.22,45.17]
>10	5	423	99.1	<0.05	Random	32.89[25.03,40.74]
Salary						
<5,000 yuan	4	1,213	98.5	<0.05	Random	40.25[35.45,45.06]
5,000∼10,000 yuan	4	2,234	99.3	<0.05	Random	37.19[30.70,43.68]
>10,000 yuan	4	896	99.4	<0.05	Random	34.52[26.22,42.83]
Department						
Emergency & ICU	6	1,401	99.5	<0.05	Random	37.25[32,58, 41.91]
Internal Medicine	2	1,762	99.8	<0.05	Random	38.73[29.33,48.13]
Surgery	3	1,607	99.8	<0.05	Random	36.28[27.71,44.85]
Pediatrics	2	376	98.6	<0.05	Random	31.98[25.98,37.98]

programs for nurses to choose either specialization in scientific research or clinical nursing. Nurses with higher education levels should focus on training as scientific research nurses while reducing clinical nursing responsibilities, and specialist nurses should focus on consolidating specialist nursing knowledge and improving their professional skills.

The results of this study showed that with the promotion of professional titles and the increase of clinical working time, the level of nurses' work alienation gradually decreased, which was inconsistent with the findings of Sulu S, Kocoglu (43, 44). Nurses with lower levels of professional titles and shorter clinical working time may lack work experience and interpersonal skills, and the probability of erroring in clinical nursing is higher than that of nurses with higher professional titles, which then leads to job dissatisfaction and work inefficiency, hence a higher level of work alienation (45). Therefore, for nurses with lower professional titles and shorter clinical working time, managers should rationalize their shifts, reduce work intensity, and gradually guide nurses to adapt to higher-intensity workloads, thereby reducing clinical nursing errors. At the same time, managers should focus on nurses' psychological state and take measures such as structural empowerment and strengthening peer mutual assistance to improve their psychological resilience. This would improve their wellbeing and professional identity (46), thereby alleviating their work alienation and finally reducing the nurse turnover rate.

According to our study, unmarried nurses have higher work alienation scores than married nurses, which was consistent with the finding of Ren (19). Married nurses tend to rely on family and social support when they feel alienated at work. However, unmarried nurses cannot constantly obtain family support since they have been independent of their parents while still in need of spouses. Sometimes they cannot effectively resolve traumatic events at work and negative emotions may persist,

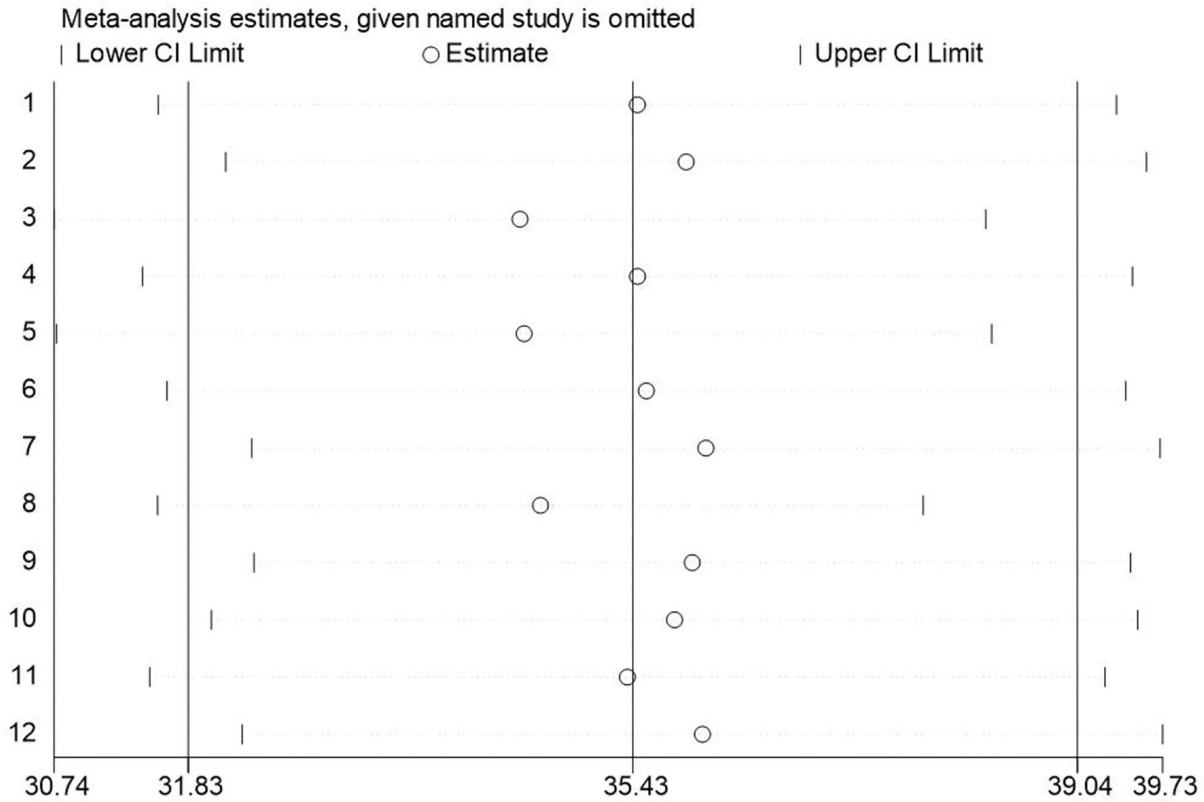

FIGURE 3
Sensitivity analysis.

finally amounting to work alienation (41). Therefore, nursing managers should provide unmarried nurses with emotional support and care. At the same time, nursing managers are obliged to improve the social support system and create good interpersonal relationships to improve the overall quality of nurses' work and life (47).

This study shows that nurses in internal medicine departments, emergency departments, and intensive care units have higher scores of work alienation. While the results of Gao et al. (48) showed that pediatric nurses had higher work alienation than internal medicine nurses, which may be a result of the small sample size—only 31 pediatric nurses were included.

With the current increase in the older adult population, China is facing challenges and difficulties in terms of the medical demand for chronic diseases. Most of the patients in the internal medicine department are frail and senile, suffering from complex illnesses. So, a higher quality of professional care and interpersonal communication skills are required, which, however, proves to be a source of great pressure for nurses. Once the pressure is too high and they cannot relieve it, it is easy to feel alienated at work. The high score of work alienation of nurses in the emergency departments and the intensive care units is consistent with the research results of Wu et al. (49). Compared with other departments, the work in the emergency departments and the intensive care units is of a faster pace, higher load, and higher risk Nurses in these departments and units tend to have a negative and exhausted mentality, and work alienation occur frequently. Managers should make reasonable human resource arrangements according to the situation of the department, conduct regular psychological counseling for nurses, and organize relevant team-building activities to improve cohesion among the nurses. At the same time, managers should reasonably allocate the workload of nurses, with human resources scientifically equipped to reduce their workload (50), thereby reducing nurses' sense of work alienation.

Chinese nurses have a moderate level of work alienation. However, males, higher education, lower professional titles, unmarried, shorter working time, lower income, internal medicine, and critical care nurses have higher work alienation scores. So, early identification of work alienation and timely intervention are needed to reduce the turnover rate of nurses and improve the quality of nursing. This study has certain limitations: (1) this study was uncontrolled binary data, and the inclusion of the literature was more extensive, which increased the heterogeneity between the studies; (2) during the meta-analysis, studies that did not use the scale compiled by Ren or were unable to calculate the score from the literature were excluded, which may impact the final combined effect size; (3) all the studies were conducted in eastern and central China. Larger samples, high-quality, and multi-center original research will need to be conducted in the future.

Implications and future research directions

This study has demonstrated the status of work alienation among nurses in China. Learning the status of work alienation can provide an up-to-date theoretical basis for the management of nurses. Most significantly, this study raises the awareness of work alienation among healthcare managers.

Three possible future research directions can be identified from our study. First, at present, there exist only a very small number of studies on work alienation among nurses, compared with studies on work alienation among other professionals, and few focused on the predictors or the consequences of work alienation. Future research should use experimental design or longitudinal designs for strong causal insights (51). Second, work alienation is a subjective negative psychological state; therefore, qualitative and quantitative studies should be conducted to explore the understanding and experiences of work alienation among nurses so as to gain in-depth knowledge about which interventions are effective to reduce this feeling, and so on. Third, work alienation has been proven to be a crucial mediator and/or moderator for the relationship between organizations and employees. For example, a previous study indicated that work alienation was an important mechanism through which laissez-faire leadership influenced job burnout (52). Therefore, similar studies should be carried out to explore the potential links between organizations and employees and extend the existing literature.

Author contributions

Conception and design: QY, JG, and CH. Administrative support: DB, CW, and CH. Provision of study materials or patients, data analysis, and interpretation: QY, DB, and CW. Collection and assembly of data, manuscript writing, and final approval of manuscript: all authors.

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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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Perceived discrimination in middle-aged and older adults: Comparison between England and the United States

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Objectives: This study examined differences in perceived discrimination across multiple characteristics in England and the United States (US), in middle- and older-aged adults.

Methods: Using data from the English Longitudinal Study of Aging ($N = 8{,}671$) and the US-based Health and Retirement Study ($N = 7{,}927$), we assessed cross-national differences in perceived discrimination attributed to disability, financial status, sex, race, sexual orientation, and weight. We also compared how perceived discrimination varied with socioeconomic position (SEP) based on wealth.

Results: Perceived discrimination due to financial status was more common in England (6.65%) than in the US (2.14%) adjusting for age, sex, and wealth [Odds Ratio (OR) = 1.09, 95% CI (1.07; 1.10)]. This affected people of low but not high SEP. Sexual orientation discrimination was more common in England [0.72 vs. 0.15%, OR = 4.61, 95% CI (2.48; 8.57)]. Sex-based perceived discrimination was more prevalent in the US (12.42%) than England (9.07%) adjusting for age and wealth [OR = 0.87, 95% CI (0.86; 0.89)]. Cross-national differences in sex discrimination did not vary with SEP. Racism was the most common type of perceived discrimination reported in both samples (England: 17.84%, US: 19.80%), with no significant cross-national differences after adjustment for sex.

Discussion: Perceived discrimination attributed to financial status and sexual orientation were more prevalent in England, while more women perceived sex discrimination in the US. This study suggests that country-specific and socioeconomic factors affect the prevalence of perceived discrimination. This may be relevant when targeting interventions aimed at reducing perceived discrimination.

KEYWORDS

cohort analysis, cross-cultural study, diversity in aging, discrimination, aging

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Introduction

Globally, populations are aging. By 2050, it is estimated that people aged 65 and over will make up 24 and 21.4% of the population in the United Kingdom (UK) and United States (US), respectively (1, 2). Health and wellbeing at an older age is a policy priority (3). Perceived discrimination is increasingly recognized as a risk factor compromising healthy aging.

Discrimination is the prejudiced and unfair treatment of individuals based on demographic or ascribed characteristics (4) including disability, race, sex, and socioeconomic background (4). Perceived discrimination is associated with poorer mental and physical health (5–7). This is supported by population-based studies of middle-aged and older adults such as the English Longitudinal Study of Aging (ELSA) and the US-based Health and Retirement Study (HRS). ELSA findings suggest that perceived age discrimination is associated with an increased likelihood of chronic illness (8). Other ELSA studies have linked perceived weight (9) and sexual orientation discrimination with depression and lower quality of life (10). In adults with health conditions such as visual impairment (11) and pain (12), perceived discrimination has been shown to negatively impact wellbeing. Analyses of the HRS sample indicate that perceived discrimination due to stable characteristics (e.g., race) is associated with loneliness, while perceived discrimination due to characteristics that can change over time (e.g., disability and weight) is associated with the onset of chronic conditions, lower self-rated health and life satisfaction (13).

Studies have investigated perceived discrimination in the ELSA and HRS cohorts separately. However, cross-national comparisons can offer additional insights. The sociocultural and historical contexts of England and the US differ and thus, may influence discrimination experiences. For example, the make-up of ethnic minority groups in England differs from the US, with those of South Asian backgrounds forming the largest minority group in England (14). While those of Hispanic/Latinx ethnicity represent the largest minority group in the US (15). Additionally, in terms of wealth distribution, England has a history of a hierarchically organized society (16), while the US is perceived as more economically egalitarian (17). Therefore, understanding differences in the prevalence of various types of discrimination may elucidate areas for interventions.

Previous work such as the Eurobarometer survey, including participants from 28 European countries, suggests that perceived discrimination due to ethnicity (64%), sexual orientation (58%), disability (50%), and gender (37%) is perceived to be common with some variability between countries (18). However, the extent of perceived discrimination in middle-aged and older adults is not well documented in such surveys (19, 20), despite evidence that social exclusion is common at these life stages and is linked to poor health (21). Additionally, cross-national comparison of the context, type and rates of perceived discrimination is limited by a lack of comparative measures in existing surveys. Perceived discrimination measures in ELSA and HRS have been harmonized, facilitating cross-national comparison.

To our knowledge, only one study to date has assessed cross-national differences in perceived discrimination between England and the US using cohort data from middle-aged and older adults. This study focused on perceived age discrimination in the ELSA and HRS cohorts and found that more adults in England than in the US reported age-related discrimination (22). Building on this evidence, we aim to assess cross-national differences in perceived discrimination attributed to other characteristics such as disability, financial status, sex, sexual orientation, race and weight in ELSA and HRS. Middle-aged and older adults have heterogeneous characteristics such as race, weight, and financial status (23), so it is important to understand the prevalence of discrimination attributed to these characteristics.

Experiences of discrimination vary depending on socioeconomic position (SEP). Perceived age discrimination was associated with lower wealth in ELSA and HRS samples (22). While, inequalities in education and wealth are well documented in middle and older age (24). Therefore, we aimed to assess cross-national differences in the wealth gradient for perceived discrimination in middle-aged and older adults.

Materials and methods

Data source and study design

In a cross-sectional analysis we used data from two nationally representative studies of aging: ELSA in England and the HRS in the US. These studies were designed to be comparable and closely matched in sampling and questionnaire content. Harmonized data files from wave 5 (2010) of ELSA and wave 7 of HRS (2010) were obtained from the Gateway to Global Aging (g2aging.org). Analyses were constrained to 2010 as perceived discrimination was assessed in ELSA at this time point only.

Study population

ELSA and HRS cohorts have been described in detail elsewhere (25, 26). Analyses were restricted to participants aged $\geq$ 50 years who provided perceived discrimination data, resulting in analytic samples of $N = 8{,}671$ (ELSA) and $N = 7{,}927$ (HRS), Figure 1.

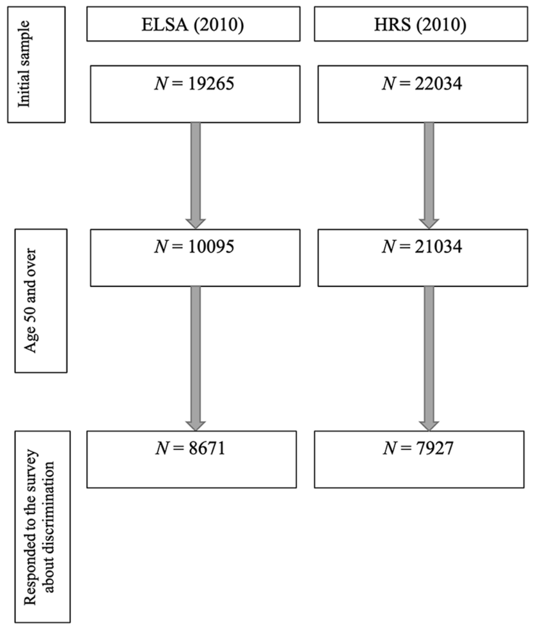

FIGURE 1
Study flow chart.

Ethical approval

ELSA was approved by the London Multicentre Research and Ethics Committee (MREC/01/02/91). Approval for HRS was obtained from the University of Michigan Institutional Review Board (https://hrs.isr.umich.edu/publications/biblio/9048).

Measures

Perceived discrimination was assessed in both cohorts using the same items based on the frequency of discrimination in five situations: "*In your day-to-day life, how often have any of the following things happened to you (1) you are treated with less respect or courtesy; (2) you receive poorer service than other people in restaurants and stores (ELSA: shops); (3) people act as if they think you are not clever; (4) you are threatened or harassed; (5) you receive poorer service or treatment than other people from doctors or hospitals*" (almost every day/at least once a week/a few times a month/a few times a year/less than once a year/never). As previously reported (27), the data were skewed, with most individuals reporting "never" experiencing discrimination, we created a binary variable to indicate whether participants had experienced discrimination in the past year (a few times or more a year vs. less than once a year or never), except for the fifth item which was dichotomized to indicate whether respondents had ever experienced discrimination from doctors or hospitals (never vs. all other options) as most participants reported "never" experiencing discrimination in this setting. A follow-up question asked participants to attribute the discriminatory experience to one or more reasons: physical disability, financial status, race, sex, sexual orientation, weight, and age. This measure has good validity for the assessment of discrimination (28, 29) and has been widely used in research investigating associations between discrimination and health in ELSA and HRS (5–8, 11, 12, 30).

Covariates

Age was modeled as a categorical variable (52–59; 60–69; 70–79; 80+ years old). Sex (female/male) was modeled in binary. Wealth (excluding pension wealth) is the most relevant indicator of SEP in these cohorts (25, 26). This measure is based on detailed assessments of socioeconomic resources (e.g., financial wealth, including housing costs, assets, earnings, debts; and physical wealth) (i.e., land and jewelery). We modeled wealth as a continuous and categorical variable based on a cohort-specific median split (below median = low SEP, above the median = high SEP).

Statistical analysis

Analyses were carried out in R. We first assessed whether the HRS and ELSA samples differed in age, sex, and wealth (our key covariates) using a series of t-tests for normally distributed continuous variables (age, wealth) and χ^2 (chi-square) tests for binary variables (sex and SEP level).

We assessed unadjusted cross-national differences in the prevalence of perceived discrimination attributed to disability, financial status, sex, race, sexual orientation, and weight using multiple logistic regression models and χ^2-tests. Analyses of perceived disability discrimination were restricted to those living with a longstanding physical limitation (defined as an impairment in basic or instrumental activities of daily living or impaired mobility). Perceived race discrimination analyses were restricted to ethnic minority participants. Perceived sex discrimination analyses were limited to female participants. perceived weight discrimination analyses were restricted to obese participants (Body Mass Index: BMI > 30 kg/m^2). We choose to restrict all analyses to improve the precision of the estimates so that we compare the prevalence of discrimination in non-dominant groups (e.g., women) who do and do not perceive discrimination.

Sexual orientation was assessed using item: "*Which statement best describes your sexual desires over your lifetime?*

Please include being interested in sex, fantasizing about sex or wanting to have sex": (1) entirely for women, (2) mostly for women, but some desires for men, (3) equally for women and men, (4) mostly for men, but some desires for women, (5) entirely for men, and (6) no sexual desires in lifetime. We categorized participants with reported desires entirely for the opposite sex as heterosexual, entirely for the same sex as gay and those reporting desires equally for both sexes, mostly for the same sex, or some desires for opposite sex as bisexual. The number of lesbian, gay, or bisexual (LGB) individuals was small in both ELSA ($n = 139$) and HRS cohorts ($n = 9$). Therefore, sexual orientation discrimination analysis was not restricted to LGB individuals. As in previous work (22), data were unweighted as we combined two subsamples of HRS and ELSA respondents, which had different weights.

We then conducted logistic regression analyses adjusting for covariates that were significantly associated with each discrimination type as in previous work (22). We implemented generalized linear models (binomial) with perceived discrimination as the independent variable and country (US/England) as the dependent variable. Likelihood ratio tests for two nested models were conducted to assess differences in perceived discrimination between the countries. We also assessed these relationships looking at each of the five discriminatory situations separately.

We performed secondary analyses to compare the role of SEP in the prevalence of perceived discrimination in England and the US. Firstly, we fitted multiple binomial regression models to compare the moderating effect of continuous wealth on each type of perceived discrimination across the two countries. We also re-ran logistic regression analyses stratified by SEP (low/high), removing adjustment for this variable. Secondly, removing the stratification by SEP, we assessed the interactive effects of SEP and country on the prevalence of perceived discrimination attributed to each characteristic separately. A log-likelihood ratio test was used to test for interaction. As in previous work (20), data were unweighted as we combined two subsamples of HRS and ELSA respondents, which had different weights.

Sensitivity analysis

We carried out the cross-national comparison stratified by SEP operationalized using education level. Education was included as binary variable (no higher degree and higher degree), describing the highest educational qualification attained. No higher degree included no formal education, GCSE, O-Level A-Levels, or equivalent in ELSA; and no formal education, education below high school or completed high school in HRS. Higher degree included university degree or higher in ELSA and college to post-college in HRS. We also included education as a covariate in addition to age, sex, and wealth.

TABLE 1 Participant characteristics.

	England ($N = 8{,}671$)	United States ($N = 7{,}927$)
Age (mean, *SD*)	66.57 (SD = 9.03)	67.28 (SD = 10.80)
Living with a physical limitation (*n*, %)	2,890 (33.33%)	386 (4.87%)
Women (*n*, %)	4,816 (55.54%)	4,583 (57.82%)
Ethnic minority groups	213 (2.46%)	717 (9.05%)
Ethnic minorities (total *n*, %)		
Black	33 (15.45%)	414 (57.75%)
Asian	49 (23%)	-
Hispanic	-	303 (42.25%)
Mixed	7 (3.29%)	-
Other/did not state	124 (58.2%)	-
Low SEP	7,581 (87%)	7,068 (89%)
Weight (BMI, kg/m^2)	28.16 (SD = 5)	35.37 (SD = 18.14)
BMI (mean, SD)		
BMI > 30 kg/m^2 (*n*, %)	1,524 (24.46%)	4,874 (61.58%)

Percentages are valid percent.
BMI, Body Mass Index; SEP, Socioeconomic Position; SD, Standard Deviation.

The analysis concerned within-country comparisons (low SEP vs. high SEP and association between wealth and perceived discrimination) was also weighted to test the impact of adjusting for selection bias. We performed weighted logistic regression to account for selection bias in HRS and ELSA separately when assessing the association between wealth and discrimination.

Results

Participant characteristics

This study included 8,671 individuals from ELSA [$M = 66.57$ (SD = 9.03) years old; 4816 (55.54%) female] and 7,927 individuals from HRS [$M = 67.28$ (SD = 10.80) years old; 4,583 (57.82%) female] who responded to the perceived discrimination survey (Table 1).

We observed significant differences in age, sex and SEP between ELSA and HRS samples. Participants in HRS were on average older [$t_{(1)} = 4.57$, $p < 0.001$], more likely to be female ($\chi^2 = 8.62$, $p < 0.01$), and less wealthy [$t_{(1)} = -9.26$, $P < 0.001$] than those in ELSA. There were no significant differences in number of individuals in low SEP between HRS ($n = 7{,}068$, 89%) and ELSA ($n = 7{,}581$, 87%) cohorts, $\chi^2 = 0.61$, $p = 0.44$.

Cross-national differences in perceived discrimination

In unadjusted analysis (Table 2), perceived discrimination attributed to disability [OR = 3.05, 95% CI (1.42; 6.55), $p <$

TABLE 2 Prevalence and cross-national differences in perceived discrimination attributed to disability, financial status, sex, race, sexual orientation, and weight.

Attribution for discrimination	Total *n*		Perceived discrimination, *n* (%)				Unadjusted cross-national difference					Adjusted cross-national difference				
	England	US	England		US		OR[a]	95% CI		χ^2	*p*-value	OR	95% CI		χ^2	*p*-value
Disability (physical limitation)	2,890	386	264	9.13	7	1.81	3.05	1.42	6.55	8.29	**0.0040**	1.06	1.02	1.11	0.75	0.3878
Financial status (low SEP)	7,581	7,068	504	6.65	151	2.14	3.31	2.75	4.00	171.60	**0.0000**	1.10	1.09	1.12	17.10	**0.0000**
Sex (female)	4,816	4,583	437	9.07	569	12.42	0.35	0.30	0.40	243.69	**0.0000**	0.87	0.86	0.89	29.41	**0.0000**
Race (ethnic minority)	213	717	38	17.84	142	19.80	0.62	0.42	0.93	4.86	**0.0275**	0.94	0.86	1.03	0.35	0.5518
Sexual orientation*	8,671*	7,927*	62	0.72	12	0.15	4.61	2.48	8.57	27.00	**0.0000**	NA	NA	NA	NA	NA
Weight (BMI > 30)	1,947	5,192	178	9.14	199	3.83	1.41	1.14	1.75	10.07	**0.0015**	1.03	1.02	1.05	1.14	0.2852

[a] ORs > 1 indicate higher prevalence in England and ORs < 1 indicate the higher prevalence in the US. Values in bold meet the 0.05 *p*-value threshold.

BMI, Body Mass Index; CI, Confidence Interval; OR, Odds Ratio; SEP, socioeconomic status.

OR was adjusted for the following covariates: Disability: age, sex and wealth; Financial status: age and sex; Sex discrimination (female): age and wealth; Sexual orientation: no significant covariates; Race: age, sex and wealth; Weight: age, sex and wealth.

*Unrestricted analysis due to small n of lesbian, gay, bisexual (LGB) individuals included in the studies, ELSA [n =139, 10 (7.2%) of whom perceived sexual orientation discrimination] and HRS [n = 9, one (11.1%) of whom perceived sexual orientation discrimination]. Cross-national differences in ageism were previously assessed by Rippon et al. We include the replication of the results in Supplementary Tables 1, 2. The results of the analysis restricted to those with BMI between 25 and 30 kg/m^2 are included in Supplementary Table 3.

0.01], financial status [OR = 3.31, 95%CI (2.75; 4.00), $p < 0.001$], sexual orientation [OR = 4.61, 95%CI (2.48; 8.57), $p < 0.001$], and weight [OR = 1.41, 95% CI (1.14; 1.75), $p < 0.01$] was more frequently reported in England than the US. Race- [OR = 0.62, 95%CI (0.42; 0.93), $p < 0.05$] and sex-based discrimination [OR = 0.35, 95%CI (0.30; 0.40), $p < 0.001$] were more prevalent in the US than in England.

In adjusted analyses, significant cross-national differences in financial status and sex-based perceived discrimination remained. Specifically, perceived financial status discrimination [OR = 1.10, 95%CI (1.09; 1.12), $p < 0.001$] was more common in England than in the US (6.65 vs. 2.14%), adjusting for age, sex, and wealth. Sex discrimination was more prevalent in the US than in England [12.42 vs. 9.07%; OR = 0.87, 95%CI (0.86; 0.89), $p < 0.001$] adjusting for age and wealth).

We also compared perceived discrimination in five discriminatory situations separately (Supplementary Table 4). In unadjusted analyses in England, being treated with less respect was the most prevalent type of discriminatory experience regardless of the attributed cause. In adjusted analyses, being treated with less respect was more often attributed to financial- [OR = 1.45, 95%CI (1.30; 1.63), $p < 0.01$], sex- [OR = 1.87, 95% CI (1.78; 1.96), $p < 0.001$], race- [OR = 1.57 95% CI (1.34; 1.84), $p < 0.001$], and weight discrimination [OR = 1.74, 95% CI (1.54; 1.97), $p < 0.001$], in England than in the US.

In the US, individuals perceived disability (86%) and sexual orientation (75%) discrimination most often in medical settings. Being harassed was the most prevalent discriminatory experience reported for financial- (73%), sex- (67%), race- (73%), and weight-based (75%) discrimination. In adjusted analyses, being harassed was attributed to financial- [OR = 0.61, 95% CI (0.55; 0.67), $p < 0.001$], race- [OR = 0.59, 95% CI (0.50; 0.69), $p < 0.01$] and weight discrimination [OR = 0.62, 95% CI (0.54; 0.71), $p < 0.01$] more frequently in the US than in England (Supplementary Table 4).

Cross-national differences in perceived discrimination stratified by SEP

Cross-national differences stratified by SEP are reported in Table 3. Figure 2 illustrates the probability of perceived discrimination as a function of wealth as estimated from unadjusted logistic regression models (95% CIs are plotted in gray). In adjusted analyses, for the low SEP groups, discrimination due to financial status remained significantly higher in England than in the US for the low SEP groups but the cross-national differences for disability and weight were no longer significant (Table 3).

Looking in England alone, there was a significant inverse wealth gradient in disability (ß = −0.61, $p < 0.001$), financial status (ß = −0.90, $p < 0.001$), and weight discrimination (ß =

TABLE 3 Prevalence and cross-national differences in perceived discrimination attributed to disability, financial status, sex, race, sexual orientation, and weight stratified by socioeconomic position (SEP).

Attribution for discrimination	SEPS	Total n		Perceived discrimination, n (%)[b]				Unadjusted cross-national difference					Adjusted cross-national difference				
		England	US	England		US		OR[a]	95% CI		χ^2	p-value	OR	95% CI		χ^2	p-value
Disability	Low SEP	2,662	332	259	9.73	6	1.81	3.36	1.47	7.66	8.58	**0.0034**	1.07	1.03	1.12	0.84	0.3587
	High SEP	195	54	3	1.54	1	1.85	0.39	0.04	3.94	0.00	0.9675	0.97	0.92	1.03	0.02	0.9006
Financial status	Low SEP	7,581	7,068	504	6.65	151	2.14	3.31	2.75	4.00	171.60	**0.0000**	1.08	1.07	1.10	13.04	**0.0003**
	High SEP	959	859	29	3.02	11	1.28	2.14	1.05	4.33	3.94	**0.0472**	1.03	1.00	1.06	0.15	0.6963
Sex (female)	Low SEP	4,257	4,131	374	8.79	512	12.39	0.34	0.30	0.40	219.16	**0.0000**	0.88	0.86	0.89	24.77	**0.0000**
	High SEP	486	452	57	11.73	57	12.61	0.37	0.24	0.55	23.04	**0.0000**	0.84	0.80	0.90	3.95	**0.0467**
Race (ethnic minority)	Low SEP	192	705	33	17.19	140	19.86	0.60	0.39	0.91	5.29	**0.0214**	0.93	0.85	1.01	0.55	0.4586
	High SEP	18	12	5	27.78	2	16.67	1.35	0.21	8.82	0.00	1.0000	1.31	0.89	1.93	0.34	0.5588
Sexual orientation*	NA	NA	NA	NA		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Weight (BMI > 30)	Low SEP	1,771	4,720	167	9.43	185	3.92	1.45	1.17	1.81	10.86	**0.0010**	1.04	1.02	1.05	1.20	0.2728
	High SEP	154	472	10	6.49	14	2.97	1.08	0.47	2.51	0.00	1.0000	1.00	0.95	1.05	0.00	0.9717

[a] ORs > 1 indicate the higher prevalence in England and ORs < 1 indicate the higher prevalence in the US. Values in bold meet the 0.05 p-value threshold.

[b] n (%) of individuals who perceived discrimination in low SEP and high SEP subgroups separately. BMI, Body Mass Index; CI, Confidence Interval; OR, Odds Ratio; SEP, socioeconomic position.

OR was adjusted for the following covariates: Disability: age and sex; Financial status: age and sex; Sex discrimination (female): age; Race: age and sex; Sexual orientation: no significant covariates; Weight: age, sex and wealth.

*Analysis was not stratified by SEP due to small n. Cross-national differences analysis stratified by the level of education is included in Supplementary Table 7.

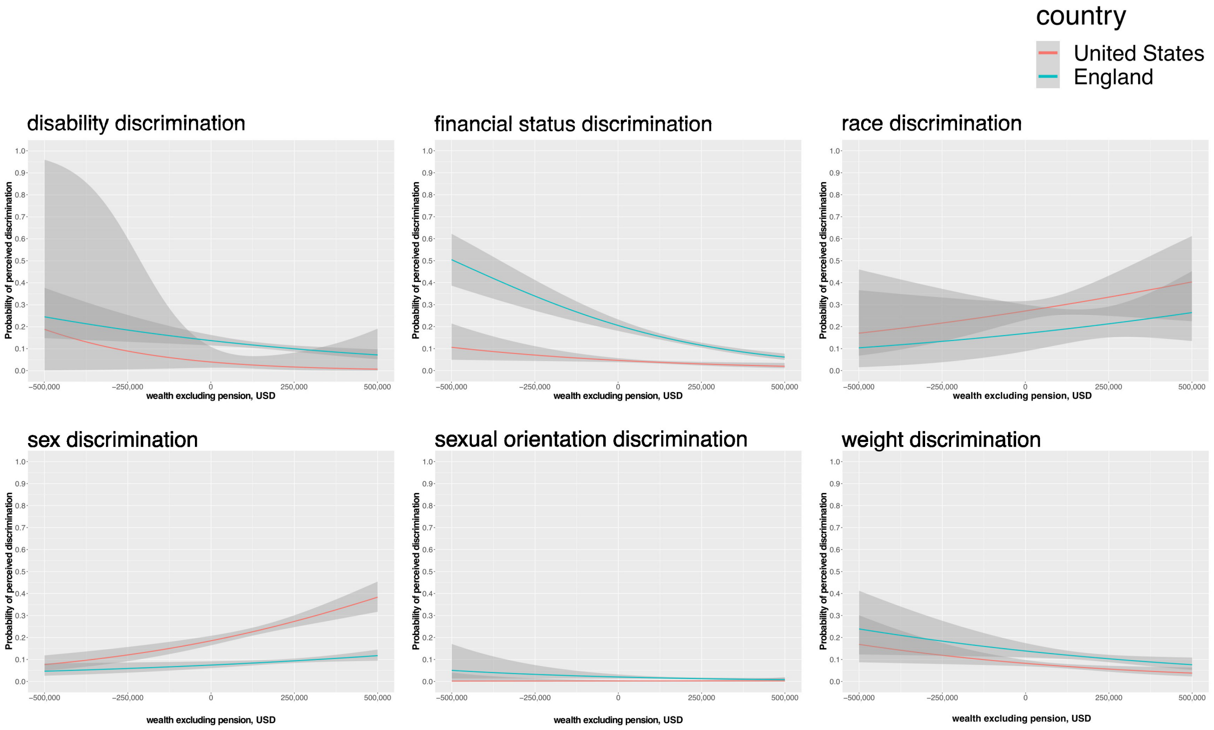

FIGURE 2
Probability of perceived discrimination (95%CI) predicted by wealth (USD) in England and US. Y-axis: the probability of perceived discrimination (yes, no); x-axis: wealth (USD)—a net sum of dept, financial wealth, housing, and physical wealth (i.e., land and jewelry). The probability of perceived discrimination predicted by wealth (USD) in England (green) and US (red) with 95% CI (in gray). Plots are produced from datasets restricted to the respective demographic or biometric characteristics [i.e., physical limitation, wealth > sample median (i.e., low socioeconomic position), ethnic minority, women, and BMI > 30]. Sexual orientation discrimination was not restricted to LGB. Wealth (USD). The analysis included ELSA (England) and HRS (US) cohorts.

−0.46, $p < 0.001$), whereby discrimination was more likely to be reported by lower than higher SEP groups (Table 4; Figure 2). This wealth gradient was not significant in the US sample. Findings were mostly similar when wealth was modeled as a categorical variable (Supplementary Table 5).

Perceived race discrimination was more common in the US than in England in low SEP groups but not in the high SEP groups, in unadjusted analyses. However, in SEP-stratified analyses adjusted for sex, there was no longer a significant cross-country difference in perceived race discrimination. There was no significant wealth gradient for the probability of perceived race discrimination in either England or the US (Table 4; Figure 2).

Sex discrimination was more commonly reported in the US for both high and low SEP individuals. Looking in the US alone, there was a positive wealth gradient ($ß = 0.10$, $p < 0.01$) in the probability of perceived sex discrimination, suggesting higher SEP individuals were more likely to perceive discrimination (Table 4; Figure 2). This wealth gradient for sex discrimination was not evident in the English sample. In adjusted analyses stratified by SEP, cross-national differences in sex discrimination remained significant for both the low SEP group and high SEP group (Table 3). Sex discrimination was significantly more prevalent in the US than in England in low SEP group as well as high SEP group when adjusting for age.

When testing the interactive effects of SEP and country on the prevalence of perceived discrimination attributed to each characteristic separately, there was a statistically significant interaction effect between SEP and country on the prevalence of perceived financial status discrimination among the overall sample ($ß = -0.05$, SE $= 0.02$, $p < 0.01$) but no other discrimination types (Supplementary Table 6).

Results of the sensitivity analysis

The cross-national comparison stratified by SEP operationalized using education level did not differ from the main results (Supplementary Table 7). When education was included as a covariate, the differences in perceived sex discrimination were attenuated to non-significant (Supplementary Tables 8, 9). No other differences between this sensitivity analysis and the main findings were observed.

TABLE 4 Wealth gradient in perceived discrimination: logistic regression coefficients describing the association between wealth (USD) and perceived discrimination.

		Unadjusted			Adjusted		
Attributed reason		**Standardized ß coefficient**	***z*-value**	***p*-value**	**Standardized ß coefficient**	***z*-value**	***p*-value**
Disability (physical limitation)	England	−0.61	−4.79	**0.0000**	−1.27	−4.81	**0.0000**
	US	−0.08	−0.27	0.7899	−0.25	−0.33	0.7430
Financial status	England	−0.90	−8.08	**0.0000**	−1.99	−8.41	**0.0000**
	US	−0.22	−1.00	0.3179	−0.03	−0.07	0.9428
Race (ethnic minority)	England	0.19	1.11	0.2655	0.39	1.08	0.2775
	US	−0.13	−0.61	0.5404	−0.25	−0.56	0.5723
Sex (female)	England	0.06	1.54	0.1242	0.03	0.81	0.4198
	US	0.10	2.81	**0.0049**	0.23	3.19	**0.0014**
Sexual orientation	England	−0.14	−0.92	0.3588	NA	NA	NA
	US	0.09	1.25	0.2107	NA	NA	NA
Weight (BMI > 30)	England	−0.46	−3.36	**0.0008**	−0.55	−2.31	**0.0210**
	US	−0.08	−1.05	0.2940	−0.01	−0.09	0.9256

Values in bold meet the 0.05 *p*-value threshold. BMI, Body Mass Index.

Wealth (USD)—a net sum of dept, financial wealth, housing, and physical wealth (i.e., land, and jewelry). ß-coefficient describing the association between between wealth and perceived discrimination in England and US. Analysis of the dataset restricted to the respective demographic or biometric characteristic [i.e., physical limitation, wealth > sample median (i.e., low socioeconomic position), ethnic minority, women, and BMI > 30]. Sexual orientation discrimination analysis was not restricted to lesbian, gay, bisexual individuals due to small *n*. Covariates: Disability: age and sex; Financial status: age and sex; Sex discrimination (female): age; Race: age and sex; Sexual orientation: no significant covariates; Weight: age and sex. The weighted logistic regression estimates are included in Supplementary Table 10.

The weighted estimates, accounting for the selection bias in ELSA and HRS separately did not deviate from the main results, when assessing the association between wealth and perceived discrimination (Supplementary Table 10).

Discussion

This study examined differences in perceived discrimination across multiple characteristics experienced by older and middle-aged adults living in England and the US. Financial status discrimination was more common in England than in the US, affecting individuals of low SEP. Sexual orientation discrimination was also perceived more frequently in England than in the US. More women perceived sex discrimination in the US than in England, in both high and low SEP groups. In the US, but not in the English sample, there was a positive wealth gradient in perceived sex discrimination. When comparing low SEP groups in unadjusted analyses, financial status, disability, and weight discrimination were more prevalent in England than in the US. Looking at England alone, we identified an inverse wealth gradient in disability-, financial status- and perceived weight discrimination in England, in both unadjusted and adjusted analyses. This was not found in the US sample. Perceived race discrimination was more prevalent in the US but only in analyses where there had been no adjustment for weight, age, sex, and wealth.

Discrimination types that are more common in England

We found financial status discrimination to be more widespread in England than in the US, independent of age, sex, and wealth. Our stratified analyses suggest this result is driven by low SEP groups. This finding aligns with earlier cross-national research in these cohorts, which found higher rates of perceived age discrimination in low SEP groups in England than in the US (22). Wealth inequality is high in both England (31) and the US (26). The history of a hierarchically organized society in England (16) and the common belief that the US is more economically egalitarian (17) may partially explain the difference.

A growing literature suggests that LGB adults have poorer health and wellbeing than their heterosexual counterparts (32). We investigated rates of sexual orientation discrimination in lesbian, gay, and bisexual (LGB) adults and observed higher reports of sexual orientation discrimination in England than in the US. We were unable to conduct adjusted analyses due to small numbers identifying as LGB, so caution is needed in interpreting our findings. However, our findings add to the limited research on middle-aged and older LGB populations (14). Longitudinal work in ELSA indicates that perceived discrimination is associated with poorer wellbeing in LGB participants, particularly when the discrimination is attributed to sexual orientation (14). This suggests the age-related burden of poor health and wellbeing in LGB groups may be compounded by discrimination, especially in England. Older adults in England grew up at a time when homosexuality was classified as a mental illness and sex between two men was illegal (33, 34). Middle-aged adults grew up at a time when schools were banned from teaching about homosexuality (35) and there was the onset of the AIDS epidemic. These and other negative experiences may have had lasting effects on participants' perceptions of discrimination. However, the social context was also challenging in the US and the cross-national difference needs further research.

In unadjusted analyses, the prevalence of disability discrimination was higher in England than in the US. The English sample included more individuals living with disability compared to the US sample. This is in keeping with international estimates showing that a slightly greater proportion of the population of the UK is in receipt of disability payments than in the US (36). Similarly, there were more individuals who perceived disability discrimination in England than in the US. This finding was patterned by SEP, as the association for high SEP groups was attenuated to the null in stratified analyses. In the UK, approximately one in five people self-report disability (37) and 4 million older adults (36% of people aged 65–74, and 47% of those aged 75+) live with a limiting long-standing illness (38). The practical difficulties associated with disability may be aggravated by discrimination. Previous work in ELSA (11, 12) and other UK cohorts (6) suggests that perceived discrimination has compounding adverse effects on wellbeing in those with disability. Further, in England, reports of perceived discrimination were inversely related to wealth. Therefore, perceived disability discrimination, if unaddressed, could place an additional burden on marginalized aging English adults.

In unadjusted analyses, individuals with obesity perceived weight discrimination more frequently in England than in the US. This difference was socially patterned, as the association remained for low SEP groups alone in stratified analyses. There was no significant difference after adjustment for age and sex. Obesity is common in both countries, particularly in low SEP groups, though rates are consistently higher in the US (39, 40). The "normalization" of obesity may have resulted in reduced perceived discrimination based on this attribute in the US (27). In ELSA, weight discrimination has been prospectively linked with poorer wellbeing (13), and cross-national comparisons suggest that the impact of obesity on wellbeing is partially mediated by discrimination (9, 41). Weight-based perceived discrimination is associated with poor health behaviors (42) which may further harm health, particularly for marginalized groups, as there is a recognized wealth gradient in health behaviors (43).

Discrimination types that are more common in the US

Women in the US perceived sex discrimination more frequently than women in England, independent of age and wealth. This discrepancy may mirror differences in gender inequality between the countries, as in 2010 and 2020, the US ranked twice as high on the global gender inequality index as the UK (44), based on economic, educational, and political disparities. Further research is needed to evaluate the impact of political under-representation and economic and employment disempowerment on reports of sex discrimination in the population. We observed a wealth gradient in sex discrimination in the US. This is in keeping with earlier work in younger samples (7). It is unclear why high SEP women report more encounters with sexism. One possibility is that they may recognize sexism more readily, for example by being able to distinguish it from wealth-based discrimination. More research is needed to investigate this possibility.

In unadjusted comparisons, perceived racial discrimination was more common in the US than in England. This difference did not remain in adjusted analyses. Caution is needed in interpreting these findings due to the low proportion of ethnic minorities in both samples (25, 26). However, this was the most reported form of perceived discrimination in both English and US cohorts. This is concerning considering the increased recognition of the impact of racial discrimination on mental health (45, 46) as well as emerging evidence on physical health impacts (5, 47).

Strengths and limitations

This study contributes to the evidence concerning the prevalence of distinct types of perceived discrimination in England and the US, using nationally representative samples of adults aged 50 and over. We have employed a harmonized measure perceived discrimination cross-nationally. In addition, cross-national differences were assessed stratifying by SEP, which may have improved precision and also elucidated a significant wealth gradient in perceived discrimination in middle-aged and older adults. However, the study is not without limitations. The analyzed sample had few ethnic minorities and LGB participants, reducing the generalizability of the findings. Unweighted estimated for the cross-national comparisons were used because ELSA and HRS are weighted differently. Study results reflect self-reported perceptions of discrimination rather than objective encounters with discrimination. In addition, as in other observational studies, the findings may be prone to the bias introduced by unmeasured confounding. Finally, future research is encouraged to include additional types of perceived discrimination (e.g., attributed to transgender and gender non-conforming status).

Conclusion

The cross-national differences in perceived discrimination identified in the study can inform country-specific policies and interventions targeted at middle-aged and older adults, with the ultimate aim of alleviating the negative impact of perceived discrimination on health and wellbeing. This study highlights the importance of considering contextual moderators such as SEP and sociocultural context in discrimination research.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: https://g2aging.org/downloads.

Ethics statement

The studies involving human participants were reviewed and approved by ELSA was approved by the London Multicentre Research and Ethics Committee (MREC/01/02/91). Approval for HRS was obtained from the University of Michigan Institutional Review Board (https://hrs.isr.umich.edu/publications/biblio/9048). The patients/participants provided their written informed consent to participate in this study.

Author contributions

RH secured funding for this study and conceived the study. RH and AA contributed to study design. AA carried out the statistical analysis and drafted the manuscript. KR and RH provided critical comments and revisions to 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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Supplementary material

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Sex difference in the associations among risk factors with depression in a large Taiwanese population study

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Background: Depression is a common psychiatric health issue affecting an estimated 5% of adults worldwide, and it can lead to disability and increased economic burden. Consequently, identifying the factors associated with depression as early as possible is a vital issue. The aim of this study was to explore these associations in a large cohort of 121,601 Taiwanese participants in the Taiwan Biobank, and also to identify sex differences in the associations.

Methods: The study cohort included 77,902 women and 43,699 men (mean age, 49.9 ± 11.0 years), who were further classified into those with depression ($n = 4,362$; 3.6%) and those without depression ($n = 117,239$; 96.4%).

Results: The results of multivariable analysis showed that female sex (vs. male sex; odds ratio = 2.578; 95% confidence interval = 2.319–2.866; $p < 0.001$) was significantly associated with depression. Older age, diabetes mellitus (DM), hypertension, low systolic blood pressure (SBP), smoking history, living alone, low glycated hemoglobin (HbA1c), high triglycerides, and low uric acid were significantly associated with depression in the men. In the women, older age, DM, hypertension, low SBP, smoking history, alcohol history, education level of middle and high school (vs. lower than elementary school), living alone, high body mass index (BMI), menopause, low HbA1c, high triglycerides, high total cholesterol, low estimated glomerular filtration rate (eGFR), and low uric acid were significantly associated with depression. Further, there were significant interactions between sex and DM ($p = 0.047$), smoking history ($p < 0.001$), alcohol use ($p < 0.001$), BMI ($p = 0.022$), triglyceride ($p = 0.033$), eGFR ($p = 0.001$), and uric acid ($p = 0.004$) on depression.

Conclusion: In conclusion, our results showed sex differences in depression, and the women were significantly associated with depression compared to men. Furthermore, we also found sex differences among the risk factors associated with depression.

KEYWORDS

depression, sex difference, Taiwan Biobank, risk factors, interaction

Introduction

Depression is a common psychiatric health issue affecting an estimated 5% of adults worldwide, and it can lead to disability and increased economic burden (1). Although the reported lifetime prevalence in Taiwan is about 1.2%, this rate may be underestimated due to the culture of low help-seeking behavior (2). Demographic risk factors including younger age, female gender, lower household income, marital status of widowed, separated, or divorced, and comorbid psychiatric disorders are associated with an increased risk of depression (3). Depression has also been associated with multiple chronic medical diseases, and it is considered to be a significant contributor to suicide (1, 4, 5). Compared with the general population, people in Taiwan with depression have been found to have a shorter life expectancy and higher mortality rate (6). Therefore, identifying the potential risk factors for depression is a vital issue.

Sex differences have been reported in many diseases, including liver disease, cancer, and cardiovascular disease, and these differences manifest in clinical presentation, disease progression, and response to management (7). Associations between the disease and risk factors may also differ by sex. For example, the incidence of myocardial infarction has been reported to be three times higher in men than in women, whereas hypertension, smoking, and diabetes mellitus (DM) are associated with a greater relative risk in women than in men (8). Epidemiological studies have also revealed that the lifetime prevalence of depression is two times higher in women compared to men (3). These differences may be due to genetic factors, hormone modulation, stress response, or structural sex inequality (9). For depression, the relationship with risk factors is considered to be bidirectional. On one hand, depression may lead to unhealthy behaviors such as smoking and alcohol consumption, which then elevate the possibility of developing chronic diseases. On the other hand, poor physical health conditions may cause depression due to common pathogenesis or the increased need for psychological support (4, 5). Although previous studies have established bidirectional relationships between depression and comorbid conditions, whether sex differences also influence the risk factors is unclear. Therefore, we conducted this study to explore sex differences in the associations among risk factors with depression in a large cohort of Taiwanese participants.

Materials and methods

Taiwan Biobank

Due to societal aging in Taiwan, the Ministry of Health and Welfare announced a policy to counter chronic diseases through health promotions, and consequently launched the TWB. Volunteers are enrolled in the TWB, with the inclusion criteria of an age between 30 and 70 years and no prior diagnosis of cancer. In this study we used data from 121,601 participants in the TWB, including lifestyle habits, medical and genetic information as detailed in the following section (10, 11).

Medical data, demographics, lifestyle habits, and laboratory data

All enrollees in the TWB are interviewed to obtain personal information on their age, sex, lifestyle factors (i.e., exercise), educational status, living alone status, and medical history (i.e., DM and hypertension). In this study, we defined regular exercise as exercising for at least 30 min three times or more in 1 week.

Body height and weight were also recorded for each enrollee, along with the body mass index (BMI) (kg/m^2). Blood samples were also drawn from each enrollee, from which glycated hemoglobin (HbA1c), hemoglobin, triglycerides, total cholesterol, and uric acid were measured. Estimated glomerular filtration rate (eGFR) was also recorded using the MDRD Study equation [186 × serum creatinine$^{-1.154}$ × Age$^{-0.203}$ × 0.742 (if female) × 1.212 (if black patient)] (12). DM was defined as self-reported, fasting glucose level $\geq$126 mg/dL or HbA1c $\geq$ 6.5%. Participants had past history of hypertension (self-reported), and whose systolic blood pressure was $>$140 mmHg and diastolic blood pressure was $>$90 mmHg were defined to have hypertension.

Depression groups

The participants were classified into two groups according to whether or not they had ever had depression. Those who answered "Yes" to the question "Have you ever had depression?" were classified into the depression group, and those who answered "No" were classified into the without depression group.

Ethical considerations

The Institutional Review Board of Kaohsiung Medical University Hospital approved this study (KMUHIRB-E(I)-20210058). Ethical approval for the TWB was granted by the IRB on Biomedical Science Research, Academia Sinica, Taiwan and the Ethics and Governance Council of the TWB. In addition, the study was conducted in accordance with the Declaration of Helsinki, and all of the participants gave written informed consent.

Statistical analysis

Continuous variables are presented as mean (±SD), with differences analyzed using the independent *t*-test. Categorical variables are presented as percentage, with differences analyzed using the chi-square test. Correlations among risk factors with depression were analyzed with multivariable logistic regression analyses. An interaction *p* in logistic analysis was identified using the following formula: Model disease $(y) = x1 + x2 + x1^{*}x2 +$ covariates $x1^{*}x2$, where y = depression; $x1$ = sex; $x2$ = each risk factor; covariates = age, sex, DM, hypertension, systolic and diastolic blood pressures, smoking and alcohol history, regular exercise habit, education status, living alone, BMI, HbA1c, hemoglobin, triglycerides, total cholesterol, eGFR and uric acid. Results were considered significant at $p < 0.05$. Statistical analysis was performed using SPSS for Windows (v26, SPSS Inc. Armonk, NY, USA).

Results

The enrolled participants ($n = 121{,}601$; mean age 49.9 ± 11.0 years; 77,902 females; 43,699 males) were divided into two groups according to those with depression ($n = 4{,}362$; 3.6%) and without depression ($n = 117{,}239$; 96.4%).

Comparisons of clinical characteristics between the two depression groups

Compared to the without depression group, the with depression group were older, had a higher proportion of females, higher prevalence of DM, hypertension, living alone, menopause status, and smoking, regularly exercised more. In addition, the with depression group had lower systolic and diastolic blood pressures, lower prevalence of educational status higher than college, higher levels of HbA1c, triglycerides and total cholesterol, and lower levels of hemoglobin, eGFR, and uric acid (Table 1).

Determinants of depression

The factors associated with depression in multivariable logistic regression analysis for the whole study cohort ($n = 121{,}601$) are shown in Table 2. This model adjusted age, sex, DM, hypertension, systolic and diastolic blood pressures, smoking and alcohol history, regular exercise, educational status, living alone, BMI, HbA1c, hemoglobin, triglycerides, total cholesterol, eGFR and uric acid. After analysis, older age, female (vs. male; odds ratio [OR] = 2.578; 95% confidence interval [CI] = 2.319–2.866; $p < 0.001$), DM, hypertension, low systolic blood pressure, high diastolic blood pressure, smoking history, educational level of middle and high school (vs. lower than elementary school), living alone, high BMI, low HbA1c, high triglycerides, high total cholesterol, low eGFR, and low uric acid were significantly associated with depression.

Determinants of depression by sex

The factors associated with depression by sex in multivariable logistic regression analysis are shown in Table 3. In the male participants ($n = 43{,}699$), older age, DM (OR = 1.524; 95% CI = 1.179–1.971; $p = 0.001$), hypertension, low systolic blood pressure, smoking history (OR = 1.395; 95% CI = 1.218–1.597; $p < 0.001$), living alone, low HbA1c, high triglycerides, and low uric acid (per 1 mg/dL; OR = 0.918; 95% CI = 0.873–0.965; $p = 0.001$) were significantly associated with depression. In the female participants ($n = 77{,}902$), older age, DM (OR = 1.753; 95% CI = 1.476–2.082; $p = 0.047$), hypertension, low systolic blood pressure, smoking history (OR = 2.323; 95% CI = 2.115–2.551; $p < 0.001$), alcohol history (OR = 1.348; 95% CI = 1.141–1.598; $p < 0.001$), educational level of middle and high school (vs. lower than elementary school; OR = 1.231; 95% CI = 1.060–1.428; $p = 0.006$), living alone, high BMI, menopause, low HbA1c, high triglycerides, high total cholesterol, low eGFR (per 1 ml/min /1.73 m^2; OR = 0.996; 95% CI = 0.994–0.997; $p < 0.001$), and low uric acid (per 1 mg/dL; OR = 0.951; 95% CI = 0.917–0.986; $p = 0.006$) were significantly associated with depression.

Interactions among risk factors and sex on depression

There were significant interactions between sex and DM ($p = 0.047$), smoking history ($p < 0.001$), alcohol use ($p < 0.001$), BMI ($p = 0.022$), eGFR ($p = 0.001$), and uric acid ($p = 0.004$) on depression (Table 3).

Discussion

The results of this large-scale study showed that the female participants were significantly associated with depression compared to the male participants. Furthermore, we found sex differences in the associations among the risk factors. There were significant interactions between sex and DM, smoking history, alcohol use, BMI, eGFR, and uric acid on depression.

A main finding of this study is that the female participants had a higher rate of depression compared to the male participants. The prevalence of depression has been shown to increase significantly during puberty, with a greater increase in girls (13). This difference remains relatively stable into adulthood, and even after menopause in women (14). The reason for the higher prevalence of depression in women cannot be explained by a single mechanism, and is likely to be due to risk factors including genetic factors, sex hormones, and stress (9, 15). Considering the effect of genetic factors, although depression is a familial disorder with heritability ranging around 30∼40% (16), genetic influences specifically in females have yet to be definitively concluded. Some studies have reported that genetic factors have a considerable impact on females (17), whereas other studies have reported that the impact is greater in males (18). Thus, more research is required not only on direct genetic factors, but also on the influence of confounding factors such as environmental factors, demographic characteristics, study measurements, and so on (19). Sex hormones are also considered to be an important risk factor for depression in women (20). Women pass through different phases during their lifetime, including puberty, premenstrual dysphoric disorder and mood swings before menstruation, postpartum depression, and depression during perimenopause and menopause, all of which are related to fluctuations in sex hormones (21, 22). In addition, stress is associated with the risk of the first onset, recurrence, and exacerbation of depression (23). Previous studies have reported that adolescent girls and women may encounter sexual abuse and domestic violence, experience greater interpersonal stress, housing problems, and the burden of taking care of others (23, 24). Thus, the effects of sex hormones, stress, and genetic factors may explain the higher risk of depression in women than in men.

TABLE 1 Comparison of clinical characteristics among participants without or with depression.

Characteristics	Depression (−) ($n = 117,239$)	Depression (+) ($n = 4,362$)	p
Age (year)	49.8 ± 11.0	51.3 ± 10.4	<0.001
Female (%)	63.6	76.1	<0.001
DM (%)	5.1	7.8	<0.001
Hypertension (%)	12.1	16.0	<0.001
Systolic BP (mmHg)	120.5 ± 18.7	119.2 ± 18.2	<0.001
Diastolic BP (mmHg)	73.8 ± 11.4	73.0 ± 11.2	<0.001
Smoking history (%)	27.1	31.6	<0.001
Alcohol history (%)	8.5	9.0	0.235
Regular exercise habits (%)	40.5	42.0	0.046
Education status			<0.001
Lower than elementary school (%)	5.3	5.8	
Middle and high school (%)	36.5	43.9	
Higher than college (%)	58.2	50.3	
Living alone (%)	7.9	13.9	<0.001
BMI (kg/m^2)	24.2 ± 3.8	24.2 ± 4.1	0.437
Menopause in female (%)	45.5	52.3	<0.001
Laboratory parameters			
HbA1c (%)	5.76 ± 0.80	5.79 ± 0.82	0.034
Hemoglobin (g/dL)	13.8 ± 1.6	13.5 ± 1.5	<0.001
Triglyceride (mg/dL)	115.5 ± 94.3	119.9 ± 85.5	0.002
Total cholesterol (mg/dL)	195.5 ± 35.8	198.4 ± 35.7	<0.001
eGFR (mL/min/1.73 m^2)	103.3 ± 23.9	102.5 ± 24.2	0.029
Uric acid (mg/dL)	5.4 ± 1.4	5.2 ± 1.4	<0.001

DM, diabetes mellitus; BP, blood pressure; BMI, body mass index; HbA1c, glycated hemoglobin; eGFR, estimated glomerular filtration rate.

Another main finding of the present study is the significant interaction between sex and DM on depression, and DM was more strongly associated with depression in the female participants than in the male participants. Previous studies have shown that patients with DM have an increased risk of developing depression, while people suffering from depression also have a higher chance of developing DM (25). Women with DM have been reported to have a more than twofold higher risk of being diagnosed with depression compared to women without DM, while the effect is significantly smaller in men (26). The mechanism for this disparity is still unclear, but it may be due to differences in risk, glucose tolerance, and insulin sensitivity between sexes. With regards to the risk of DM, men have been reported to have a lower age and BMI at the time of diagnosis, whereas women have been more related to obesity (27). In addition, obesity has been reported to have a stronger link with depression in women than in men, which is due to behavioral and psychosocial impairment and hypothalamic–pituitary–adrenal axis dysfunction, a stress regulation problem related to psychiatric disorders (27, 28). We also found that the female participants with high BMI had an increased risk of depression, whereas the risk was not significant in the male participants. In response to oral glucose tolerance tests, men often have impaired fasting glucose while women usually have impaired glucose tolerance (29). These differences may be associated with impairment in first- or second-phase insulin secretion, respectively, stimulated by glucose (30). Although insulin sensitivity and insulin secretion status are similar in men and women diagnosed with DM, the reduction in insulin sensitivity is greater in women than in men when the metabolic condition declines from normal to illness (27). Confounders of menopause including lower skeletal muscle mass, body fat distribution, and higher androgen activity and testosterone level, especially estrogen deficiency, have also been linked to elevated insulin resistance and the risk of DM in middle-aged women (31, 32). Taken together, these mechanisms may partly explain the relationship between DM and depression in women.

Another important finding of this study is the significant interaction between sex and alcohol and smoking history on depression, and the association was stronger in the female participants than in the male participants. Many studies have postulated a positive association between substance use and depressive symptoms in young adolescents, and that this association is more pronounced in girls (33, 34). In middle-aged and older adults, smoking has been associated with a 20% higher risk of developing depression, while those with depression

TABLE 2 Determinants for depression using multivariable logistic regression analysis in all study participants ($n = 121,601$).

Parameters	Depression		
	Multivariable		
	OR	95% CI	*p*
Age (per 1 year)	1.012	1.008–1.016	<0.001
Female (vs. male)	2.578	2.319–2.866	<0.001
DM	1.669	1.447–1.925	<0.001
Hypertension	1.399	1.272–1.539	<0.001
Systolic BP (per 1 mmHg)	0.991	0.989–0.994	<0.001
Diastolic BP (per 1 mmHg)	1.005	1.001–1.010	0.022
Smoking history	1.978	1.826–2.142	<0.001
Alcohol history	1.106	0.985–1.241	0.087
Regular exercise habits	1.013	0.949–1.082	0.703
Education status			
Lower than elementary school	Reference		
Middle and high school	1.236	1.076–1.419	0.003
Higher than college	1.063	0.922–1.225	0.403
Living alone	1.734	1.586–1.897	<0.001
BMI (per 1 kg/m^2)	1.010	1.000–1.019	0.041
Laboratory parameters			
HbA1c (per 1%)	0.917	0.874–0.963	0.001
Hemoglobin (per 1 g/dL)	1.002	0.977–1.027	0.899
Triglyceride (per 10 mg/dL)	1.005	1.003–1.008	<0.001
Total cholesterol (per 1 mg/dL)	1.001	1.000–1.002	0.006
eGFR (per 1 mL/min/1.73 m^2)	0.996	0.995–0.998	<0.001
Uric acid (per 1 mg/dL)	0.944	0.917–0.972	<0.001

Values expressed as odds ratio (OR) and 95% confidence interval (CI). Abbreviations are the same as in Table 1.
Adjusted for age, sex, diabetes, hypertension, systolic and diastolic blood pressures, smoking and alcohol history, regular exercise habit, education status, living alone, BMI, HbA1c, hemoglobin, triglyceride, total cholesterol, eGFR and uric acid.

have been reported to have 41 and 18% higher risks of starting to smoke and heavy drinking, respectively (35). In addition, any amount of alcohol consumption has been associated with a greater increase in depressive episodes in women than in men, especially with the synergistic effects of smoking (36). Possible mechanisms for the relationship between smoking and depression include the self-medication hypothesis, alternative hypothesis, bidirectional relationship, or there may be no relationship at all (37). Smoking may be a way to alleviate the symptoms of depression or keep individuals in a vulnerable state to environmental stress by regulating the hypothalamic–pituitary–adrenal axis (38, 39). It could also be a bidirectional relationship, or just a consequence of sharing common risk factors so that there is actually no direct relationship. With regards to the influence of alcohol use on depression, previous studies have suggested that a bidirectional and mutually reinforcing relationship may explain the correlation between alcohol use disorders and major depression (40). The association may be due to psychosocial impairment resulting from chronic heavy drinking that eventually elicits depressive symptoms or affects the release of neurotransmitters such as dopamine and gamma-aminobutyric acid receptors (41). Taken together, an increased risk of depression related to smoking and alcohol consumption has been reported in females of all ages due to the influence of psychosocial, biological, and environmental factors.

Another interesting finding of the present study is the negative correlation between eGFR and depression found in the female participants but not in the male participants. Depression has been associated with poor clinical outcomes of chronic kidney disease (CKD), including faster eGFR decline, early dialysis therapy initiation, death, or hospitalization (42, 43). In adults with normal kidney function, the presence of depressive symptoms has also been associated with a higher risk of rapid kidney function decline (44). The mechanism for this relationship is unclear, but it may be related to inflammation or stress-related physiological changes. Previous studies have reported that patients with kidney disease have higher levels of interleukin-6 (IL-6) and C-reactive protein, which are both considered to be related to the severity of depression due to increased production through various pro-inflammatory

TABLE 3 Association of risk factors with depression using multivariable logistic regression analysis in different sex.

Parameters	Male (n = 43,699)			Female (n = 77,902)			Interaction p
	Multivariable*			Multivariable#			
	OR	95% CI	p	OR	95% CI	p	
Age (per 1 year)	1.015	1.008–1.023	<0.001	1.006	1.001–1.012	0.031	0.265
DM	1.524	1.179–1.971	0.001	1.753	1.476–2.082	<0.001	0.047
Hypertension	1.403	1.187–1.659	<0.001	1.420	1.263–1.595	<0.001	0.084
Systolic BP (per 1 mmHg)	0.989	0.983–0.995	<0.001	0.992	0.989–0.995	<0.001	0.082
Diastolic BP (per 1 mmHg)	1.008	0.999–1.016	0.091	1.004	0.999–1.010	0.089	0.295
Smoking history	1.395	1.218–1.597	<0.001	2.323	2.115–2.551	<0.001	<0.001
Alcohol history	1.006	0.859–1.178	0.941	1.348	1.141–1.598	<0.001	<0.001
Regular exercise habits	0.997	0.874–1.138	0.963	1.013	0.939–1.093	0.735	0.859
Education status							
Lower than elementary school	Reference			Reference			
Middle and high school	1.384	0.939–2.039	0.101	1.231	1.060–1.428	0.006	0.524
Higher than college	1.283	0.873–1.888	0.205	1.045	0.895–1.221	0.576	0.123
Living alone	1.876	1.541–2.283	<0.001	1.661	1.501–1.838	<0.001	0.374
BMI (per 1 kg/m^2)	1.003	0.983–1.023	0.781	1.011	1.000–1.020	0.044	0.022
Menopause in female	–	–		1.189	1.070–1.321	0.001	
Laboratory parameters							
HbA1c (per 1%)	0.899	0.824–0.980	0.016	0.921	0.868–0.978	0.007	0.063
Hemoglobin (per 1 g/dL)	1.020	0.967–1.077	0.462	0.986	0.958–1.015	0.350	0.688
Triglyceride (per 10 mg/dL)	1.005	1.001–1.009	0.021	1.007	1.003–1.011	0.001	0.033
Total cholesterol (per 1 mg/dL)	1.001	0.999–1.003	0.317	1.001	1.000–1.002	0.024	0.422
eGFR (per 1 mL/min/1.73 m^2)	1.001	0.997–1.004	0.738	0.996	0.994–0.997	<0.001	0.001
Uric acid (per 1 mg/dL)	0.918	0.873–0.965	0.001	0.951	0.917–0.986	0.006	0.004

Values expressed as odds ratio (OR) and 95% confidence interval (CI).

*Adjusted for age, sex, diabetes, hypertension, systolic and diastolic blood pressures, smoking and alcohol history, regular exercise habit, education status, living alone, BMI, HbA1c, hemoglobin, triglyceride, total cholesterol, eGFR and uric acid.

#Adjusted for age, sex, diabetes, hypertension, systolic and diastolic blood pressures, smoking and alcohol history, regular exercise habit, education status, living alone, BMI, HbA1c, hemoglobin, triglyceride, total cholesterol, eGFR, uric acid and menopause.

pathways and decreased clearance (45). On the other hand, higher levels of psychological stress have been shown to increase the progression of kidney function decline, which can also result in depression by affecting the immune and endocrine systems (46, 47). Sex differences have also been observed in the epidemiology of CKD, with a higher rate in women than in men. Women with CKD often suffer from a higher burden and stress, have a greater severity of symptoms, and handle the disease in a more emotional way, which can then predispose to the development of depression (48). However, further investigations are required to elucidate the underlying mechanism and the influence of depression on kidney function in people with normal kidney function.

We also noted that compared to lower than elementary school, educational level of middle and high school, not higher than college, were associated with depression. Studies have been revealed that education plays an important role in protection against depression with individuals receiving lower levels of education may have higher rates of depression. It was also indicated that adults with depression have lower educational aspirations and expectations and often their parents were also less educated (49). Education is often considered to influence health, not only depression, through mechanisms of economy, health behavior, social-psychology, and access to health care. Higher levels of educations provide better socioeconomic conditions, less unhealthy lifestyle, better coping skills of stressors and daily hassles, and better management of health problems (50). Interestingly, it was found that education has stronger health effects on women than men, especially on self-rated health (51). Taken together, education have an important relationship with depression; people with lower education level would have higher rate of experiencing depression.

The last important finding of this study is the significant interaction between sex and uric acid on depression, with low uric acid being more strongly associated with depression in the male participants than in the female participants. Previous studies have suggested an association between depression and lower levels of serum uric acid (52, 53). Meng et al. (53) reported that although the differences were small compared to normal controls, the change in serum uric acid was consistent between subtypes of depression. In addition, Black et al. (52) proposed that the lower levels may be related to a greater severity and longer duration of depressive symptoms. Uric acid is the end product of purine metabolism and also considered a strong peroxynitrite scavenger, and it plays a role in dealing with oxidative stress (54). Biological changes in purine metabolism and oxidative stress may be involved in the relationship with depression. The purinergic system has been linked to mood disorders through dysfunction driven by adenosine triphosphate and P2Y receptors, which regulate drive, cognition, appetite, sleep and mood (55). The excessive oxidative stress associated with depression can lead to increased consumption of uric acid as an antioxidant (56). Our results suggest that hyperactive purine degeneration with lower serum levels of inosine and guanosine and higher serum levels of xanthine may be associated with low uric acid in patients with depression (57). In addition, we found that low uric acid was more strongly associated with depression in the male participants than in the female participants. This disparity may be due to sex differences in oxidative stress, as women under chronic stress have been shown to have better antioxidative capacity, lower reactive oxygen species-induced damage, and estrogen-driven protection, resulting in lower consumption of uric acid (58, 59). Further studies on the sex-specific association between serum uric acid and depression are needed to elucidate the mechanism.

The key strengths of this research are that we included a large cohort of healthy community-dwelling participants, and the comprehensive control of confounding factors. However, several limitations should also be noted. As this study was cross-sectional it was not possible to determine how long each participant had depression, and consequently we could not conclude causal relationships between the risk factors and depression. Longitudinal studies are needed to investigate sex differences and incident depression. Second, the prevalence of depression in TWB is 3.6%, higher than previous reported 1.2% (2). However, data on the presence of depression were obtained from self-reported questionnaires, and depression was not verified by psychiatrist diagnosis, which may not be rigorous enough. In addition, it is possible that some participants took medications for hypertension, glucose, hyperuricemia and lipid control. However, data on such medications are not provided by the TWB. Therefore, we could not evaluate the effects of these medications on the association between laboratory data and depression. Another limitation is that we could not ascertain the severity of depression. Fifth, the enrolled participants were all ethnically Chinese, and thus caution should be taken when extending our results to other ethnicities. Finally, because the average age in the depression group is higher than non-depression group, cohort effect could not be excluded.

In conclusion, our results showed sex differences in the incidence of depression, and the female participants were significantly associated with depression compared to the male participants. Furthermore, we found sex differences in the associations among the risk factors with depression in this a large study of Taiwanese participants.

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 Institutional Review Board of Kaohsiung Medical University Hospital approved this study (KMUHIRB-E(I)-20210058). The patients/participants provided their written informed consent to participate in this study.

Author contributions

Conceptualization, methodology, validation, formal analysis, writing—review and editing, and supervision: HT, J-IL, J-HG, and S-CC. Software and investigation, resources, project administration, funding acquisition, and visualization: S-CC. Data curation: J-IL, J-HG, and S-CC. Writing—original draft preparation: HT, J-IL, and S-CC. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

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

Publisher's note

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The psychological impact of Early Pregnancy Loss in Portugal: incidence and the effect on psychological morbidity

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Introduction: Worldwide, up to a quarter of all recognized pregnancies result in Early Pregnancy Loss (EPL), also known as miscarriage. For many women, this is a traumatic experience that leads to persistent negative mental health responses. The most common morbidity reported in studies from different countries is complicated grief, usually comorbid with depression, anxiety, and Post-Traumatic Stress Disorder (PTSD). To our best knowledge, no studies characterizing the psychological impact of EPL have been made in Portugal.

Methods: An online survey was conducted to evaluate clinical symptoms of perinatal grief, anxiety, depression, and PTSD in women who suffered a spontaneous loss within 20 weeks of gestation. Out of 1,015 women who answered this survey, 873 were considered eligible, and subsequently distributed in 7 groups according to the time passed between their loss and their participation in the study.

Results: The proportion of women showing symptoms of all comorbidities was greater in those whose loss had happened within a month, and there was a significant gradual decrease over time in scores and proportions of clinical perinatal grief and PTSD. In terms of depression symptoms, scores dropped significantly in the group whose loss occurred 13–24 months before their participation but proportions oscillated without great changes in the other groups. Regarding anxiety, there were small oscillations, but there was no significant decrease of symptoms over time.

Discussion: Overall, despite a general drop in scores for most morbidities over time, substantial proportions of women showed persistent symptoms of clinical morbidities 3 years or more after the loss. Therefore, it is essential to promote monitoring of possible complicated responses to the event, to provide appropriate and timely intervention to those women in need.

KEYWORDS

Early Pregnancy Loss, miscarriage, perinatal grief, depression, anxiety, PTSD

1. Introduction

In the last decades, several studies performed in different parts of the world have reported that 15 to 25% of all recognized pregnancies end up in Early Pregnancy Loss (EPL) (1). Further, the World Health Organization has reported that approximately one in every four confirmed pregnancies ends in loss before the 28th week of gestation (2). No consensus exists on whether losses are considered Early Pregnancy Losses before the 28, 24, or 20th week of gestation. However, here it will be defined as the fetal demise and removal from the womb at or before the 20th week of gestation (1, 3). Knowing the actual incidence is challenging, as many early losses are not accounted for. In the particular case of Portugal, the National Statistics Institute (INE) only classifies fetal deaths as before or after 32 weeks of gestation. Even though 40% of fetal deaths correspond to losses at a gestational age of 32 weeks or less (4, 5), it is unclear how many correspond to losses at or before the 20th week of gestation.

The physical risks to the mother's well-being are low in cases of EPL if appropriately managed (6). Nevertheless, an invasive medical procedure is required in some cases, which could be perceived as physical trauma (6, 7). In a study performed by Beutel et al. (8), 48% of the women participating had no significant emotional reactions the first days after the loss, but more recent studies support that a significant number of women end up experiencing very sad feelings after pregnancy loss in general, and for some, these emotions can be very intense (3, 9, 10). Feelings of shock, stress, guilt, anger, distress, confusion, sleep and eating disturbances, loneliness, low self-esteem, hopelessness, and helplessness are among the most commonly reported (11). Several reviews and/or meta-analytic studies have shown that, while many women who suffered an EPL cope with their loss naturally and without complications, it can lead to negative mental health responses in about 25–50% of this population (6, 12, 13).

Grief is a normal response to the loss of a significant one, and it is characterized by feelings of sadness, sleep and eating disturbances, loneliness, longing, anger, and thoughts, memories, and images of the deceased (14). We usually cope naturally and adapt to the world without our loved one, but when grief disrupts the person's daily functioning, and causes social impairment, it is considered Complicated Grief (CG) (15). Previous studies suggest that high levels of grief remain the first few days or weeks after an EPL, but tend to reduce gradually after the 4 or 7th week, and may resolve about 3 or 4 months after the event (Lee and Slade, 1996) (16–18). However, other studies have shown that, despite a typical decline 6 months after the loss, intense feelings of grief can persist 2 years or more (19, 20). A population studied by Krosch et al. (21) with a mean time after the loss of 4 years, showed a proportion of 57% with clinically significant levels of perinatal grief; and a later study by deMontigny et al. (22), which compared mean scores of perinatal grief in women whose miscarriage had occurred 0–6 months, 7–12 months, 1–2 years, and over 2 years before, reported that the scores of perinatal grief did not vary significantly over time.

After an EPL, grieving women tend to show high levels of other comorbidities, the most reported being depression, anxiety, and post-traumatic stress disorder (PTSD) symptoms (22–26). Clinical depression and anxiety, commonly comorbid and thus often mentioned together, are likely to have their first episode triggered by a psychosocial stressor, such as what can be experienced with an Early Pregnancy Loss (27). Some studies have reported short-term anxiety to affect approximately 20–40%, and depression 15–55% of women who have suffered an EPL (28, 29). A more recent study showed even greater morbidity, with 73% of their sample presenting symptoms of depression, and 100% with moderate symptoms of anxiety (30). These studies seem to support some early studies reporting that anxiety might be more frequent and have higher morbidity than depression in this population (18, 31). However, another study reported that, while 10.5% of their sample showed symptoms of depression, 6.8% showed symptoms of anxiety (32). Furthermore, a number of studies have shown that depression and anxiety symptoms can prevail, not only in the immediate weeks after the loss but as far as 6 months, 1, or even 3 years after an EPL.

Focusing on anxiety, some studies have shown that anxiety levels decreased over time, more specifically within 4 weeks and 9 months after the event (18, 24, 25). Nevertheless, other studies have reported no significant changes in the frequency or mean scores of anxiety symptoms within a week and 2–5 years after the loss (22, 33, 34).

Regarding depression, studies have shown that 16–22% of women present symptoms of clinical depression within the first month post-loss, which are significantly reduced 3–4 months after the loss (18, 24, 34, 35). Some studies have investigated the incidence of depression symptoms covering even longer timeframes. An early study covering a timeline from 2 weeks to 6 months after the loss, reported that about 36% of their participants showed moderate-to-severe depression symptoms 2 weeks after the loss, a proportion that gradually decreased but remained relevant 6 months after the loss, with almost 11% of the latter experiencing major depression (36). A relatively recent study covering a slightly longer timeframe reported more modest frequencies, with 10% of their sample showing symptoms of moderate/severe depression at 1 month, and presenting a small decline to 7% at the 9-month mark (25). Other studies have focused on emphasizing the reduction of depression symptoms over time, reflecting on the mean scores over time shown in their samples rather than the frequency of clinically significant cases. The study of deMontigny et al. (22) showed that women who experienced EPL within the past 6 months had higher scores of depressive symptoms than those who experienced it between 7 and 12 months, 1–2 years, or over 2 years ago. Further, an earlier study performed by Broen et al. (33) extended their time frame to the span of 5 years and reported a decrease in depression scores when compared to 10 days after the loss. Interestingly, despite not reaching scores or proportions as high as those seen in the first 3–6 months post-loss, some studies have reportedly shown a slight spike or increase in depression symptoms 1–2 years after the loss, disrupting the generally gradual decline (22, 37).

Finally, symptoms of Post-Traumatic Stress Disorder (PTSD) are also often observed in women that underwent an EPL. PTSD can be defined as a trauma resulting from exposure to a threatening event that causes profound discomfort, and it is characterized by avoidance, numbing, the presence of intrusive thoughts, hyperarousal, and hypervigilance for an imminent traumatic event (38, 39). For women that undergo EPL, hospitalization, pain, the sole sight of blood, fetal tissue, the fetus, or even the subjective perception that a baby is dying inside the womb can be traumatic enough for the appearance of PTSD symptoms (24, 40). Recent studies suggest that around 10–45% of these women show symptoms of post-traumatic stress disorder (39, 41). Regarding its persistence in time, an early study by Engelhard et al. (42), reported that symptoms of PTSD were visible in 25% of their sample at the 1-month mark, and had substantially decreased by the 4-month mark. Further studies have indicated the persistence of PTSD symptoms at 1 month, 9 months, and even years after the loss, and others have brought evidence of a gradual decline of PTSD symptoms 1–9 months after the event (21, 24, 25).

The psychological effects beforehand described are sometimes overlooked by overexposed clinicians, which has led, in some cases, to negative outcomes in terms of quality of life, physical health, ability to work, depression and anxiety in subsequent pregnancies, among others (22, 24, 43). For instance, EPL has been linked with an increased risk of avoidant behaviors (e.g., alcohol and drug dependence), sexual dysfunction, and couple separation (8, 40, 44). Hence, characterizing or having actual data on the impact of EPL on the mental health of women in different nations and cultures is key to understanding and highlighting the need for preventive interventions. To our best knowledge, no extensive studies on the psychological impact of EPL have been conducted in Portugal. In fact, the research found has been mostly focused on the parents' experience and feelings faced after the loss [e.g. (45, 46)]. Such studies have undoubtedly provided essential information to understand these women's emotional experiences, but generally provide no rigorous data regarding the actual proportions of these women that might be in need of help in terms of complicated psychological responses. Aiming to address these issues, we conducted an online survey to evaluate the psychological impact of EPL on women residing in Portugal, in terms of clinical symptoms of perinatal grief, depression, anxiety, and PTSD. In addition, we aimed at assessing how the intensity and persistence of these symptoms was modulated by the time passed since the loss to determine the influence of time on possible symptoms of clinical morbidities.

2. Materials and methods

2.1. Design and procedures

This was a descriptive cross-sectional research where we characterized the target population and compared the variables at a single point in time. This study had four dependent variables: the scores of depression, anxiety, perinatal grief, and PTSD symptoms. Our independent variable was the time passed since the miscarriage event, and it had seven levels according to the months passed since the loss: 0–1, 2–3, 4–6, 7–12, 13–24, 25–36, and 37 or more. Other variables were not considered for statistical analysis because they were collected for descriptive purposes only. We developed an online survey with a self-reporting questionnaire using Google Forms. The questionnaire was disseminated through ads on social networks, associations for support regarding fertility and pregnancy loss, and posters sent to the main Gynecology and Obstetrics units in the country for display. Data collection started on February 23, 2022 and ended on July 4, 2022. The participants were informed of the objectives of the study, the data collection procedure, and the tasks to complete. Further, we ensured the protection of their data and highlighted their right to quit the study at any time. Considering the online nature of the questionnaire, consent to participate in the study was obtained by ticking a checkbox. Only after this verification, the participants had access to the questionnaire. Whoever decided not to participate was taken to a check-out section. This study was approved by the Data Protection Committee (February 9, 2022) and the Ethics Committee (February 17, 2022—Number P27) of the University of Madeira.

2.2. Sample

This was a self-selecting sample of adult women who have suffered a pregnancy loss and were eligible to fill out the questionnaire if they met the following inclusion criteria: (1) Having suffered a pregnancy loss in the first 20 weeks of gestation, (2) Being ≥18 years old, and (3) Being a resident in Portugal. Participants were not eligible if they had (1) termination for medical reasons or (2) voluntary abortion. The survey was answered by 1,015 women. After the survey was closed, a close analysis of the responses obtained was performed. Out of the 1,015 respondents, 142 were excluded (8 for not being Portugal residents; 14 for suffering a pregnancy loss over the 20-week gestational age mark; 4 for carrying out a voluntary interruption of pregnancy; 6 for not providing key information or having faulty data; and 110 for undergoing a medical interruption of pregnancy), leaving a sample of 873 eligible responses. The 873 eligible responses were distributed as follows: Group 0–1, $n = 131$; Group 2–3, $n = 78$; Group 4–6, $n = 146$; Group 7–12, $n = 107$; Group 13–24, $n = 135$; Group 25–36, $n = 65$; and Group 37+, $n = 211$.

2.3. Materials

The online survey comprises clinically validated questionnaires and questions based on prior surveys in the field (11, 22). The survey was created under the expert judgment of co-authors with experience in perinatal mental health, who ensured content validity of the survey. The survey was composed of the following sections:

2.3.1. Socio-demographic and clinical data

Participants were asked for socio-demographic information such as their age, nationality, place of residence, profession, and others. It was also requested basic clinical information about previous pregnancies, fertility problems, diagnosed mental health issues, and any previous or recurring treatments. It was aimed at characterizing this population and identifying factors that could potentially influence the psychological impact of pregnancy loss.

2.3.2. The hospital anxiety and depression scale

It is a screening device for anxiety and depression that, despite its name, has proven to be valid in primary care and useful in psychiatric and psychological work (47, 48). Different studies have shown its internal consistency and satisfactory validity for populations of different ages and gender (49, 50). Its Portuguese translation by Pais-Ribeiro et al. has shown similar properties to the original and confirmed it as reliable and valid (47*). This instrument is used in hospital and clinical environments to measure levels of anxiety and depression symptoms using two scales: seven items to measure depression, and other seven items to measure anxiety. These are to be answered using a Likert scale of four points (0–3). After summing up all the items of each subscale, their score ranges from 0 to 21, being 0–7 considered normal, while 8–10 indicates symptoms of mild, 11–14 moderate, and 15–21 severe anxiety or depression (47).

2.3.3. Posttraumatic stress disorder checklist for DSM-5

This instrument has shown to be valid and reliable in both its initial evaluation and in more recent studies (53*, 51, 52), and it is the instrument of choice by the PTSD: National Center for PTSD of the U.S. Department of Veterans Affairs (53*). Its Portuguese version has also shown validity and reliability in assessing PTSD symptomatology (54). It evaluates post-traumatic stress symptoms, and is composed of 20 items corresponding to post-traumatic stress symptoms identified by the Diagnostic Statistical Manual of Mental Disorders—5th Edition (DSM-5). Respondents answer to what extent they were affected by each symptom the previous month on a five-point Likert scale (0–4). There are several rules for provisional diagnosis using this tool, but the National Center for PTSD indicates that a provisional diagnosis can be determined by: (1) summing all 20 items and using a cut-off score of 31–33; (2) a single item considered symptomatic if rated equal or above the cutoff point of 2 (moderately). Here we use the total score, with a score of 33 or higher indicating probable PTSD and that the participant may benefit from PTSD follow-up, while less than 33 indicates that the symptoms are subthreshold or do not meet the criteria for PTSD (55).

2.3.4. Perinatal grief scale—reduced version

This instrument has been validated worldwide for different types of pregnancy losses, showing high internal consistency (56–58). Its Portuguese version has also been validated with good levels of reliability (57). It evaluates the level of grief resolution after a pregnancy loss, fetal death, neonatal death, or ectopic pregnancy. It is composed of 33 items measured on a scale of five points (1–5). The final score is obtained by summing all the elements (with two reversed questions) and can vary from 33 to 165. It can be interpreted in different ways, but the general interpretation uses a threshold of 91 points, with a score of 91 or above considered to represent potential psychiatric morbidity (58).

2.3.5. Information about the loss

Participants were asked about their last pregnancy loss and the support received from their social network during the pregnancy and the loss process. It was aimed at registering relevant data about the loss such as rituals performed, the communication with their social environment, and the impact of the loss on their marital relationships, among others, to identify factors that could influence the psychological impact of the loss. The results of this section that are not related to the time passed since the loss are out of the scope of this paper.

2.3.6. Mental health responses in the context of the loss

This section addressed satisfaction with the hospital environment, the health practitioners' behavior, the information provided regarding psychological support after the loss, and others. The goal was to characterize the participants' feelings and thoughts on their hospital experience at the moment of the loss. The results of this section are out of the scope of this paper.

2.3.7. Lifestyle and leisure profile

Participants answered questions regarding the frequency they exercised, played sports, and other activities they perform to relax. It was aimed at recording the participants' preferences regarding leisure and distraction activities, which indicates the return to normality that is intended to be reached during the grief process. The results of this section are out of the scope of this paper.

The participants were informed that filling out this questionnaire would take approximately 20 min.

2.4. Data analysis

Categorical variables are presented as frequencies and/or percentages, while quantitative data are presented through their mean ± standard deviation. To carry out the analysis of the psychological impact the event had on the target population and its frequency in time after the event, the 873 eligible responses were distributed into seven groups based on the time that had passed between the EPL and their participation in the study: Group 0–1 (1 month or less); Group 2–3 (2–3 months); Group 4–6 (4–6 months); Group 7–12 (7 months to 1 year); Group 13–24 (1–2 years); Group 25–36 (2–3 years); and Group 37+ (over 3 years). One-way independent samples ANOVA tests were used to measure the effect of time after the loss on the scores obtained from the different scales, using time after the loss as the independent variable with seven levels (corresponding to the seven groups). Effect sizes are reported using eta squared. *Post hoc* multiple comparisons were performed, with a Bonferroni correction, to determine significant changes between time groups. When reporting the proportions of participants with above-threshold symptoms in the different dependent variables, the Pearson's Chi-square (χ^2) test was used to test for significance across proportions. All statistical analyses were done using SPSS (59) and the threshold for significance was set at 5% ($\alpha = 0.05$).

3. Results

3.1. Socio-demographic and clinical characterization

Regarding the socio-demographic data collected, the age of the participants ranged from 21 to 57 years ($M = 36.04$, $SD = 4.9$), 99% ($n = 864$) of the sample was white/Portuguese white/of European origin, 99% ($n = 864$) of Portuguese nationality, and 98.6% ($n = 861$) non-migrants (Table 1). All the districts and autonomous regions of Portugal were represented. A majority of 88.9% ($n = 776$) were married or in a civil union/domestic partnership and 8.8% ($n = 77$) were single. 61.7% ($n = 539$) had living children. 80.2% ($n = 700$) had higher education, 93.2% ($n = 814$) were employed, and 96.6% ($n = 843$) earned more than the minimum wage.

Data collected on some basic clinical and mental health characteristics showed that most of our sample (69.2%, $n = 604$) reported to have had only one loss up until their participation in this study. 84.4% ($n = 737$) had never been diagnosed with any infertility issues, and a majority of 86.5% (755) of the sample had never gone through any Medically Assisted Reproduction (MAR) technique to get pregnant. The self-reported mental health history collected showed that 71.4% ($n = 623$) had not been diagnosed with any mental health issue (e.g., anxiety or depression) by the time of their participation in this study, and that 62.4% ($n = 545$) had not received any mental health

TABLE 1 Socio-demographic and clinical data per time group, with the highest values in bold.

		Time since the loss						
		0–1	2–3	4–6	7–12	13–24	25–36	37+
Age		M = 34.89 (SD = 4.9)	M = 34.46 (SD = 4.5)	M = 33.75 (SD = 4.9)	M = 35.01 (SD = 4.8)	M = 36.32 (SD = 4.3)	M = 36.83 (SD = 4.6)	M = 39.02 (SD = 4.1)
Nationality	Portuguese	**98.5% (*n* = 129)**	**100% (*n* = 78)**	**100% (*n* = 146)**	**97.2% (*n* = 104)**	**99.3% (*n* = 134)**	**100% (*n* = 65)**	**98.6% (*n* = 208)**
	Others	1.5% (*n* = 2)	—	—	2.7% (*n* = 3)	0.7% (*n* = 1)	—	10.0% (*n* = 2)
Ethnicity	White/Portuguese	**97.7% (*n* = 128)**	**100% (*n* = 78)**	**100% (*n* = 146)**	**96.3% (*n* = 103)**	**98.5% (*n* = 133)**	**100% (*n* = 65)**	**100% (*n* = 211)**
	White/European origin							
	Black/Portuguese black/African descendant/ African origin	2.3% (*n* = 3)	—	—	1.9% (*n* = 2)	1.5% (*n* = 2)	—	—
	Asian/Portuguese Asian/Asian origin	—	—	—	—	—	—	—
	Gypsy/Portuguese gypsy	—	—	—	—	—	—	—
	Other	—	—	—	1.9% (*n* = 2)	—	—	—
Immigration Status	Immigrant	3.8% (*n* = 5)	—	—	2.8% (*n* = 3)	1.5% (*n* = 2)	—	0.9% (*n* = 2)
	Non-immigrant	**96.2% (*n* = 126)**	**100% (*n* = 78)**	**100% (*n* = 146)**	**97.2% (*n* = 104)**	**98.5% (*n* = 133)**	**100% (*n* = 65)**	**99.1% (*n* = 209)**
Marital Status	Married/Civil union	**86.3% (*n* = 113)**	**89.7% (*n* = 70)**	**90.4% (*n* = 132)**	**84.1% (*n* = 90)**	**91.1% (*n* = 123)**	**87.7% (*n* = 57)**	**90.5% (*n* = 191)**
	Divorced	2.3% (*n* = 3)	2.6% (*n* = 2)	0.7% (*n* = 1)	2.8% (*n* = 3)	—	1.5% (*n* = 1)	3.3% (*n* = 7)
	Single	11.5 (*n* = 15)	7.7% (*n* = 6)	8.9% (*n* = 13)	13.1% (*n* = 14)	8.9% (*n* = 12)	9.2% (*n* = 6)	5.2% (*n* = 11)
	Widow	—	—	—	—	—	1.5% (*n* = 1)	0.9% (*n* = 2)
Schooling	Primary education (Year 4)	—	—	—	—	—	—	—
	Primary education (Year 6)	—	—	—	—	—	—	—
	Lower secondary education (Year 9)	0.8% (*n* = 1)	2.6% (*n* = 2)	1.4% (*n* = 2)	1.9% (*n* = 2)	0.7% (*n* = 1)	—	0.9% (*n* = 2)
	Upper-secondary education	16.0% (*n* = 21)	14.1% (*n* = 11)	8.2% (*n* = 12)	13.1% (*n* = 14)	8.9% (*n* = 12)	6.2% (*n* = 4)	7.1% (*n* = 15)
	Vocational education	6.1% (*n* = 8)	1.3% (*n* = 1)	6.2% (*n* = 9)	11.2% (*n* = 12)	6.7% (*n* = 9)	3.1% (*n* = 2)	3.3% (*n* = 7)
	Higher education	**76.5% (*n* = 100)**	**82.1% (*n* = 64)**	**83.6% (*n* = 122)**	**72.8% (*n* = 78)**	**83.7% (*n* = 113)**	**90.8% (*n* = 59)**	**88.6% (*n* = 187)**
	Other	0.8% (*n* = 1)	—	0.7% (*n* = 1)	0.9% (*n* = 1)	—	—	—
Employment Status	Employed	**96.2% (*n* = 126)**	**94.9% (*n* = 74)**	**93.8% (*n* = 137)**	**94.4% (*n* = 101)**	**93.3% (*n* = 126)**	**87.7% (*n* = 57)**	**91.5 (*n* = 193)**
	Unemployed	3.8% (*n* = 5)	5.1% (*n* = 4)	6.2% (*n* = 9)	5.6% (*n* = 6)	6.7% (*n* = 9)	12.3% (*n* = 8)	8.5% (*n* = 18)
Wage	More than 705 euros	**93.9% (*n* = 123)**	**97.4% (*n* = 76)**	**97.3% (*n* = 142)**	**97.2% (*n* = 104)**	**97.8% (*n* = 132)**	**95.4% (*n* = 62)**	**96.7% (*n* = 204)**
	Less than 705 euros	6.1% (*n* = 8)	2.6% (*n* = 2)	2.7% (*n* = 4)	2.8% (*n* = 3)	2.2 (*n* = 3)	4.6% (*n* = 3)	3.3% (*n* = 7)
Living children	With living children	41.2% (*n* = 54)	44.9% (*n* = 35)	35.6% (*n* = 52)	**57.0% (*n* = 61)**	**70.4% (*n* = 95)**	**75.4% (*n* = 49)**	**91.5% (*n* = 193)**
	Without living children	**58.8% (*n* = 77)**	**55.1% (*n* = 43)**	**64.4% (*n* = 94)**	43.0% (*n* = 46)	29.6% (*n* = 40)	24.6% (*n* = 16)	8.5% (*n* = 18)

(Continued)

TABLE 1 (Continued)

		Time since the loss						
		0–1	2–3	4–6	7–12	13–24	25–36	37+
Number of pregnancy losses	One only	**69.5% (*n* = 91)**	**70.5% (*n* = 55)**	**78.1% (*n* = 114)**	**69.2% (*n* = 74)**	**56% (*n* = 76)**	**64.6% (*n* = 42)**	**72.0% (*n* = 152)**
	Two or more	30.5% (*n* = 40)	29.5% (*n* = 23)	21.9% (*n* = 32)	30.8% (*n* = 33)	43.7% (*n* = 59)	35.4% (*n* = 23)	28.0% (*n* = 59)
Pregnant at the moment	Yes	3.8% (*n* = 5)	14.1% (*n* = 11)	30.8% (*n* = 45)	**50.5% (*n* = 54)**	17.8% (*n* = 24)	13.8% (*n* = 9)	7.6% (*n* = 16)
	No	**96.2% (*n* = 126)**	**85.9% (*n* = 67)**	**69.2% (*n* = 101)**	49.5% (*n* = 53)	**82.2% (*n* = 111)**	**86.2% (*n* = 56)**	**92.4% (*n* = 195)**
Previous infertility diagnosis	Yes	18.3% (*n* = 24)	20.5% (*n* = 16)	11.6% (*n* = 17)	8.4% (*n* = 9)	20.7% (*n* = 28)	24.6% (*n* = 16)	12.3% (*n* = 26)
	No	**81.7% (*n* = 107)**	**79.5% (*n* = 62)**	**88.4% (*n* = 129)**	**91.6% (*n* = 98)**	**79.3% (*n* = 107)**	**75.4% (*n* = 49)**	**87.7% (*n* = 185)**
Has resorted to MAR techniques	Yes	14.5% (*n* = 19)	17.9% (*n* = 14)	13.0% (*n* = 19)	8.4% (*n* = 9)	17.8% (*n* = 24)	18.5% (*n* = 12)	10.0% (*n* = 21)
	No	**85.5% (*n* = 112)**	**82.1% (*n* = 64)**	**87.0% (*n* = 127)**	**91.6% (*n* = 98)**	**82.2% (*n* = 111)**	**81.5% (*n* = 53)**	**90% (*n* = 190)**
Previous mental health complication diagnosis	Yes	25.2% (*n* = 33)	20.5% (*n* = 16)	29.5% (*n* = 43)	27.1% (*n* = 29)	34.1% (*n* = 46)	29.2% (*n* = 19)	30.3% (*n* = 64)
	No	**74.8% (*n* = 98)**	**79.5% (*n* = 62)**	**70.5% (*n* = 103)**	**72.9% (*n* = 78)**	**65.9% (*n* = 89)**	**70.8% (*n* = 46)**	**69.7% (*n* = 147)**
Mental health treatment received	Received in the past and currently receiving	12.2% (*n* = 16)	19.2% (*n* = 10.3)	17.8% (*n* = 26)	13.1% (*n* = 14)	12.6% (*n* = 17)	15.4% (*n* = 10)	17.5% (*n* = 37)
	Received in the past but no longer receiving	24.4% (*n* = 32)	10.3% (*n* = 8)	21.2% (*n* = 31)	21.5% (*n* = 23)	26.7% (*n* = 36)	24.6% (*n* = 16)	22.3% (*n* = 47)
	Never	**63.4% (*n* = 83)**	**70.5% (*n* = 55)**	**61% (*n* = 89)**	**65.4% (*n* = 70)**	**60.7% (*n* = 82)**	**60% (*n* = 39)**	**60.2% (*n* = 127)**

treatment neither before or at the moment of participating in the study (Table 1).

3.2. Information regarding the loss

The participants were asked to provide information about their last instance of an EPL. The information reported by the participants showed that the lost pregnancy had been planned for 81.4% ($n = 711$) of our sample and it had been spontaneous (without recurring to MAR) for 91.1% ($n = 795$). The loss was of a one-embryo/fetus pregnancy for 95.6% ($n = 835$) of our sample. Finally, 77.5 ($n = 677$) of our sample reported the clinical cause of their loss to be unknown (Table 2).

3.3. Perinatal grief

The mean scores of perinatal grief were the highest in the group whose loss happened within a month. There was a significant effect of [$F(6, 866) = 7.67$, $p < 0.001$]. The effect size was small-to-medium, $\eta^2 = 0.051$. Multiple comparisons with the 0–1 months post-loss group indicated that the mean scores decreased significantly after the 4–6-month mark (Table 3).

We compared the different groups regarding the frequency that probable clinical levels of perinatal grief were found. A cut-off score of 91 was used to define whether the sample showed probable clinical levels of perinatal grief (58) (Figure 1). A chi-square (χ^2) analysis of the proportions of above-threshold Perinatal Grief across groups showed a significant difference, χ^2 (6, $N = 873$) = 34.5, $p < 0.001$. The effect size was medium, with $\phi = 0.20$. We observed greater proportions of clinical symptoms in the 0–1-month group that gradually decreased in the older groups, with a greater decrease after 4–6 months after the loss (Figure 1). From this point on, the frequency of clinical symptoms did not change much until a considerable drop was observed in the 25–36 months post-loss group. However, the decline in proportions did not continue in the 37+ months post-loss group, which showed a nearly 10% increase when compared to the 25–36 months post-loss group.

3.4. Anxiety

Regarding self-reported symptoms of anxiety, results show that the mean scores of anxiety symptoms are the highest in the group whose loss happened 7–12 months before participation, and the effect of time post-loss on anxiety scores was not significant [$F(6, 866) = 2.02$, $p = 0.06$]. The effect size was small, $\eta^2 = 0.014$ (Table 3).

To compare the percentage of individuals showing the presence of anxiety symptoms in each group, we used the following cut-off: mild (8–10), moderate (11–14), and severe (15–21) (47) (Figure 2). A chi-square (χ^2) analysis of the proportions of mild-to-severe symptoms of anxiety across groups showed no significant differences, χ^2 (18, $N = 873$) = 27.36, $p = 0.07$. The effect size was small-to-medium, with $\phi = 0.10$. Greater proportions of clinical symptoms of anxiety were observed in the 0–1-month group, being the majority moderate symptoms. After a decline in frequency in the 2–3 months post-loss group, there were no greater changes in numbers and, with the

TABLE 2 Self-reported information about the participants' last Early Pregnancy Loss instance per time group, with the highest values in bold.

		Time since the loss						
		0–1	2–3	4–6	7–12	13–24	25–36	37+
Planned pregnancy	Yes	**86.3% (*n* = 113)**	**85.9% (*n* = 67)**	**82.9% (*n* = 121)**	**81.3% (*n* = 87)**	**81.5% (*n* = 110)**	**73.8% (*n* = 48)**	**78.2% (*n* = 165)**
	No	13.7% (*n* = 18)	14.1% (*n* = 11)	17.1% (*n* = X)	18.7% (*n* = 20)	18.5% (*n* = 25)	26.2% (*n* = 17)	21.8% (*n* = 46)
Pregnancy process	MAR	11.5% (*n* = 15)	11.5% (*n* = 9)	9.6% (*n* = 14)	9.3% (*n* = 10)	9.6% (*n* = 13)	12.3% (*n* = 8)	4.3% (*n* = 9)
	Spontaneous	**88.5% (*n* = 116)**	**88.5% (*n* = 69)**	**90.4% (*n* = 132)**	**90.7% (*n* = 97)**	**90.4% (*n* = 122)**	**87.7% (*n* = 57)**	**95.7% (*n* = 202)**
Type of pregnancy	One embryo/Fetus	**97.7% (*n* = 128)**	**96.2% (*n* = 75)**	**97.9% (*n* = 143)**	**92.5% (*n* = 99)**	**97% (*n* = 131)**	**89.2% (*n* = 58)**	**95.3% (*n* = 201)**
	Twins	2.3% (*n* = 3)	3.8% (*n* = 3)	2.1% (*n* = 3)	7.5% (*n* = 8)	3% (*n* = 4)	10.8% (*n* = 7)	4.7% (*n* = 10)
Clinical cause of the loss	Unknown	**70.2% (*n* = 92)**	**79.5% (*n* = 62)**	**79.5% (*n* = 116)**	**79.4% (*n* = 85)**	**77% (*n* = 104)**	**81.5% (*n* = 53)**	**78.2% (*n* = 165)**
	Congenital and chromosomal anomalies	8.4% (*n* = 11)	6.4% (*n* = 5)	5.5% (*n* = 10)	5.5% (*n* = 6)	2.9% (*n* = 4)	3.1% (*n* = 2)	5.2% (*n* = 11)
	Maternal health problems	0.8% (*n* = 1)	—	0.7% (*n* = 1)	0.9% (*n* = 1)	1.5% (*n* = 2)	—	1.9% (*n* = 4)
	Pregnancy complications	—	—	0.7% (*n* = 1)	0.9% (*n* = 1)	—	—	—
	Fetal-fetus transfusion syndrome	—	—	—	—	—	3.1% (*n* = 2)	10% (*n* = 2)
	Ectopic pregnancy	6.1% (*n* = 8)	5.1% (*n* = 4)	4.8% (*n* = 7)	3.7% (*n* = 4)	5.9% (*n* = 8)	6.2% (*n* = 4)	4.7% (*n* = 10)
	Other	14.9% (*n* = 19)	9.1% (*n* = 7)	9.1% (*n* = 13)	10% (*n* = 11)	12% (*n* = 17)	9% (*n* = 6)	9.8% (*n* = 20)

TABLE 3 Mean scores per time group in the PGS, HADS Anxiety Subscale, HADS Depression Subscale, and the PCL-5 and significance.

	Time since the loss							
	0–1	2–3	4–6	7–12	13–24	25–36	37+	*p* value[1]
PGS	**M = 89.84 (SD = 24.39)**	**M = 79.63 (SD = 26.72)**	**M = 80.18 (SD = 26.13)***	**M = 77.90 (SD = 27.51)***	**M = 76.32 (SD = 24.13)****	**M = 70.38 (SD = 25.00)****	**M = 72.66 (SD = 24.21)****	**<0.001**
HADS anxiety	M = 8.98 (SD = 3.68)	M = 7.73 (SD = 4.15)	M = 8.45 (SD = 4.40)	M = 9.13 (SD = 4.30)	M = 7.73 (SD = 4.10)	M = 8.05 (SD = 4.36)	M = 8.42 (SD = 4.03)	0.061
HADS depression	**M = 6.42 (SD = 3.50)**	**M = 5.06 (SD = 3.88)**	**M = 5.73 (SD = 3.90)**	**M = 5.55 (SD = 3.80)**	**M = 4.82 (SD = 3.31)***	**M = 4.83 (SD = 3.55)**	**M = 5.69 (SD = 3.94)**	**0.011**
PCL-5	**M = 24.37 (SD = 13.68)**	**M = 20.36 (SD = 14.12)**	**M = 23.29 (SD = 15.42)**	**M = 21.49 (SD = 15.35)**	**M = 18.84 (SD = 13.90)***	**M = 16.92 (SD = 14.47)***	**M = 18.41 (SD = 12.99)***	**<0.001**

[1] *p* value results of one-way ANOVA tests.

*Significance of a value of *p* between 0.001 and 0.05 in *post hoc* comparisons to baseline (0–1).

**Significance of a value of $p < 0.001$ in *post hoc* comparisons to baseline (0–1).

exception of mostly moderate symptoms in the 7–12 and 37+ group, mild symptoms were more common, and cases of severe anxiety were very few across the groups (Figure 2).

3.5. Depression

Regarding depression symptomatology, the mean scores are the highest in the 0–1 months post-loss group (Table 3). There was a significant effect of time post-loss on depression scores [$F(6, 866) = 2.80$, $p = 0.01$]. The effect size was small, $\eta^2 = 0.019$. *Post-hoc* comparisons showed that in comparison to Group 0–1, the mean score is significantly lower in Group 13–24, only.

A comparison of the number of our participants showing above-threshold (mild-to-moderate) depression scores in each group based on the following cut-off scores: mild (8–10), moderate (11–14), and severe (15–21) (47) (Figure 3), showed no significant differences, $\chi^2 (18, N = 873) = 27.922$, $p = 0.06$ (25% with expected count less than 5). The effect size was small-to-medium, with $\boldsymbol{\phi} = 0.10$. The highest frequency of cases was found in the 0–1 months post-loss group, most corresponding to mild cases. A drop in cases can be seen in the 2–3 months post-loss group when compared to the 0–1 months post-loss group. Nevertheless, it was followed by greater proportions and oscillation among the groups with losses older than 3 months, with the second highest proportion in the 7–12 months, and the lowest in the 13–24 months post-loss group. Most timeframes showed a majority

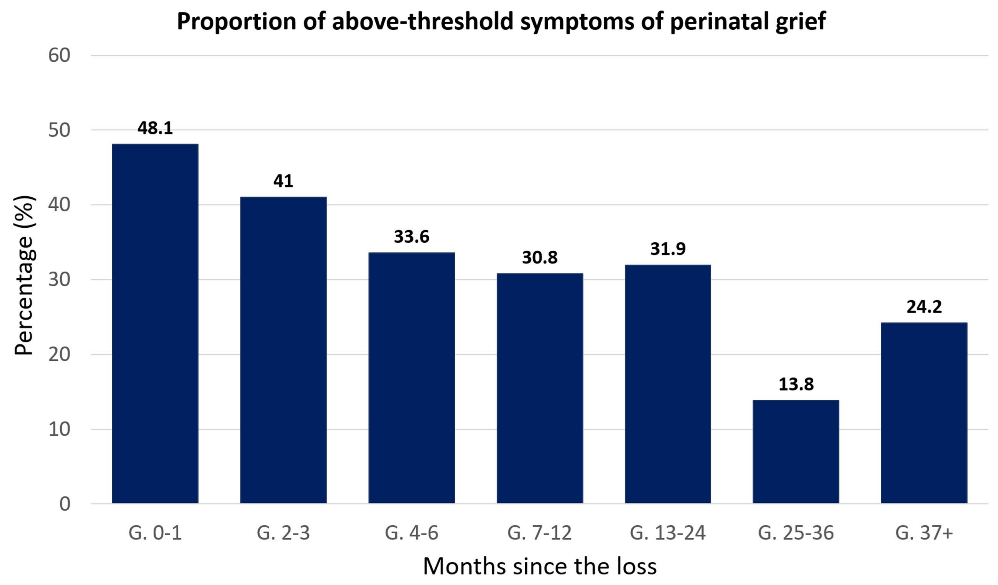

FIGURE 1
Bar chart representing the percentage of individuals showing above-threshold symptoms of perinatal grief, categorized according to the time passed between the loss and their participation in the study.

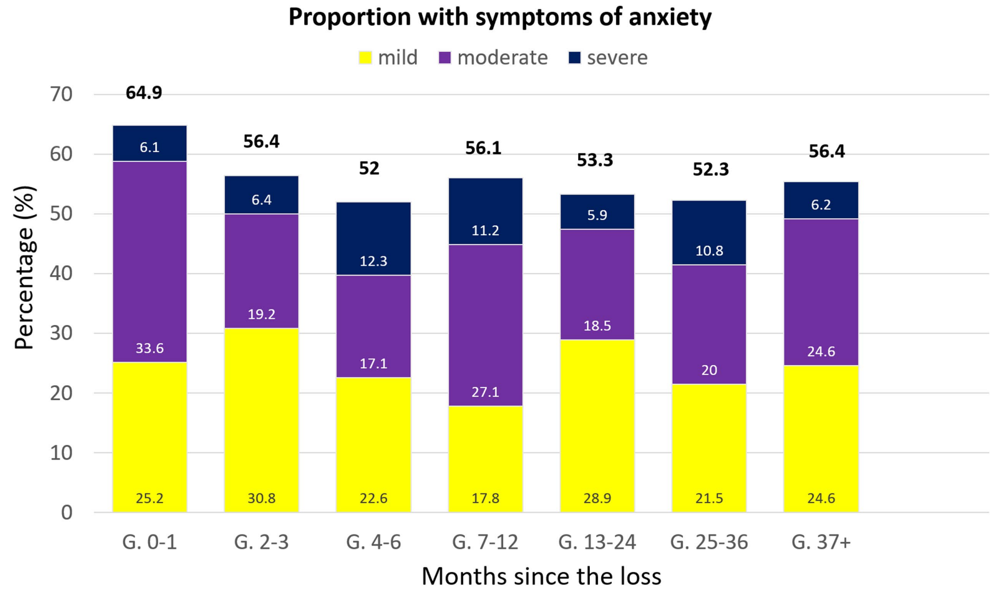

FIGURE 2
Bar chart representing the percentage of individuals showing above-threshold symptoms of anxiety, categorized according to the time passed between the loss and their participation in the study.

with mild symptoms, with only the 7–12 months post-loss showing the same percentage of mild and moderate symptoms. Proportions of severe symptoms of depression were very low in general.

3.6. Post-traumatic stress disorder

The mean scores of self-reported symptoms of PTSD indicate that the greatest mean score corresponds to the 0–1 months post-loss time frame. The effect of time post-loss on PTSD symptoms was significant [$F(6, 866) = 4.41$, $p < 0.001$]. The effect size was small-to-medium, $\eta^2 = 0.030$. In comparison to Group 0–1, the mean score decreased significantly after the 13–24 months mark (Table 3).

We compared the differences in proportions of individuals with probable PTSD within the groups, and a cut-off score of 33 in the PCL-5 was used (55). A chi-square (χ^2) analysis of the differences in frequency of Post-Traumatic Stress Disorder symptoms across groups showed significance, $\chi^2(6) = 14.5$, $p = 0.02$. The effect size was

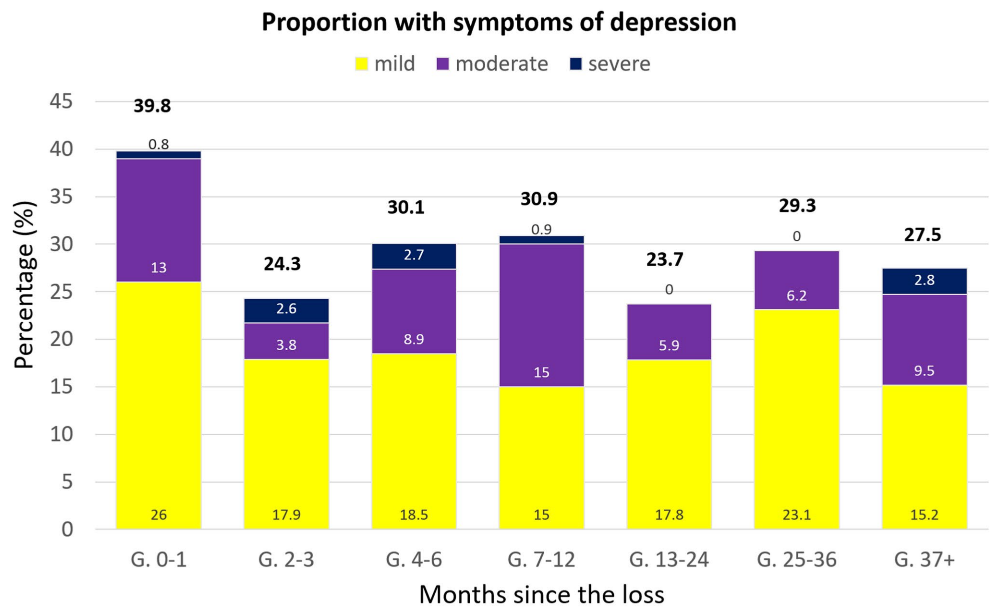

FIGURE 3
Bar chart representing the percentage of individuals showing above-threshold symptoms of depression, categorized according to the time passed between the loss and their participation in the study.

small-to-medium, with ϕ=0.13. It is visible that the highest number of cases corresponds to the 0–1 months post-loss group and they gradually decreased in the following groups until the fewest cases were found in the 37+ months post-loss group (Figure 4).

4. Discussion

Early Pregnancy Loss can be a devastating event for some parents. Even though most surpass their grief naturally, a non-neglectable proportion of women has shown detrimental mental health responses after the event, being complicated grief, depression, anxiety, and PTSD, the most common morbidities reported around the world. This study aimed to characterize the impact this kind of loss has had in Portugal-resident women in terms of the aforementioned clinical morbidities.

Regarding perinatal grief scores, our results showed that there was a significant effect of time on these scores, with significant reductions starting at the 4–6 months mark. These results differ from those obtained by the study performed by deMontigny et al. (22), where it was concluded that perinatal grief did not vary significantly according to the time after the loss. It is important to note that deMontigny's study, similarly to ours, was also cross-sectional and obtained data through a self-reporting online questionnaire, but they collected data from a smaller sample (231 women) and obtained slightly lower mean scores of perinatal grief for the 7–12 months, 1–2 years, and over 2 years marks in comparison (22). A closer look at the frequency of above-threshold scores of perinatal grief indicated that almost half of the population in our sample (48.1%) whose loss happened within 1 month showed potentially clinical symptoms of perinatal grief. These values are close to those obtained in a cohort study conducted in Sri Lanka (13) which assessed a sample of 137 women using the PGS, and whose results showed that up to 54% of their sample met clinical levels of perinatal grief at 6–10 weeks after EPL. The proportions of clinically relevant symptoms of perinatal grief in our sample gradually decreased, reaching their lowest point in the 25–36 months post-loss group. Nevertheless, almost a quarter (24.2%) of our sample whose loss occurred over 3 years ago showed scores above the cut-off levels. Interestingly, studies such as Krosch et al. (21) show much more concerning proportions, with 57% of their sample showing above cut-off levels of perinatal grief 4 years after the loss, a time when intense feelings of grief are expected to have resolved. On one hand, these results might suggest that a small but still important proportion of women who go through an EPL most likely had difficulties resolving their grief, still feeling deeply affected by the event even today, making follow-up evaluations essential to identify women in need of psychological support. On the other hand, this study was disseminated mostly online, which makes it susceptible to self-selection bias. This means that a proportion of women who have successfully resolved their loss or did not consider it a traumatic event might not have had interest in participating. As a result, women whose loss is still unresolved might be overrepresented in these groups whose loss happened over 3 years before.

When it comes to anxiety, our results revealed no effect of time since the loss on its scores. These results were similar to early studies carried out by Broen et al. and Nikcévic et al. which showed no significant changes in anxiety scores over time (18, 33). A more descriptive analysis of the proportions of clinical levels of anxiety in these groups indicate that, ranging from mild to severe, they remain above 50% even in the population whose loss happened 3 years before or over. Most of our population who had suffered the loss within 1 month had symptoms of moderate anxiety, while they were mostly mild in populations whose loss happened between 3 and 6 months before. Proportions of moderate-to-severe levels of anxiety symptoms at 1 and 3 months after the loss in our sample were quite similar to two studies carried out by Farren et al., common ranges being 30–40% at

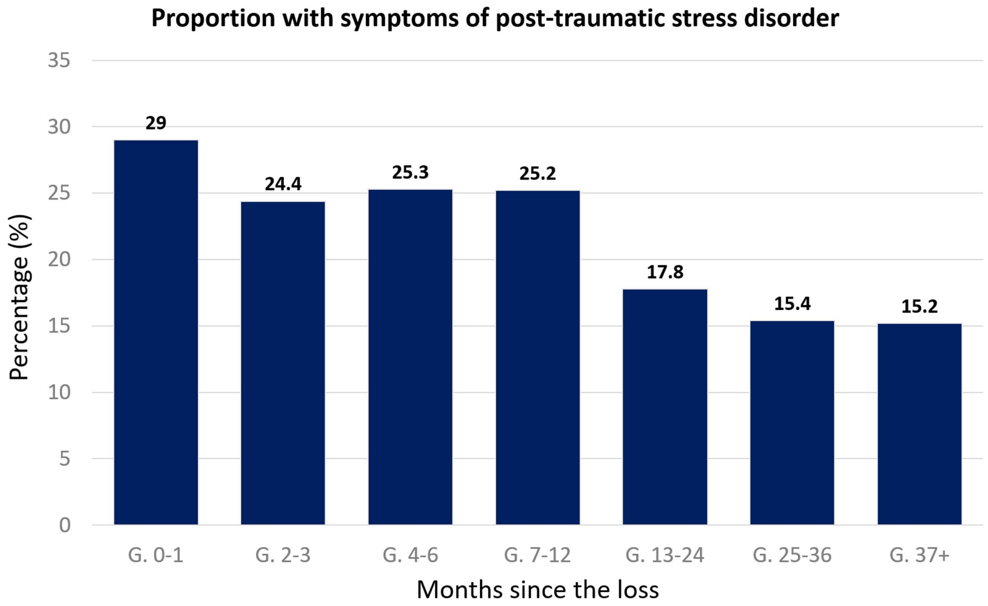

FIGURE 4
Bar chart representing the percentage of individuals showing above-threshold symptoms of post-traumatic stress disorder, categorized according to the time passed between the loss and their participation in the study.

1 month, and 20–26% at 3 months (24, 25). However, while the latter study by Farren et al. (25) showed a score of moderate-to-severe levels reduced to 22% at 9 months, our group whose loss happened between 7 and 12 months before showed an increase in proportions close to levels reported in the group of 0–1 months post-loss. Results obtained both in our study and in Farren et al.'s suggest that, in some cases, symptoms could spike in those months near the anniversary of the loss or when the baby could have been around a year old had the pregnancy succeeded. It is also worth to note how high these proportions are even though most women in all groups reported not having been previously diagnosed with any mental illness, a factor that has been associated to an increase in the likeliness of developing prolonged symptoms of psychological morbidities (60, 61). Even more concerning is the fact that most women in all groups reportedly never received any mental health treatment, which might explain the frequencies of above-threshold scores.

Regarding depression symptoms, our results showed a significant effect of time-after-loss in depression scores, with the only significant reduction in scores showing when comparing the 0–1 months post-loss group to the 13–24 months one. This significant reduction in depression symptoms might be related to the fact that most women in this group reported having living children, a factor that authors like deMontigny have associated to the reduction of depression scores (12, 22). However, this does not explain why this significant reduction is not visible in the other groups with older pregnancy losses, whose majority also reported having living children. Further, even though most in these groups reported having never received mental health support or treatment, over a quarter of the women whose loss happened within 7–12 months before participation reported having received mental health treatment in the past, which might have influenced this result. When analyzing the frequency of above-threshold scores of depression, there seems to be much less morbidity in comparison to anxiety, always present in less than 40% of all groups. Even though above-threshold scores of depression were found more frequently in the population whose loss happened within 1 month, it remains visible in a proportion of around 20–30% of women whose loss happened within 2 months or over 3 years before. Regardless of the time after the loss, most of these correspond to symptoms of mild depression. When it comes to the proportions of our sample showing symptoms of moderate-to-severe depression, our results are similar to a study performed by Farren et al. (24), referring specifically to the 1-month and 3 months mark. However, even though a more recent study by Farren et al. (25) showed a steady decline of moderate-to-severe levels of depression by the 9-month mark, our group whose loss happened within 7–12 months before showed a slight increase in proportions compared to 2–3 months, and even 0–1-month groups. Our results are, again, consistent with deMontigny et al.'s, who reported an increase in depression symptoms 1–2 years after the loss that disrupts the generally gradual decline (22, 25). Again, this spike in proportions might be related to the fact that a number of participants belonging to this group are likely close to the anniversary of the loss, a factor that could play part in an increase of stronger symptomatology. Altogether, our study provides evidence that symptoms of anxiety and depression could persist for 1–3 years after the event, stressing the need of periodical screening of these women's mental condition in order to detect complicated responses to the loss and provide support if needed.

The analysis of our sample revealed a significant decrease over time in the mean scores of PTSD symptoms, with the most significant decrease visible after the 13–24 months mark. When describing the different groups in terms of the frequency of above-threshold scores of PTSD symptoms, these are in accordance with what has been reported in the literature, although none of the studies found used the same instruments we did. A study by Farren et al. (24) has reported a proportion of 28% likely to meet the criteria for moderate-to-severe PTSD at 1 month, and 39% of women meeting such criteria 3 months after EPL, showing an increase in time. Regardless, in our study, the greatest proportion of women with symptoms of PTSD was found in the group whose loss happened within 1 month, similar but lower proportions appear in the groups whose loss happened between 2 months and 1 year before, and even lower proportions in the groups whose loss happened over 1 year before show symptoms. Our results, therefore, are more similar to those reported by a more recent study by Farren et al. (25), where the percentages decreased gradually from 1 month (34%), through 3 months (26%) to 9 months after the loss (21%). Nevertheless, we cannot ignore studies like Krosch et al 's (21), where out of a population with a mean time after the loss of 4 years, 43.9% showed symptoms of PTSD, indicating that the number of women showing relevant symptoms of PTSD years after the loss could be higher than commonly believed, possibly influenced by personal and/or environmental circumstances unique for each population. In a nutshell, despite a generally gradual decline, we cannot reject the possibility that a percentage of these women remain with high levels of PTSD long after the event and are in need of further psychological evaluation or even an intervention, making longitudinal screening of symptoms important to provide timely support for those in need and avoid severe deterioration of these women's mental health. Overall, the results for our sample in Portugal are generally in line with those from studies that took place in other parts of the world, and in different times and contexts, with the percentages of the population showing symptoms of clinical perinatal grief, depression, anxiety, and PTSD lying within those reported by other authors, and there seems to be an effect of time in the persistence of all morbidities, except anxiety. Our results are in accordance with other studies that showed no effect of time in the prevalence of anxiety symptoms, and its greater morbidity when compared with depression.

We believe that there are some factors that could have modulated our results. Most participants in all groups indicated that the clinical cause of their loss was unknown (70.2–81.5%), a factor that has been reported to influence negatively the parents' grieving, closure, and recovery process (18, 46). Additionally, other factors related to the event, such as the presence of social support, or the healthcare management, might have also played a part in the persistence of mental health complications in some individuals (22). deMontigny's work showed that the women's level of satisfaction with the health care received was significantly associated with reported symptoms of perinatal grief, anxiety, and depression (22). Therefore, this is an aspect that deserves future consideration. Factors related to the participants' clinical history might also be worth studying. For example, it would be interesting to analyze whether having had an earlier infertility diagnosis or having recurred to MAR techniques had an influence in those women who showed above-threshold symptoms of mental health morbidities. For instance, a study by Mutiso and colleagues showed that mode of conception strongly influenced the presence of depression symptoms after miscarriage (62). It is worth highlighting that some of these losses, specifically those that happened up to 2 years before the study, happened in the context of the COVID-19 pandemic. The WHO warned on its official website at the time, more specifically its regional office for Europe, that "the main psychological impact to date is elevated rates of stress or anxiety" (63). Further, lockdown measures were taken in many countries, including Portugal, which deeply disrupted people's routines and usual activities, to which the WHO expressed that "levels of loneliness, depression, harmful alcohol and drug use, and self-harm or suicidal behavior are also expected to rise" (64). Hence, in the context of the pandemic, not only social isolation and routine disruption might have been partially responsible for increased levels of depression and anxiety, but also some of these women might have suddenly lost family members and/or friends to the virus, situations likely to have a strong influence in the development of complicated grief or even PTSD symptoms.

This study has some limitations that need to be considered. The data were collected through an online survey. While this methodology is excellent for gathering a large sample that is geographically dispersed, and has also been used by other authors [e.g. (22)] when analyzing the effect of time, this comes from reports of different women in different moments after their losses. A longitudinal within-subjects study might have shown slightly different trends in the results. Furthermore, our data is strongly inclined to a specific population, with a majority of women in all groups being non-immigrant, white Portuguese, married, with higher education, employed, earning more than minimum wage, and resident in big cities like Lisbon and Porto. This means that women who are immigrants, from ethnic minorities, unemployed, earning a precarious wage, or living in less developed/countryside areas of Portugal are underrepresented in our sample. Additionally, many individuals who have suffered this kind of loss might have declined to take part in the study either because the event had no relevant effect on their lives, or because they might not have wanted to be reminded of such an unhappy event by the questionnaire. In fact, it is common that women with stronger symptoms of trauma avoid engaging in activities that make them confront the event of the loss (24). Hence, our results might be lacking insight into individuals belonging to the extremes of both sides of the spectrum.

The effect of Early Pregnancy Loss on women's mental health is an important but underserved area, especially in Portugal. Our findings have highlighted that, despite not being a majority, a proportion of women still show symptoms of clinical levels of PG 6 months or over a year after the event. Furthermore, symptoms of other comorbidities such as depression, anxiety, and PTSD are also prevalent in a few cases, regardless of the time since the loss occurred. Considering this, we believe that it is essential that follow-up consultations after EPL include more than a check-up on their physical health. Rather, follow-up consultations should include screenings of PG, anxiety, depression, and PTSD to help detect any possible development of adverse mental health responses to the loss. Even though high levels of these morbidities are normal to be found within the first weeks or months after the event, they should diminish or dissipate after 6 months, so we believe the period between six-month to one-year post-loss to be ideal for screening for cases that require further attention or might benefit from counseling or psychological support.

Despite the importance of providing follow-up to the mental well-being of women who have suffered EPL, health professionals may find different limitations to providing such a service, such as lack of time, training or any follow-up protocol to follow (Catlin et al., 2017(65); Litlemore et al., 2019 (66). Some studies in countries such as Canada, the United States, and the United Kingdom, have provided evidence of the significant impact that factors like childlessness, a history of mental health illness, lack of social support, or marital satisfaction have on these women's mental distress (22) (Barat et al., 2020) (67). Therefore, we believe that by paying special attention to the social situation and clinical history of these women, health practitioners would be able to at least prioritize mental health follow-up for women whose circumstances make them more prone to develop complicated mental health responses.

Finally, future studies should focus on the factors that may predict complicated mental health responses in Portugal. Through our study, we showed that time may not always "cure it all" and does not ensure mental well-being after a miscarriage. However, longitudinal studies on factors that might work as predictors of long-term complicated mental health responses still need to be studied in Portugal, especially because some may vary across cultures. For instance, infertility diagnosis might be a stronger predictor of declining mental health after a miscarriage in cultures where the woman's main value is procreation and family care.

Data availability statement

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

Ethics statement

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

Author contributions

DM, AF, and MC defined and designed the study and interpreted the results. DM collected and analyzed the data. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

Publisher's note

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Improving kidney care for people with severe mental health difficulties: a thematic analysis of twenty-two healthcare providers' perspectives

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Introduction: People with severe mental health difficulties (SMHDs) and concurrent kidney disease have less access to quality kidney care and worse clinical outcomes. Our research investigates the barriers and facilitators to effective kidney care for people with SMHDs, and how care might be improved for this underserved population.

Methods: We conducted semi-structured interviews with twenty-two physical (n=14) and mental (n=8) healthcare professionals with experience working with people with SMHDs and concurrent kidney disease. Interview data were analysed and interpreted using reflexive thematic analysis.

Results: Four themes were generated from the data: 1. *"It's about understanding their limitations and challenges, without limiting their rights"* describes how some people with SMHDs need additional support when accessing kidney care due to challenges with their mental state, motivation, cognitive difficulties, or mistrust of the healthcare system. 2. "*There are people falling through the cracks*" describes how the separation of physical and mental healthcare, combined with under-resourcing and understaffing, results in poorer outcomes for people with SMHDs. 3. "*Psychiatry is a black spot in our continuing medical education*" describes how many renal healthcare providers have limited confidence in their understanding of mental health and their ability to provide care for people with SMHDs. 4. "*When they present to a busy emergency department with a problem, the staff tend to go '...psych patient'*" describes how stigma towards people with SMHDs can negatively impact quality of care.

Conclusion: Healthcare professionals accounts' describe how people with SMHDs and kidney disease can have favourable outcomes if they have appropriate hospital, community and social supports. Findings indicate that effective management of kidney disease for people with SMHDs requires integrated physical and mental health care, which takes an individualised "whole person" approach to addressing the interaction between kidney disease and mental health.

KEYWORDS

kidney disease, mental health, mental illness, health inequities, schizophrenia, dialysis, transplantation, kidney failure

Introduction

People with severe mental health difficulties (SMHDs), including schizophrenia, psychosis, bipolar disorder and major depression, die an average of 15–20 years earlier than the general population (1). The majority of deaths in people with SMHDs are due to preventable physical conditions, such as diabetes, cardiovascular disease and kidney disease (2–4). There is growing evidence that unequal access to healthcare plays a critical role in this disparity. Numerous barriers to accessing healthcare for people with SMHDs have been identified, including cognitive functioning, lack of social support, difficulty communicating healthcare needs, and fear or suspiciousness towards healthcare providers (5). Pervasive stigma regarding SMHDs and the separation of mental healthcare from other medical services also contribute to this disparity (6).

Chronic Kidney Disease occurs when damage to the kidneys impairs their ability to filter blood. This results in the accumulation of excess waste and fluid in the body, leading to other health problems such as cardiovascular disease and stroke (7). Kidney failure, also known as end-stage kidney disease, occurs when the kidneys can no longer adequately filter the blood, and kidney transplant or dialysis are needed for survival. Kidney failure carries a substantial and unique burden in terms of self-management and adherence. People on haemodialysis must undergo treatment several times a week for 4 hours at a time, and restrict fluid intake to 500mls per day (8). Failure to attend even one session may be life-threatening (9). This, combined with treatment side-effects, can significantly impact quality of life and ability to work or engage in other activities (10). Additionally, people on haemodialysis must adhere to a strict diet to prevent health complications. This diet can be extremely challenging, and restricts intake of foods high in sodium, potassium, phosphorous, protein and fluid (11). Kidney transplant is the optimal treatment for kidney failure as it increases survival and significantly improves quality of life (12). However, kidney transplant recipients must also be able to adhere to life-long medication regimens, lifestyle changes and medical appointments to sustain graft function (13).

The prevalence of kidney disease is higher in people with SMHDs (14). This is due to a range of factors, including the use of psychotropic medications such as lithium, as well as higher rates of smoking, type 2 diabetes and cardiovascular disease (14–20). However, available data regarding the rates of SMHDs in people with kidney disease is limited. In the United States, rates of psychiatric hospitalisations are 1.5 to 3 times higher in people with kidney failure compared to those with other chronic illnesses (21), and 27% of Medicaid-enrolled adults with kidney failure have been hospitalised with a psychiatric diagnosis (22). Recent data from Ireland suggests the prevalence rates of bipolar disorder, psychosis and schizophrenia diagnoses in people with kidney disease are 2.2, 1 and 1%, respectively (23). However, as this study relied on self-report surveys, it likely underestimates the true prevalence of SMHDs in people with kidney disease.

After developing kidney disease, people with SMHDs also have poorer clinical outcomes and limited access to kidney care. People with kidney failure and co-occurring SMHDs have higher risk of mortality and hospitalisations, particularly through the emergency department (22, 24, 25). There is also evidence that people with SMHDs are more likely to die before reaching the later stages of kidney disease (26). Furthermore, people with SMHDs are less likely to receive a kidney transplant (19, 27). This is despite evidence that, following a careful selection process, people with SMHDs have comparable kidney transplant outcomes to those without SMHDs (28–30). People with kidney failure and co-occurring SMHDs are also less likely to receive appointments with renal clinicians (nephrologists) or erythropoietin prescriptions (26). Research in other long-term conditions illustrates that people with SMHDs often have difficulty adhering to medications, diet, and fluid restrictions (31). Given the significant burden of adherence in kidney disease (32), people with SMHDs likely experience specific challenges in receipt of kidney care.

Despite the higher risk for kidney disease in people with SMHDs and the observed poorer outcomes for this population, research investigating kidney care for people with SMHDs is limited. To our knowledge, the only published research in this field is a qualitative study exploring the experiences of renal nurses providing acute haemodialysis to people with SMHDs, which did not focus specifically on barriers or facilitators to care (33). Nurses in this study described working with people with SMHDs as "challenging," and identified staff shortages and lack of staff education regarding mental health as barriers to care. Participants described empathy and effective communication skills as facilitators to care, and expressed a need for more support from mental health teams. As healthcare providers work within healthcare systems and provide care to many patients over significant periods of time, they likely have insights into a range of barriers and facilitators to kidney care for people with SMHDs, as well as practical suggestions regarding how care for this population might be improved. As care for people with SMHDs is complex and multidimensional, research exploring the perspectives of a range of healthcare professionals from hospital and community settings is needed to inform the provision of kidney care for this population.

To better understand the barriers and facilitators to effective kidney care for people with SMHDs, we interviewed healthcare and mental healthcare professionals with experience working with people with SMHDs and concurrent kidney disease. It is hoped that our findings will contribute to improvements in kidney care for people with SMHDs and ultimately improve clinical outcomes for this underserved population.

We aimed to address two research questions:

A. What are the barriers and facilitators to effective kidney care for people with SMHDs, from the perspective of healthcare and mental healthcare providers?
B. How might kidney care for people with SMHDs be improved?

Methods

This study was conducted as part of a larger research project investigating kidney care for people with SMHDs. Design and implementation of the wider research project were influenced by a PPI advisory group of three individuals with kidney disease and concurrent mental health difficulties. We adopted a qualitative approach using semi-structured interviews. This ensured that participants were asked the same broad, open-ended questions related to barriers and facilitators to effective kidney care for people with SMHDs, while allowing flexibility to discuss issues other than those predetermined by the researchers. The interview schedule was developed based on existing literature regarding inequities in access to healthcare for people with SMHDs (5) and access to kidney care for people from other minority backgrounds (34). The schedule was then informed by guidance from the PPI advisory panel and a Consultant Nephrologist (KB) (See Supplementary Appendix A for interview schedule).

Background to pathway of care for kidney disease in Ireland

All people living in Ireland are entitled to receive healthcare though the public healthcare system, which is managed by the Health Services Executive (HSE). Both public and private healthcare services are available, and a minority of people with kidney disease have private consultations with nephrologists that are reimbursed by their private health insurance. However, the bulk of the costs are borne by the State, particularly for dialysis treatment (35). All adults with kidney failure in Ireland are under the clinical governance of 1 of 11 HSE renal units. In Ireland, people with kidney disease have access to a highly trained workforce of multi-disciplinary clinicians, and to the most modern equipment and medications (36).

Many people with kidney disease attend nephrology clinics for years before developing kidney failure. During this time, nephrologists monitor kidney function and slow the progression of kidney disease. In some cases, individuals first present to nephrology services with advanced kidney disease and require dialysis immediately. These late referrals or "crash landers" typically have worse health outcomes (37). Of the 5,148 people with kidney failure in Ireland, 52% have a functioning kidney transplant, the optimal treatment for kidney failure (35). However, not all people are eligible for transplant due to various reasons such as medical conditions or lack of suitable donors. Those who are not eligible for transplant must undergo dialysis to stay healthy. In Ireland, 41% of people with kidney failure are treated by centre-based haemodialysis, and 6% by home-based modalities (peritoneal dialysis or home haemodialysis) (35). Most people waiting for a kidney transplant will be on dialysis, although some can undergo a pre-emptive transplant before requiring dialysis. A retrospective study indicated that 45% of people transplanted in Ireland between 1996 and 2000 had their kidney transplant last for 15 years or more (38). After the graft fails, people typically return to dialysis. Some individuals are subsequently able to receive additional kidney transplants after graft failure.

System of care for SMHDs in Ireland

As a result of recent changes in mental health policy, almost all of the larger psychiatric hospitals in Ireland have been closed and replaced with smaller acute inpatient units and community-based mental health services (39, 40). However, there is frequent criticism that community mental health teams in Ireland are not developed or resourced enough to provide adequate community support, and have significant regional variation and inadequate multidisciplinary input (41, 42). There is also still a significant number of individuals with SMHDs who are repeatedly admitted to acute inpatient units and spend significant periods of time there (43). In response, specialist rehabilitation units were commissioned in 2018, to provide specialist inpatient rehabilitation and recovery services to people with SMHDs with ongoing complex needs (40). However, there is an absence of intensive care high support hostels, crisis houses, and specialist rehabilitation units in each regional area (43).

Participants

Twenty two professionals from physical healthcare ($n = 14$) and mental health ($n = 8$) were recruited through three Dublin-based hospitals and the Irish Kidney Association (see Table 1 for participant demographics). The study was advertised in three Dublin-based hospitals and through the Irish Kidney Association, inviting healthcare professionals with experience working with people with kidney disease and co-occurring SMHDs to participate. Snowball sampling was also used, whereby participants referred other potential participants who had experience working with this population. The inclusion criteria were that the participant must be a healthcare or mental healthcare provider who has experience working with people with kidney disease and co-occurring SMHDs; be fluent in English; and able to provide informed consent.

Procedure

This study was approved by the University College Dublin Research Ethics Committee (HS-21-19- Cogley-Dalton). Participants completed a semi-structured interview with the first author (CC), in a quiet room or *via* a teleconferencing platform. The interviewer did not know the participants and there was no monetary compensation for participation. Interviews took place between August 2021 and May 2022, and lasted 35–120 min ($M = 53$ min). Interviews were digitally recorded and transcribed verbatim.

Analysis

Interviews were analysed using thematic using reflexive thematic analysis, using an adapted version of the procedures described by Braun and Clarke (44–46) (See Table 2 for a detailed description of procedures). Thematic analysis was chosen for its

TABLE 1 Summary of participant demographics.

Age	Mean: 44.66 years; Range: 28–68 years; SD: 10.46
Gender	16 female; 8 male
Role	4 Nurses in Haemodialysis
	3 Consultants of Liaison Psychiatry
	3 Clinical Nurse Specialists in Nephrology
	2 Consultants of Nephrology
	2 Registrars in Nephrology
	2 Dieticians in Nephrology
	2 Counselling Psychologists in Nephrology
	1 Consultant of Immunology
	1 Liaison Psychiatric Nurse
	1 Community Mental Health Nurse
	1 Clinical Psychologist in Nephrology
	1 Physiotherapist in Nephrology
Time spent in role	Mean: 8.3 years; Range: 6 months – 38 years

ability to analyze and capture the diverse experiences of participants with different roles (47). Analysis was conducted within a critical realist framework (48), interpreting participants' accounts as "real" without rendering them independent of the cultural, disciplinary or political context in which they occurred. The use of thematic analysis was descriptive and sought to "stay close" to participants' descriptions. We adopted a predominantly inductive approach, by open-coding data and emphasising data-based meaning. A degree of deductive analysis was employed to ensure the themes were relevant to the research questions (see Figure 1). Braun and Clarke describe their approach to thematic analysis as "reflexive" as it emphasises the active role of the researcher in the interpretation and generation of themes (49). Their gauges of quality include researcher reflexivity, systematic and rigorous coding, and theoretical knowingness (46). To monitor the impact of assumptions and biases throughout data collection and analysis, CC kept a reflexive journal and discussed her reactions and assumptions with two academic supervisors who work in Clinical Psychology (PD and JB). CC is a PhD researcher with a background working in health psychology. CCa is a post-doctoral researcher with background training in mental health nursing and with multiple years of experience working with people with SMHDs and people with kidney disease.

TABLE 2 Process of thematic analysis.

Phase	Process and author involvement
Phase 1: Data familiarisation	CC conducted interviews, keeping notes of insights and impressions. Interviews were transcribed verbatim. CC removed potentially identifying information and assigned pseudonyms to participants. CC read the data multiple times to facilitate deep familiarisation, and discussed impressions with JB and PD
Phase 2: Coding	CC and CCa independently and systematically conducted open coding and subsequently discussed findings, to foster reflexivity, enhance understanding, and improve "trustworthiness" of the analysis. Coding was an iterative process, staying close to participants' accounts and primarily focusing on semantic meaning. Codes were stored and organized using NVivo 12 software
Phase 3: Generating initial themes	CC generated initial themes relating to barriers and facilitators to kidney care for people with SMHDs, by clustering together related or similar codes based on patterns of shared meaning
Phase 4: Reviewing and refining themes	CC, CCa, PD and JB reviewed initial themes. Through discussion, themes were discarded or reworked until they were seen as providing a "good fit" with the data. CC reviewed the themes against the coded data and the entire dataset
Phase 5: Defining and naming themes	CC refined and developed the "story" of each theme and subtheme, finalising theme names and writing the results section in full. These were reviewed by other authors
Phase 6: Producing the report	CC selected illustrative extracts which other authors reviewed and agreed upon. CC wrote the final paper, with input from all other authors

Results

Four overarching themes were generated from the data, relating to barriers and facilitators to kidney care for people with SMHDs, and how kidney care might be improved for this population. A summary of the identified barriers and facilitators to care are illustrated in Figure 1.

"It's about understanding their limitations and challenges, without limiting their rights"

Participants reported that many people with SMHDs require additional support due to issues with their mental state, motivation and organisation, cognitive difficulties, or mistrust of the healthcare system. As the difficulties experienced by each person with a SMHD varies widely, participants emphasised the importance of understanding the specific needs of each individual, so they can be given appropriate support to access kidney care.

Fluctuating mental state impacts engagement in kidney care

Depression was described by renal healthcare providers as the most common mental health-related barrier to care, impacting peoples' ability to engage and adhere to treatment recommendations: "It becomes clear the reason why they are not able to do things at home is because they are so depressed they do not have any motivation to cook food." (Laura, dietician). Haemodialysis nurses reported that a number of their patients had died by suicide, and expressed concern about the high risk of death for people who miss dialysis or do not adhere to diet guidelines: "If they want to die, they know how to die. Just eat 10 bananas" (Lucas, Haemodialysis Nurse).

Participants also described how individuals experiencing mania or psychosis can struggle to sit through a full dialysis session. Nurses discussed the difficulties they face when administering haemodialysis to people with SMHDs who are restless or agitated: "That needle can dislodge and hurt the patient, so much blood goes everywhere. And the patient is at risk of dying." (Mia, Haemodialysis Nurse). In addition, some hold strongly held beliefs about their treatment or specific healthcare providers that can impact adherence:

> *People with bipolar, if they're a bit high, they say "There's nothing wrong with me. I don't need that."* – Liam, Liaison Psychiatrist

> *We have people who think dialysis will end up killing them, or if we give them a certain injection it will give them heart failure. And then they end up just refusing to show up to dialysis* – Elijah, Haemodialysis nurse

In addition to posing risks to their health, fluctuating mental state was described as a barrier to transplant for some people with SMHDs, as poor medication adherence and appointment attendance post-transplant is associated with high risk of kidney rejection. One nephrology consultant described the difficulty of weighing the

“It’s about understanding their limitations and challenges, without limiting their rights.”

Barriers:	**Facilitators:**
• Mental state (depression, mania, psychosis) • Strongly held beliefs about treatment • Motivation and organisation • Cognitive difficulties and limited health literacy • Difficulty communicating healthcare needs • Difficulty handling transitions • Anxiety and mistrust of healthcare • Limited social support • Socioeconomic factors (deprivation, homelessness)	• Close monitoring of mental state • Individualised care planning, developed collaboratively with person and family/carers • Person-centred support for adherence and attendance • Family and community supports • Delivering information using simple, concrete language • Trust and rapport with healthcare professionals • Continuity of care • Proactive support to facilitate listing for transplantation

“There are people falling through the cracks”

Barriers:	**Facilitators:**
• Separation of physical and mental healthcare • Renal settings not equipped to manage complex mental health needs • Limited flexibility in care and few resources to proactively support adherence • Community mental health settings not equipped to manage renal needs • Limited access to GPs and Nephrologists • Lack of communication between renal and mental health teams • Lack of oversight/coordination of care	• On-site access and adequate resourcing of mental health professionals (Liaison Psychiatry, Social Work and Psychology) in renal settings • Close monitoring of kidney function in the community and early access to Nephrology specialists (particularly for those on lithium) • Funding for transport to appointments and additional prompting for attendance • Community mental health teams supporting adherence • Direct point of contact between renal and community mental health teams

“Psychiatry is a black spot in our continuing medical education”

Barriers:	**Facilitators**:
• Lack of mental health/psychiatry training for healthcare providers • Limited understanding of SMHDs in renal settings • Healthcare providers’ discomfort with SMHDs leading to less proactive care • Time constraints • Diagnostic overshadowing	• Close collaboration between renal and mental health professionals • Clinicians’ dedication and proactive engagement • Education for healthcare providers on mental health, communication and trauma-informed care • Careful consideration of risks of changing psychotropic medications, including PwSMHDs in decision making

“when they present to a busy emergency department with a problem, the staff tend to go ‘...psych patient’”

Barriers:	**Facilitators:**
• Stigma and discrimination towards PwSMHDs • PwSMHDs’ complaints taken less seriously • Fear and misperceptions about people with SMHDs	• Education for healthcare providers challenging biases and misconceptions • Empathy and considering perspective of PwSMHDs

Access to kidney care

- Contact with healthcare services and interactions with healthcare providers
- Appointment attendance
- Adherence to diet, medications and dialysis requirements
- Reporting of physical symptoms and advocating for their own care
- Stage of kidney disease at first presentation to nephrology services
- Treatment options and eligibility for kidney transplant

Inequities in the provision of kidney care and clinical outcomes for people with SMHDs

FIGURE 1
Summary of barriers and facilitators to effective kidney care for people with severe mental health difficulties (pwSMHDs).

potential benefits and risks of putting a people with SMHDs forward for transplant when there are concerns regarding adherence:

> *The conflict of my heart is am I, as a responsible senior clinician, going to refer this man to a transplant program? (…) Is he going to take his tablets every day? Is he going to end up rejecting that kidney and be worse off than he was before?* – David, Nephrology Consultant

Participants also discussed the risk of steroid-induced psychosis post-transplant, and emphasised the need for close monitoring during transition periods, to enable immediate intervention if necessary. Participants described the need to have an individualised advance care plan for people with fluctuating mental states, including specific guidance on how treating clinicians should respond if the person becomes acutely unwell:

> *In a cardiac arrest situation, everybody knows what to do. You go in. You call a crash trolley. That's our job. What about if somebody had a severe change in their mental health? What do you do? Should there not be a similar protocol?* – Charlotte, Physiotherapist

They recommended that care plans be developed collaboratively by members of the renal MDT, mental health team, the person with the SMHD, and involve family and carers as appropriate. Participants described multiple instances whereby advance planning of care and supports were used to successfully facilitate people with SMHDs receiving a kidney transplant.

Difficulties with motivation and organisation impact adherence and attendance

Mental healthcare providers described how low motivation can often be a feature of SMHD, which can result in some people with SMHDs being less proactive in their own care. Thus, they may require more proactive support to attend appointments:

> *I think medics often think, "Well, if they don't turn up, that's their choice." And that's fine for some people. But when they have a lack of motivation as a part of their illness, that's when you need more prompting and more proactive engagement.* – Liam, Liaison Psychiatrist

Participants reported that adhering to the restrictive food and fluid guidelines can be particularly challenging for people with SMHDs on haemodialysis, and that external supports are sometimes necessary to sustain their adherence:

> *The diet can be very bland and very difficult. And even the rigor that requires double boiling of vegetables and stuff like that. That's hard with the best will in the world, not to mind if you're struggling with motivation and organizational skills. (…) And for some, drinking large amounts of fluids is a component of their psychiatric disorder.* – Noreen, Liaison Psychiatrist

Conversely, participants described how other people with SMHDs can have high levels of health-related anxiety: "One would be very focused on numbers and be really worried if they heard that they had high potassium." (Samuel, Registrar in Nephrology). As a result, some people with SMHDs may follow treatment guidelines too rigidly, which can also lead to health complications:

> *If you advise on something they might take that to the letter of the law, and sometimes that can be a good thing, but in the overall it might be driving anxiety and other issues. Some people might be overly compliant or overly restricted in their diet, and then that could turn into an issue as well.* – Laura, dietician

Participants also described how lack of organisation and motivation can result in under-reporting of physical symptoms in people with SMHDs. Alogia, a symptom of some SMHDs whereby a person has poverty of speech, can also contribute. As a result, people with SMHDs are more likely to seek medical attention when they are in a "physical health crisis" (Mia, Mental Health Nurse), which can lead to later diagnosis of kidney disease and poorer outcomes:

> *You get the referral from the GP or the mental health services, but they have presented at a later stage and the kidney disease is already underway. So you're kind of catching up with what damage has been done.* – Evelyn, Advanced Nursing Practitioner in Nephrology

Mental healthcare participants described how the motivation of people with SMHDs to seek healthcare is also impacted by socio-economic factors, including limited health education and higher rates of poverty, homelessness and addiction in this population: "To be honest, attending some appointment is not going to be their priority when there is so much else going on in their lives, so many disadvantages." (Elizabeth, Community Mental Health Nurse).

Because of difficulties with organisation and motivation, mental healthcare professionals described the need for external supports to help people with SMHDs manage their physical and mental health, navigate the healthcare system and attend appointments. Participants reported that support from family members is extremely helpful, but that many people with SMHDs have limited social supports to advocate for their care. Indeed, participants reported that the highest risk group of people with SMHDs are not those with the most significant impairments, but rather those who are not in fully supported accommodation and have limited family support:

> *Adherence is more of an issue for the patients in that intermediate group who are more vulnerable, because they aren't well enough to be able to have routine social supports of family or partners, but aren't ill enough to be requiring full supports to help with medication changes post-transplant.* – Noreen, Liaison Psychiatrist

Cognitive difficulties impact communication needs and treatment options

Mental healthcare providers described how some people with SMHDs have cognitive difficulties, including with information processing, disorganised thinking, literal thinking, memory, and attention. This impacts the ability of some people with SMHDs to understand kidney disease, adhere to treatment requirements, communicate with healthcare providers and navigate the healthcare system. As a result, treatments requiring higher levels of education and understanding, such as peritoneal dialysis or home haemodialysis, are less likely to be offered to people with SMHDs.

Participants highlighted the need to give people with SMHDs more time to communicate and take in information. However, resource restraints limit the time they can spend with people with SMHDs: "If I'm spending a lot of time with that one person, I cannot spend that time with somebody else, and that is challenging" (Charlotte, physiotherapist). Participants recommended individualizing the delivery of information, using simple language, direct and concrete communication styles, checking the persons' understanding, and repeating information. Providing individualised information in a variety of formats, including verbal, written and video, was also recommended.

> *I find it very helpful to write down information for people, writing down the date and management plan and individualizing it. So that patients can look at it afterwards and remember, "Oh, that was the plan because…"* – Noreen, Liaison Psychiatrist

Where possible, sharing information with carers and family members was also recommended, so they can act as an additional source of information to the person with the SMHD, and support their adherence to treatment recommendations at home. As the needs of each person with SMHDs are different, participants described how families often inform care plans and help healthcare providers know what to expect when providing care to people with SMHDs.

Anxiety and mistrust impact their interactions with healthcare

Participants reported that many people with SMHDs have high levels of anxiety and mistrust, particularly when interacting with healthcare. The anxiety was attributed to previous negative experiences with medical establishments, such as being involuntarily detained, as well as being a feature of their SMHD. Mental health providers described how fear and anxiety often led to people with SMHDs avoiding healthcare appointments:

> *It takes a lot of effort to get the person to go to the doctor. And if they don't get a positive response from the receptionist when they go in, they turn and walk out of the place.* – James, Liaison Psychiatric Nurse

Participants reported that people with SMHDs' mistrust of healthcare providers led to not sharing important information regarding their health. High levels of anxiety also make it more difficult for people with SMHDs to listen to healthcare providers or engage in care: "when she's not well, her anxiety levels kind of are just on the Richter scale. And she's not really listening, she's not able to." (Evelyn, Clinical Nurse Specialist). Participants highlighted the importance of listening to each person's concerns, showing empathy, and working to build a trusting relationship with them: "It's about empathy, really listening to the person and trying to understand their distress. Even if it might not make much sense to us." (James, Liaison Psychiatric Nurse). Participants also highlighted the value of trauma-informed care:

> *We need to be trauma informed because a lot of people with psychosis do have a significant trauma history. It doesn't mean you are expected to delve into that, but, to be aware that this could be a significant factor.* – Jack, Community Mental Health Nurse

Having a predictable routine was described as helpful for many people with SMHDs. Participants reported that after adapting to dialysis, the attendance of people with SMHDs is often better than those without SMHDs. However, periods of transition, including the initiation of dialysis and transplant, are more challenging for people with SMHDs: "some of them have a low tolerance for change." (Olivia, Nephrology Consultant). Participants stressed the value of continuity of care and the long-term relationships renal healthcare providers often have with their patients, as clinicians come to learn the specific needs of each people with SMHDs: "It can help because we can say 'Look, that's actually normal for them, and this is a good sign that they are reacting that way.'" (Charlotte, Physiotherapist). Similarly, matching patients to their preferred nurses and doctors can reduce anxiety and help care go more smoothly. Participants praised the dedication that renal teams show to their patients, and described how this is essential to ensuring people with SMHDs stay engaged in kidney care:

> *I think renal teams try and do as much as they can to have people well enough for dialysis. There was one case in particular where he was quite psychotic, and very disengaged, and they really put a huge amount of work into seeing him, and engaging him. And even when he wouldn't engage with us, the renal team stuck with it, kept with him.* – Emma, Liaison Psychiatrist

Participants also discussed how rates of SMHDs are higher in people who are from minority backgrounds, including those who are not Irish, White, or who do not speak English as a first language. Participants described how people with SMHDs from minority backgrounds face additional barriers to kidney care, and may have additional mistrust of healthcare professionals, due to previous negative experiences due to lack of cultural awareness or racism: "Because of that bad treatment, there can be higher levels of fear and avoidance." (Isabelle, Clinical Psychologist). To improve access to kidney care for this population, participants highlighted the need for healthcare providers to be responsive to cultural needs, as well as differing health beliefs and practices.

"There are people falling through the cracks"

Participants stressed the interaction between physical and mental health, and described how the separation of physical and mental healthcare results in poorer outcomes for people with SMHDs.

Participants reported that people with SMHDs often have more complex physical health problems due to the use of psychotropic medications; health behaviours such as diet, smoking and drug addiction; as well as socioeconomic factors, such as higher rates of poverty and homelessness. Participants described how these health complications can impact treatment options and eligibility for a kidney transplant. Participants described how integrated physical and mental healthcare is necessary for effective care for people with SMHDs: "With better treatment of a person's mental illness, the physical illness became much easier to manage. So you cannot separate them out and box them." (Grace, Consultant Immunologist). However, participants reported that physical health settings are often not equipped to manage the needs of people with SMHDs:

> *The system expects a certain type of person who is able to engage fully, is organized enough, has their transport and is able to get here with no issues. And not for vulnerable groups, people with mental health difficulties, the homeless, with not enough support.* – Grace, Consultant Immunologist

For example, participants described how renal departments are often not adequately resourced with liaison psychiatry, social work, psychology or clinical nurse specialists trained in mental health: "There is no dedicated psychiatry for the renal outpatient service, so unless someone is actually suicidal, they will not be coming down." (Samuel, Nephrology Registrar). Interdisciplinary working between renal and mental health professionals were described as improving care for people with SMHDs: "We have a good working relationship with the medical Consultants, and when they ring me, I know that there's something up, and we need to respond quickly." (Emma, Liaison Psychiatrist). Similarly, participants highlighted the benefits of having on-site access to mental health staff:

> *There was a man who they couldn't manage in a previous dialysis centre because of his behaviour. So he got transferred to our dialysis unit because of our ability to have enhanced interventions. So when he came initially he was having two staff sitting beside him throughout his dialysis, and now he comes in himself and has good working relationships within the context of a very complex psychiatric presentation. (…) And that's the process of liaison psychiatry, is that access to onsite psychiatry rather than calling somebody in from elsewhere who doesn't know the system, doesn't know the patients, doesn't know the staff, and isn't available to come in at the times when the patient is there on dialysis* – Noreen, Liaison Psychiatrist

Participants described how, because of time and resource constraints, there is often little flexibility in terms of how care is provided in Irish hospitals:

> *We need to think, what is the target population we're looking at? How can we design it around that person and their needs? Because most healthcare systems are built around the professionals' needs, not the patients'.* – Jack, Community Mental Health Nurse

For example, participants described how appointments are typically at set slots with little allowance for additional time. Similarly, while dialysis nurses often spend significant periods of time contacting patients, rescheduling appointments and organising transport to facilitate attendance, most pre-clearance clinics have limited resources to do this. This can result in people with SMHDs "falling through the cracks" (Elizabeth, Community Mental Health Nurse) and losing contact with healthcare services. Participants also described how the separation and specialisation of healthcare departments can result in a lack of oversight regarding the "bigger picture of care" (James, Liaison Psychiatric Nurse) of people with SMHDs:

> *It's about the holistic care. And I think that's where healthcare in Ireland is really poor. Everyone does their own bit. And sometimes assumptions are made that another service is doing it, when they're not.* – Evelyn, Advanced Nursing Practitioner in Nephrology

Similarly, mental health practitioners described how mental health settings are often inadequately resourced to support the complex health needs of people with SMHDs, carry out regular health screenings, or promote prevention. They reported that limited access to general practitioners (GPs) in the community often negatively impacts people with SMHDs' access to physical healthcare, medical benefits, and referrals to mental health teams. Mental health participants were very aware of the impact of lithium on the kidneys, and reported they regularly monitor the bloods of people taking lithium-based medications. However, they described how access to Nephrology specialists is often limited to when the person's kidney damage has already progressed. In the absence of specialist advice, mental health practitioners are often unsure of how to prevent further kidney damage: "You're looking at their kidney function reducing and you think, oh god, what am I supposed to do now?" (Liam, Liaison Psychiatrist).

Participants described how close interdisciplinary working and communication between renal and mental healthcare professionals is needed to optimize care for people with SMHDs:

> *We can't just separate out and treat the mental health part, just like we can't just treat the kidneys and not worry about the rest of the body. We need to treat the whole person, so the more integrated the different services can be the better things will be for the patient.* – James, Liaison Psychiatric Nurse

However, communication between community mental health and renal teams can be limited. Mental health participants described the difficulties of having separate physical and mental healthcare records, as well as not having a named person on the renal team to contact about concerns. Participants reported that liaison psychiatry can often act as a bridge between the physical and mental healthcare teams.

Under-resourcing of community mental health teams also impacts their ability to coordinate the physical and mental healthcare of people with SMHDs. For example, community mental health nurses described how they sometimes help people with SMHDs attend healthcare appointments by prompting or accompanying them. However, this does not occur routinely as it is not specified in their job descriptions, and the resourcing of local community mental health teams varies widely. Community mental health workers reported that they sometimes use their own taxi voucher books to ensure people with SMHDs can attend appointments: "Which I think is a little unfair because that means our budgets are being interfered with, but also we are managing complex conditions that are definitely outside our scope of practice." (Jack, Community Mental Health Nurse).

"Psychiatry is a black spot" in our continuing medical education

Most renal healthcare providers reported that they have a limited understanding of SMHDs, and had received little to no education regarding SMHDs since medical school: "Psychiatry is a black spot in our continuing medical education. My psychiatry education was probably highest in medical school." (David, Consultant Nephrologist). Renal healthcare providers described having less training in psychiatry than in other specialities, and some admitted they sought it out less. Participants described how most healthcare providers are less comfortable working with mental health conditions that cannot be explained in "concrete and biological terms" (Samuel, Registrar in Nephrology), without a clearly defined intervention:

> *For example, post-myocardial infarction, a person's mortality and morbidity is better predicted by their level of depression than by their left ventricular ejection fraction, but we like to measure left ventricular ejection fraction. We don't follow the evidence, we follow the technology and we steer away from what feels more vague and fuzzy. Even though with our increasing knowledge around the brain*

> *and neuroscience, now we have really solid evidence-based pathways to support ways forward.* – Noreen, Liaison Psychiatrist

Most renal healthcare providers reported that they do not fully understand the meaning of different SMHD diagnoses, or how they might impact the delivery of care for people with SMHDs. Because of this lack of understanding, combined with inadequate access to mental healthcare professionals and limited time to spend with patients, some renal healthcare providers described taking a "do not ask questions approach" (Samuel, Nephrology Registrar) to mental health. Participants reported that healthcare providers often felt anxious when interacting with people with SMHDs, due to lack of experience and education: "I've seen it a lot in acute hospitals, when they deal with people with mental disorders there's often a lot of apprehension and discomfort, which is really unfortunate in my opinion." (James, Liaison Psychiatric Nurse). Indeed, many renal healthcare providers who worked in a hospital with limited access to mental health professionals described feeling "helpless" (Lucy, Haemodialysis Nurse) when discussing the mental health needs of their patients:

> *I think when it comes to mental health stuff though we sort of hold our hands up. It's almost like dentistry, we are never going near the mouth, that's just been cordoned off. We respond in a similar way to psychiatric stuff.* – David, Consultant Nephrologist

Mental healthcare professionals described how an important part of their role on the MDT is upskilling and increasing the confidence of physical healthcare providers when responding to the needs of people with SMHDs:

> *It is about normalizing psychiatric brain disorders as a routine part of medical care. (…) It allows an increased proactivity, and an increased sense of confidence in the healthcare professionals, in terms of engaging actively in the patient's care* – Liam, Liaison Psychiatrist

Participants reported that lack of training in mental health can also lead to "diagnostic overshadowing" (Emma, Liaison Psychiatrist), whereby physical symptoms are misattributed to mental health difficulties in people with SMHDs. For example, one liaison psychiatrist described how delirium, a state of acute confusion common in kidney failure due to the build-up of toxins affecting the brain, can often be overlooked or misunderstood in people with SMHDs:

> *The people who present as very flat, they often seem quite depressed, and actually, they're so disengaged and not communicating that no-one has actually asked them, do they know where they are? Or assessed their attention, or orientation. But to us it's still very evident that it's delirium.* – Emma, Liaison psychiatrist

As Liaison Psychiatry have a good understanding of the interface between physical and mental health difficulties, they were described as being able to provide a more nuanced formulation to the renal team, taking biological, psychological and social factors into account. Two liaison psychiatrists described the value of being able to tease apart and make sense of overlapping physical and mental health symptoms:

> *For example, some patients with mental disorders may require more analgesia than the team would expect, so I explain to the team why that is and how to support the patients with that. Rather than them either over investigating, "Has something gone wrong here and that's why they have more pain?" Or patient blaming and saying "He doesn't need any more."* – Noreen, Liaison Psychiatrist

Participants also described how input from liaison psychiatry is essential for the management of psychotropic medications. Mental health participants stressed how, when considering changing or discontinuing lithium-based medications due to their impact on kidney function, the renal team must take the potential risks for their mental health into account:

> *Occasionally there's some patients for whom lithium is the only medication that works and you're making a cost-benefit consideration in terms of transplanting somebody on lithium, and knowing the lithium may have an impact on their new kidney. But yet, in terms of their mental state, the risk-benefit ratio is worth them staying on the lithium* – Noreen, Liaison Psychiatrist

When considering changes in psychotropic medications, participants highlighted the importance of informed consent and taking the preferences of the person with the SMHD into account. Mental health participants also advocated for more awareness in renal teams regarding the potential risks of relapses in mental health, as well as the need for advance planning of support when changing psychotropic medications:

> *Relapses can permanently lower a person's level of functioning and have lasting impacts on their independence. (…) So sometimes it's a bit of a copout from some of the renal teams by not understanding and just giving this advice that we all know. Yes we need to change their meds, but it's HOW do we change it, or how do we manage to change?* – Jack, Community Mental Health Nurse

Some participants suggested providing additional training in SMHDs for healthcare providers, regarding the mind–body link, the interaction between SMHDs and kidney disease, features of specific SMHDs, and psychotropic medications. However, most participants reported it is difficult to incentivise healthcare providers to take part in training because of understaffing and time restraints. Due to the wide range of SMHDs and their presentations, participants recommended having a mental health professional working closely with the renal MDT, who is readily available to healthcare providers and can advise on the care of people with SMHDs on a case by case basis: "I think having a psychologist and psychiatrist in the transplant team is hugely important. Because if it's really difficult for me to find out what I have to do to help each individual person. Because people have all sorts of difficulties." (Grace, Consultant Immunologist).

"When they present to a busy emergency department with a problem, the staff tend to go '…psych patient'"

Participants described how stigma towards people with SMHDs can lead to discrimination against them in healthcare settings: "I think there is discrimination against people with a mental health diagnosis, and I think it's quite prevalent." (Jack, Community Mental Health Nurse). For example, mental healthcare professionals described how the complaints of people with SMHDs are taken less seriously when they present to primary care or emergency services:

> *I remember I had one patient who wasn't interacting, so the doctor said "Oh, she's depressed. We need to get her over to the psychiatric unit." And she wasn't depressed, it turns out she had bacterial encephalitis. And because of lack of intervention an infection was allowed to grow, and she had a horrible death, which was wrong, it should have been picked up earlier. And I know that's an extreme example, but I encounter examples all the time where people with mental health diagnoses, especially those with schizophrenia, are dismissed.* – Jack, Community Mental Health Nurse

The same participants reported that renal healthcare providers are generally very diligent about their patients' symptoms. However, they expressed concerns that stigma and diagnostic overshadowing may prevent people with SMHDs from being referred to nephrology from other services. Mental healthcare professionals also reported that the negative symptoms of SMHDs, such as lack of motivation, can be negatively interpreted by HPCs: "People with major mood disorder or with psychosis can come across as abrupt or not interested or unmotivated or rude." (Liam, Liaison Psychiatrist). Similarly, participants reported that although in their experience people with SMHDs did not show more aggression than other patients, there is a perception that people with SMHDs are more dangerous. One haemodialysis nurse reported that this anxiety, combined with uncertainty regarding how to respond to mental health difficulties, can lead to renal healthcare providers' spending less time with people with SMHDs.

Participants also described how, in an under-resourced system when healthcare providers are burnt out, it can be difficult to accommodate the additional needs of people with SMHDs: "Particularly when they present to a busy emergency department with a problem, the doctors tend to go '…psych patient'" (Liam, Liaison psychiatrist). For example, participants described how healthcare providers can be frustrated when people with SMHDs miss appointments, and do not consider the factors that may have contributed to their not attending: "We do not often think about what we could have done to make it easier for them to show up. We just think 'why would I bother trying to help them again?'" (Liam, Liaison Psychiatrist).

A Community Mental Health Nurse (Jack) reported that education for healthcare providers is an effective way of reducing stigma towards people with SMHDs. He described how he had effectively taught healthcare providers skills in "what to do and what to say," corrected biases and misconceptions that may negatively impact care for people with SMHDs, and helped the providers feel more comfortable treating people with SMHDs. Mental healthcare providers emphasised the importance of normalizing SMHDs, and treating people with SMHDs with empathy and respect:

> *Everyone just goes "oh god, let's get psychology in" when they hear the person has schizophrenia and is hearing voices. But no, we can all talk to this one person. They're still human. You can still work with them. It's still the same skills we use with any other human being* – Isabelle, Clinical Psychologist

Discussion

For people with kidney disease, it is well documented that those with SMHDs have poorer access to kidney care and worse clinical outcomes (14). To our knowledge, this is the first study to qualitatively assess the barriers and facilitators to kidney care for people with SMHDs. Our findings give insight into a number of ways in which care might be improved for this underserved population. Our results indicate that many people with SMHDs experience additional barriers to kidney care, due to challenges with their mental state, motivation and organisation, cognitive difficulties, or mistrust of the healthcare system. Participants' accounts describe how the separation of physical and mental healthcare, combined with under-resourcing and understaffing of mental health professionals, make it difficult to support the additional needs of people with SMHDs. Findings also suggests that lack of mental health training for healthcare providers impacts their confidence in their ability to provide care to people with SMHDs. Our results also indicate that system-wide stigma towards people with SMHDs in healthcare contributes to poorer outcomes for this population. Despite these identified barriers, our findings indicate that with adequate social, community and hospital supports, people with SMHDs and kidney disease can have favourable outcomes even in the context of significant impairments and complex presentations. However, effective care for this population requires integrated physical and mental health care, which takes an individualised "whole person" approach to addressing the interaction between kidney disease and mental health (50).

In many ways, participants' accounts describe how Nephrology services are well suited to manage the needs of people with SMHDs, if they are adequately resourced with mental healthcare professionals. For example, renal healthcare providers typically have long-term relationships with their patients (51), and this continuity of care is associated with better health outcomes for people with SMHDs (52). The close monitoring and proactive follow-up conducted by renal nurses means that fluctuations in mental and physical health are quickly noticed and responded to, and this also reduces the risk of diagnostic overshadowing. Furthermore, in contrast to the stigmatising and pessimistic attitudes displayed by healthcare providers elsewhere (6, 53), most renal healthcare participants in this study held positive views about people with SMHDs and their treatment outcomes.

Barriers to kidney care for people with SMHDs were identified at the person, provider and systems, level, and were largely consistent with those described for people with SMHDs accessing other forms of healthcare (5, 54). Several barriers specific to kidney care for people with SMHDs were identified for the first time, including the high burden of adherence to recommendations regarding diet, fluid intake, medications, and dialysis treatment. Research has shown that the most effective ways to improve medication adherence for people with SMHDs are tailored to the person's specific needs, and take into account their motivational, cognitive and functional difficulties (55). They also use a problem-solving approach to identify barriers to adherence, and address ambivalence that people with SMHDs have towards committing to medication regimens (55). Interestingly, our results indicate that the most vulnerable cohort of people with SMHDs with kidney failure are not those with the most significant impairments, but those who are not deemed "unwell enough" to be in fully supported accommodation and have few social supports. As evidenced in other chronic conditions such as diabetes, this highlights the importance of family and other external supports in promoting adherence for people with SMHDs (56). Tailored environmental support systems combined with cognitive adaptation training have been shown to significantly improve medication adherence in people with schizophrenia (57). However, to our knowledge there are no studies addressing adherence in people with SMHDs and kidney failure. Given the burden of adherence and its critical impact on outcomes, research addressing adherence for people with SMHDs and kidney failure who are living in the community should be prioritized.

The risks associated with non-adherence to treatment, combined with high rates of suicide and self-harm in people with SMHDs (58), make people with SMHDs and kidney failure an extremely vulnerable group. The link between depression and poorer adherence in people with kidney failure is well documented (59). Results highlight the need for close monitoring of mental state for people with SMHDs, and access to on-site mental health professionals who can facilitate appropriate interventions in a timely manner. Individualised care plans should be available to all clinicians working with individuals with fluctuating mental states. In addition to having crisis and contingency plans, individualised care plans should clearly outline agreed intervention strategies for mental and physical health, strategies for self-management, and advance directives or statements the person has made (60). Care plans should be developed collaboratively by members of the nephrology MDT, mental health team, the person with the SMHD, and their family or carers as appropriate.

Renal healthcare participants lacked confidence in their understanding of mental health and their ability to care for people with SMHDs, consistent with previous research (33). Given the wide range of SMHDs and the complexity of kidney care for this cohort, findings indicate that renal healthcare providers require individualised input from mental healthcare professionals on a case-by-case basis. Our results add to existing evidence that close collaboration with mental health professionals increases physical healthcare providers' competence and proactive engagement when working with people with SMHDs (61). Findings indicate that Nephrology departments should have comprehensive and proactive multidisciplinary team-based care including psychiatry, psychology, social work, and clinical nurse specialists, similar to the approach outlined in the Irish National Cancer Strategy 2017–2026 (62). At minimum, timely and frequent communication between renal and mental healthcare providers is necessary to ensure safe and effective treatment for people with SMHDs.

Another issue specific to people with SMHDs and kidney disease is the management of lithium-based psychotropic medications. Lithium is considered by many to be the "gold standard" treatment for bipolar disorder, and appears to be superior to other mood stabilisers in preventing suicide in people with SMHDs (63, 64). Long-term lithium use has been associated with higher rates of chronic kidney disease, although there is little evidence that discontinuing lithium decreases risk of kidney failure (65, 66). In line with international best practice guidelines (67), mental health participants in this study reported they regularly monitor the kidney function of clients on lithium. However, our results indicate that some mental healthcare providers need additional support from specialist Nephrology services to inform preventative measures for people with SMHDs in the early stages of kidney damage. This study also adds to existing evidence that the decision to change or discontinue lithium treatment for people with SMHDs and kidney disease requires careful consideration of the potential risks and benefits for each person (65, 68). Renal healthcare providers should be aware of the increased risk of mania, depression and suicide following removal of lithium (69), and consider how these risks can be managed before discontinuation. Because of the uncertainties involved, the decision making process must include the people with SMHDs, their family or carers, nephrologists and mental health professionals.

Findings highlight the impact of stigma towards people with SMHDs in healthcare, and how it can lead to dismissal of symptoms, diagnostic overshadowing, and less effective care (70). Stigma occurs on multiple levels throughout the healthcare system, including intraindividual (e.g., patient self-stigma and reluctance to seek care), interpersonal (e.g., negative attitudes and discriminatory behaviours by clinicians) and structural (e.g., investment of resources) (6). System-wide interventions to reduce healthcare providers' stigma may improve people with SMHDs' access to Nephrology specialists and the quality of kidney care they receive. Our findings add to evidence that interventions should teach skills in "what to do" and "what to say" when interacting with people with SMHDs, and target clinicians' unconscious biases and false beliefs that may be having a negative impact on care (71). Research suggests that most effective stigma-reducing programs also use social contact, whereby healthcare providers hear testimonies from people with lived experience of SMHDs (72).

Strengths, limitations and areas for future research

To our knowledge, this is the first study investigating barriers and facilitators to effective kidney care for people with SMHDs. The perspectives of a range of healthcare and mental healthcare professionals with differing roles and perspectives add valuable insights into how kidney care for people with SMHDs might be improved. However, as the perspectives of people with SMHDs and their carers/family members may be very different from those of professionals, further research involving their perspectives is crucial to understanding the full range of barriers and facilitators to care for this population. Furthermore, as this was a relatively small sample of healthcare providers based in Ireland, further research is required to determine whether findings are transferrable to kidney care in other settings. The current study also did not include the perspectives of General Practitioners, who may have additional insights into the barriers and facilitators to effective kidney care for this population.

This study focused on kidney care for a wide range of mental health-related diagnoses and presentations. Research focusing on kidney care for people with specific difficulties (e.g., psychosis, mood fluctuations, strongly held beliefs, etc.) may give more nuanced and specific insights into how to improve clinical outcomes for these individuals. Given the concern about risk among professionals in the current study, assessing the rates of suicide and loss of contact with healthcare services for people with SMHDs and co-occurring kidney disease should be a research priority. Lastly, further research is needed to determine how to effectively support adherence in people with SMHDs and kidney failure living in the community, in the context of limited social supports.

Conclusion

As evidenced in other medical conditions, many people with SMHDs require additional support to access kidney care, due to fluctuating mental state, problems with motivation and organisation, cognitive difficulties, or anxiety and mistrust of the healthcare system. Our results highlight the need to understand the specific limitations and challenges of each person with a SMHD, so that individualised supports can be provided. Findings indicate that, with adequate social, community and hospital supports, people with SMHDs and kidney disease can have favourable outcomes even in the context of significant impairments and complex presentations. However, the separation of physical and mental healthcare, combined with under-resourcing and understaffing, often make it difficult for renal settings to meet the full range of needs of people with SMHDs with kidney disease. Lack of ongoing education in mental health for renal healthcare providers and the resulting discomfort treating people with SMHDs can also negatively impact outcomes for this population. This study gives insight into a number of ways in which care can be improved for people with SMHDs, including integrated physical and mental health care, which takes a "whole person" approach to addressing the interaction between kidney disease and mental health. Our results indicate that renal departments should have multidisciplinary team-based care, including psychiatry, psychology, social work, and clinical nurse specialists. Communication and coordination between renal and mental healthcare providers is also necessary to ensure safe and effective kidney care for people with SMHDs. As this study focused solely on the perspective of healthcare providers, further research including the perspectives of people with SMHDs with kidney disease and their family members is needed to inform the provision of care for this population.

Data availability statement

The datasets presented in this article are not readily available because the de-identified transcripts include potentially identifying information. Requests to access the datasets should be directed to clodagh.cogley@ucdconnect.ie.

Ethics statement

The studies involving human participants were reviewed and approved by Human Research Ethics Committee – Humanities. University College Dublin, Ireland HS-21-19-Cogley-Dalton. The patients/participants provided their written informed consent to participate in this study.

Author contributions

CCo, PD'A, JB, and KB conceived and planned the study. AS, JH, and PC, facilitated recruitment. CCo collected the data. CCo and CCa conducted analyses, with input from PD'A, JB, and KB. CCo wrote the manuscript with input from all authors. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1225102/full#supplementary-material

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The relationship between alexithymia, depression, anxiety, and stress in elderly with multiple chronic conditions in China: a network analysis

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Objective: This study aimed to construct a network structure to investigate the connections between alexithymia, depression, anxiety, and stress in Chinese older adults with multiple chronic conditions (MCC), identifying core and bridge symptoms, and comparing the network structure across different levels of alexithymia.

Methods: This study used a cross-sectional survey design and convenience sampling to recruit participants from six cities in Jiangsu Province. The study assessed the levels of alexithymia, depression, anxiety, and stress in older adults with MCC using the Toronto Alexithymia Scale (TAS-20) and the Depression Anxiety and Stress Scale-21 (DASS-21). Network analysis was performed using R language to identify core and bridge symptoms in the network and compare the network structure across different levels of alexithymia.

Results: A total of 662 participants were included in the analysis, including 395 men and 267 women. The mean age was 70.37 ± 6.92 years. The finding revealed that the "Difficulty Identifying Feelings" (DIF) node had the highest strength centrality (strength = 2.49) and predictability (rp = 0.76) in the network. The next highest strength centrality was observed for "Meaningless" (strength = 1.50), "Agitated" (strength = 1.47), "Scared" (strength = 1.42), and "No look forward" (strength = 0.75). They were identified as core symptoms. The bridge strength analysis identified "Panic," "Scared," "No wind down," "No initiative," and "No positive" as the bridge symptoms. There were notable differences in the overall network structure and specific connections between the groups with and without alexithymia ($p < 0.05$).

Conclusion: "DIF" is a core node in the network of older adults with MCC, indicating its significance as a potential target for psychological interventions in clinical practice. Preventing and mitigating bridge symptoms such as "panic," "Scared," "No wind down," "No initiative," and "No positive" can effectively

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impede the spread of symptom activation, thereby interrupting or severing the connections among comorbidities in older adults. Additionally, compared to non-alexithymia individuals, the psychological issues of older adults with alexithymia require prioritized intervention from healthcare professionals.

KEYWORDS

multiple chronic conditions, alexithymia, depression, anxiety, stress, network analysis

1. Introduction

The aging population and the prevalence of chronic diseases in the elderly have become a significant public health issue globally (1). In China, around 180 million elderly people suffer from chronic diseases, accounting for 75% of the elderly population (2). Moreover, the prevalence of multiple chronic conditions (MCC) in the elderly is as high as 65.14% (3). Older adults with MCC not only face physical discomfort and ongoing treatment costs but also commonly experience psychological problems such as depression, anxiety, and stress (4). Studies have shown that these negative psychological symptoms interact with each other and often co-occur in older adults with MCC (5). It is crucial to understand the psychological well-being of older adults with MCC, intervene in their psychological health, and facilitate their rehabilitation and treatment. Vasiliadis et al. highlighted the link between psychological distress and physical burden in older adults, emphasizing the impact of disease burden (6). Su et al. demonstrated the influence of psychological problems on subjective cognitive functioning and the role of self-efficacy in older adults (7). Wei et al. showed the interconnectedness of depression and anxiety, often co-occurring and influencing individuals (8). However, most studies on psychological problems have focused on foreign populations, and the psychological distress experienced by older adults may vary across countries due to cultural and geographical differences. Further research is needed to explore psychological distress in Chinese older adults, particularly those with MCC. Moreover, limited research has examined the impact of alexithymia on psychological distress in older adults (9, 10), especially those with MCC. Nevertheless, it is evident that older adults with MCC are more susceptible to these emotional issues (11, 12).

Alexithymia, initially described by Sifneos (13), is a cognitive-affective disorder characterized by difficulties in processing, regulating, and recognizing emotions. It is prevalent among elderly patients with chronic diseases (14, 15), with a global prevalence ranging from 10 to 60% (16). Elderly patients with MCC have a higher prevalence of alexithymia compared to those with a single chronic condition, and the prevalence increases with age (17). Alexithymia affects communication skills, disease management, recovery, and overall quality of life and mental health in the elderly. Studies have shown that individuals with alexithymia are more susceptible to anxiety, depression, and suicidal tendencies (18). Physical symptoms often accompany alexithymia, further impacting patients' recovery and treatment outcomes (19). Additionally, there is a detrimental cycle between anxiety, depression, and alexithymia (18). Although research (9, 10) on the relationship between alexithymia and psychological distress has mainly focused on adolescents, it is essential to investigate the significant role of alexithymia in psychological distress among older adults with MCC. Understanding this role can contribute to promoting the mental and physical well-being of elderly individuals in later life.

Previous studies have primarily used the common cause theory (20) and latent variable perspectives (21) to explore the link between alexithymia and psychological issues. These approaches focus on singular influences between symptoms, assuming the presence of a latent common cause or underlying variables. They often use total scores on scales or statistical techniques like structural equation modeling, Pearson correlation analysis, or multiple regression analysis to assess the severity and correlation of psychological problems (21). However, these approaches overlook the distinct individual symptoms within anxiety and depression. Symptoms such as meaninglessness, worthlessness, sadness, worry, and panic interact in complex ways, contributing to the development of anxiety and depression. Some symptoms act as primary indicators, while others serve as bridges connecting with other disorders. It is crucial to identify and intervene in these specific symptoms for significant outcomes. Traditional methods like correlation analysis and multiple regression analysis may not fully capture the relationships between specific dimensions of alexithymia and individual symptoms of depression, anxiety, and stress (20, 21). Alternative approaches are needed to comprehensively understand the intricate associations and interactions among specific symptoms and their relationship with alexithymia and psychological distress.

The symptom network approach is a valuable tool for understanding the intricate interactions between alexithymia and psychological distress, such as depression, anxiety, and stress (22). It involves characterizing the collective symptoms related to a patient's condition and quantitatively studying the associations between these symptoms using complex network analysis (22). This method applies network analysis principles, treating symptoms as nodes and their relationships as edges to construct a symptom network (23). By assessing the centrality of nodes, core symptoms within the network can be identified (24). These core symptoms have the highest activation and closely interact with other symptoms in the network. Targeting these core symptoms with psychological interventions can effectively weaken the network connections and improve intervention efficiency. Bridge symptoms within the network can be identified by assessing the bridge centrality index of a node (25). These symptoms have the strongest connections between symptom clusters. Interventions targeting bridge symptoms can sever the associations between these clusters. The study by Blanke et al. employed symptom network analysis to investigate the direct effects of cognitive-behavioral therapy on insomnia and its indirect effects on depression (26). Their findings provide valuable guidance for clinical practitioners aiming to alleviate symptoms of insomnia and depression effectively. Similarly, Zhu et al. utilized network analysis to compare core symptom differences among HIV patients with varying durations of illness, offering specific guidance for implementing precise intervention measures (27). Overall, the symptom network approach provides a comprehensive understanding of symptom interactions and serves as a valuable tool for guiding interventions in psychological research and clinical practice.

Therefore, this study aimed to use symptom network analysis to explore the relationship between alexithymia and depression, anxiety, and stress in elderly patients with MCC. The goal is to identify core and bridge symptoms in the network and analyze the mechanisms that influence their connection. Additionally, the study will classify alexithymia based on its severity and construct separate symptom networks to compare the characteristics and differences in network structures among different alexithymia groups for depression, anxiety, and stress. By thoroughly investigating the mechanisms underlying psychological problems in elderly patients with MCC, the study aims to provide valuable theoretical and practical support for improving their mental health. Based on our review of prior literature, this is the first study in Chinese communities that employs a symptom network analysis approach to examine the relationship between alexithymia and depression, anxiety, and stress in older adults with MCC.

2. Materials and methods

2.1. Study design and participants

This cross-sectional study involving multiple geographic areas was conducted, primarily using a convenience sampling method, between November 2022 and March 2023. According to the requirements for network analysis sample size (28), the sample size should be larger than the total parameters (including threshold parameters and pairwise correlation parameters). The threshold parameter equals the number of nodes, and the pairwise correlation parameter equals (total number of nodes) × (total number of nodes − 1) / 2. In this study, a total of 24 nodes needs to be constructed, therefore the threshold parameter is 24, and the pairwise correlation parameter is $(24 \times 23) / 2 = 276$. Hence, the minimum sample size required is 300 participants. The sample was drawn from older adults with MCC in communities and villages in six prefecture-level cities (Nanjing, Suzhou, Changzhou, Zhenjiang, Lianyungang, and Suqian) in Jiangsu Province, China. The inclusion criteria were as per the following: (1) age ≥60 years; (2) suffering from two or more chronic diseases; and (3) informed consent and voluntary participation in this study. The exclusion criteria were as so: (1) elderly people who declined to participate in the study; (2) those with cognitive dysfunction or intellectual disabilities that may affect the validity of this study; (3) non-residents or residents who could not identify their place of residence; and (4) those involved in other research projects. This study protocol adheres to the guidelines detailed in the Declaration of Helsinki and was reviewed by the Medical Ethics Committee of Jiangsu University, under approval number 20221019-7.

Our data collection used a combination of online and offline methods. Previous research experience has taught us that using multiple data collection methods can better avoid missing key samples (29, 30). The online component used an online survey platform, Questionnaire Star,[1] to distribute the questionnaire, and a uniformly trained researcher from the team used consistent instructions to distribute the questionnaire to eligible respondents and to explain the purpose, meaning, completion, and precautions of the survey. The survey was conducted using voluntary participation and anonymity. All participants agreed before filling out the questionnaire and, if they refused to participate, they could voluntarily exit the link. If they chose the latter, their responses would not be recorded. For some elderly participants who were illiterate or found the online questionnaire challenging to complete, the researcher asked questions verbally and filled in the online questionnaire with their answers. Additionally, to account for elderly participants who did not have access to smartphones, we prepared a paper questionnaire identical to the online questionnaire and followed the same completion requirements.

2.2. Measurements

2.2.1. Demographic information and disease characteristics

Demographic and disease-related information collected in this study included the following: gender, age, marital status, place of residence, residential status, per capita monthly household income, number of chronic diseases, and type of medication taken.

2.2.2. The Toronto Alexithymia Scale

We used the Chinese version of the Toronto Alexithymia Scale (TAS-20) to measure the degree of alexithymia. The scale was developed by Taylor (31) and later formed into a Chinese version after cross-cultural debugging by Jin et al. (32). The Cronbach's alpha coefficient of the Chinese version of the scale is 0.830. There were 20 items in total, containing three dimensions; namely, difficulty identifying feelings (DIF), difficulty describing feelings (DDF), and externally oriented thoughts (EOTS). A Likert 5-point scale was used; 1 (completely disagree) to 5 (completely agree), where items 4, 5, 10, 18, and 19 were scored in reverse, with a total score of 20–100. Higher scores represent higher levels of alexithymia in the individuals. A total score <51 indicates no alexithymia, a total score between 52 and 60 indicates suspected alexithymia and a total score ≥61 can be judged as having alexithymia. In China, this scale has been shown to be a good tool for measuring alexithymia (33). In the current study, the Cronbach's alpha coefficient for the total scale was 0.890, the Cronbach's alpha coefficient for the three dimensions DIF, DDF, and EOTS are 0.907, 0.754, and 0.456. The EOTS dimension should be interpreted with caution.

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[1] www.wjx.cn

2.2.3. The Depression Anxiety and Stress Scale-21

We used a simplified version of the Depression Anxiety and Stress Scale-21 (DASS-21) to measure depression, anxiety, and stress levels in older adults with MCC. The scale is a simplified version based on the DASS scale developed by Lovibond and Lovibond (34), which was later revised by Gong et al. (35) to form a simplified Chinese version. The full scale contains a total of 21 entries, and the three subscales of depression, anxiety, and stress each contains 7 entries, all of which are rated on a 4-point Likert scale—0 (does not meet) to 3 (always meets)—with higher total scores representing the presence of higher negative emotions. The DASS-21 has been widely used in different countries and samples with good reliability and validity (36). In the current study, Cronbach's alpha coefficient for the total scale was 0.943, and Cronbach's alpha coefficients for the three dimensions of depression, anxiety, and stress were 0.874, 0.830, and 0.844, respectively.

2.3. Statistical analysis

We used SPSS version 26.0 for the descriptive statistics and different R packages from R version 4.2.0 for network analysis with the aim of exploring the relationship between alexithymia and depression, anxiety, and stress in older adults with MCC in Chinese communities. In the network, Items that are reverse scored (including items 4, 5, 10, 18, and 19) are converted into positive scores, and the three dimensions of alexithymia (DIF, DDF, and EOTS) were used as 3 nodes. The 21 entries in the Depression Anxiety and Stress Scale-21 were used as 21 nodes, for a total of 24 nodes in the final drawn network. We conducted four main analyses: network estimation (23), centrality and predictability measures (37), accuracy and stability estimation (28), and network comparison (38). All network visualizations were presented using the Fruchterman–Reingold algorithm in the qgraph package (39).

2.3.1. Estimated network

We utilized the qgraph package (version 1.9.2) and the bootnet package (version 1.5.0) in R to construct a network representing the interactions between alexithymia, depression, anxiety, and stress in older adults (28). For network estimation, we employed the graph least absolute shrinkage and selection operator (gLASSO) method (40) and the extended Bayesian information criterion (EBIC) (41). These methods allowed us to minimize spurious connections and obtain a more realistic network structure (28). The gamma parameter in EBIC determined the reduction of spurious edges, and we set it to the default value of 0.5, as recommended in the literature (28). In the network representation, each symptom, such as "Meaningless," was considered a node, and the line connecting neighboring symptoms represented an edge, with thicker edges indicating stronger correlations between the nodes. The color of the edges indicated the direction of correlation, with blue representing positive correlation and red representing negative correlation (23). To visualize the network, we employed the Fruchterman–Reingold algorithm, which positioned the core nodes closer to the center and the edge nodes on the periphery of the network (39).

2.3.2. Centrality and predictability measurement

To evaluate and quantify the significance of each node (symptom) in the network, we computed three key centrality indices: strength, closeness, and betweenness (28). However, prior research (42) has demonstrated that closeness and betweenness are not reliable measures in mental health-related network analyses. Therefore, this study primarily focused on strength, the most commonly used centrality metric. Strength represents the sum of weighted connections of a node and measures its importance in the network. A higher strength value for a node (symptom) indicates a stronger connection and a more influential role in the network of older individuals, thus identifying it as a core symptom. Furthermore, we utilized the networktools package (version 1.5.0) to estimate the bridge centrality index, aiming to identify the bridge symptoms that connect the four conditions of alexithymia, depression, anxiety, and stress (25). Bridge symptoms refer to the symptoms that link different symptom clusters and reflect the degree of connectivity between the current node and other cluster nodes. Additionally, we employed the mgm package (version 1.2-12) to estimate the predictability of each node. Predictability (43) quantifies the extent to which changes in a node can be explained by changes in its connected nodes and reflects the controllability of the network. Higher predictability values indicate a greater influence of neighboring symptoms on a particular symptom in older adults with MCC (44). We denote predictability as rp.

2.3.3. Estimating the accuracy and stability of the network

We validated the accuracy and stability of the constructed network using the R package bootnet (version 1.5.0) (28). Accuracy was assessed by calculating 95% confidence intervals (CIs) for the edge weights. We used a non-parametric bootstrap method (1,000 bootstrap samples) to construct the CIs, and fewer overlaps in the 95% CIs represented more accurate edge estimates. Stability assessment was performed by calculating the correlation stability coefficient of the strength centrality using the case-dropping subset bootstrap (1,000 bootstrap samples). That is, the network is considered stable if the centrality of the nodes does not change significantly after most of the samples are excluded from the dataset. The correlation stability coefficient should preferably be greater than 0.5, but at least greater than 0.25, and it is optimal if it is greater than 0.7 or more (28). We used rcS to denote the correlation stability coefficient. Finally, we performed bootstrap variability tests on the edge weights and node strengths (1,000 bootstrap samples, $\alpha = 0.05$) to assess whether there is a significant difference between two edge weights or two node strengths.

2.3.4. Network comparison

To examine potential differences in the depression, anxiety, and stress networks among different levels of alexithymia, we conducted a Network Comparison Test (NCT) using the R package NetworkComparisonTest (version 2.2.1) to assess network differences (38). The NCT is a two-tailed substitution method for comparing two networks, considering network structure invariance, global strength invariance, and edge strength invariance. Global strength invariance and edge strength invariance tests are performed only if network structural invariance is violated. In our study, as we observed discrepancies in the network structure, we conducted tests for global strength invariance and edge strength invariance. Furthermore, we employed the Holm-Bonferroni correction to conduct multiple comparisons of different edge strengths, aiming to identify specific edges that differed significantly between the two networks. A significance level of $p < 0.05$ was used to determine the presence of a significant difference between the networks.

3.Results

3.1. General characteristics of participants

We eventually included 662 eligible participants, including 395 (59.7%) men and 267 (40.3%) women. The mean age of the elderly with MCC was 70.37 years. Most of the older adults were married (89.6%), resided in rural areas (56.6%), and lived predominantly with their spouses (58.2%), as is detailed in Table 1. The mean scores for each scale entry are detailed in Table 2.

3.2. Network structure, centrality, and predictability measurements

Figure 1 displays the network structure map between alexithymia and symptoms of depression, anxiety, and stress in 662 co-morbid older adults, which was constructed based on the EBICglasso model. Out of the 276 possible edges, 175 (63%) were non-zero edges, and the majority of edges showed positive correlations. The predictability of symptoms is presented in Figure 1 and Table 3 using a circular pie chart. The mean predictability value of symptoms in older adults with MCC was 0.51. Figure 2 presents the centrality indices of the network: strength, closeness, betweenness, and expected impact. In our constructed network containing 24 items, we found that "DIF" and "DDF" (weight = 0.64), "Agitated" and "No relax" (D11–D12, weight = 0.41), "Scared" and "Meaningless" (D20–D21, weight = 0.35), "Heart aware" and "Scared" (D19–D20, weight = 0.31), "Agitated" and "Down-hearted" (D11–D13, weight = 0.22) had a strong edge between them. The edge weight values between symptoms are shown in Supplementary Table S1. Figure 2 and Table 2 display the graphs and specific values of the centrality measures of the network, respectively. As we mentioned in the previous section, we used strength as the main centrality measure. We found that the top five symptoms with the highest strength in the constructed network structure were "DIF" (strength = 2.49), "Meaningless" (strength = 1.50), "Agitated" (strength = 1.50), "Scared" (strength = 1.42), and "No look forward" (strength = 0.75). The top five symptoms with the highest predictability were "DIF" (rp = 0.76), "DDF" (rp = 0.71), "Meaningless" (rp = 0.66), "Agitated" (rp = 0.65), and "Scared" (rp = 0.60).

TABLE 1 General characteristics of co-morbid elderly.

Variables	*N*/% or Mean ± SD
Gender	
Male	395 (59.7)
Female	267 (40.3)
Age	
Age	70.37 (6.92)
Marital status	
Single	11 (1.7)
Married	593 (89.6)
Widowed	58 (8.8)
Residence	
Rural	375 (56.6)
Urban	287 (43.4)
Residence status	
Living alone	119 (18.0)
Living with spouse	385 (58.2)
Living with children	158 (23.9)
Average monthly household income	
3,000 CNY and below	259 (39.1)
3,000–5,000 CNY	240 (36.3)
5,000–8,000 CNY	132 (19.9)
8,000 CNY and above	31 (4.7)
Number of chronic diseases	
2 kinds	317 (47.9)
3 kinds	264 (39.9)
4 kinds and above	81 (12.2)
Type of medication taken	
None	23 (3.5)
1–2 kinds	272 (41.1)
3–4 kinds	248 (37.5)
5 kinds and above	119 (18.0)

3.3. Network accuracy and stability

We tested the accuracy and stability of the network structure by estimating 95% CIs for the edge weights. After estimation, we derived a central stability coefficient rcS = 0.75 > 0.70, which indicates that our results were sufficiently stable. The test of the variability of the edge weights showed that most of the edges were statistically significant ($p < 0.05$) (see Figures 3 and 4).

3.4. Bridge symptoms in the network

As shown in Figure 5 and Table 2, we found that "panic" (D15, bridge strength = 0.96), "scared" (D20, bridge strength = 0.82), "No wind down" (D1, bridge strength = 0.80), "No initiative" (D5, bridge strength = 0.72), and "No positive" (D3, bridge

TABLE 2 Content and mean scores of items on the TAS-20 and DASS-21.

Items	Abbreviations	Mean	SD
D1 I found it hard to wind down	No wind down	0.83	0.73
D2 I was aware of dryness of my mouth	Dry mouth	0.98	0.77
D3 I couldn’t seem to experience any positive feeling at all	No positive	0.75	0.75
D4 I experienced breathing difficulty	Breath difficult	0.67	0.73
D5 I found it difficult to work up the initiative to do things	No initiative	0.73	0.75
D6 I tended to over-react to situations	Over-react	0.89	0.74
D7 I experienced trembling (e.g., in the hands)	Trembling	0.82	0.79
D8 I felt that I was using a lot of nervous energy	Nervous energy	1.10	0.77
D9 I was worried about situations in which I might panic and make a fool of myself	Worried	0.77	0.77
D10 I felt that I had nothing to look forward to	No look forward	0.86	0.80
D11 I found myself getting agitated	Agitated	0.77	0.75
D12 I found it difficult to relax	No relax	0.94	0.74
D13 I felt down-hearted and blue	Down-hearted	0.90	0.79
D14 I was intolerant of anything that kept me from getting on with what I was doing	Intolerant	0.67	0.72
D15 I felt I was close to panic	Panic	0.68	0.75
D16 I was unable to become enthusiastic about anything	Not enthusiastic	0.89	0.73
D17 I felt I wasn’t worth much as a person	Worthless	0.49	0.69
D18 I felt that I was rather touchy	Touchy	0.76	0.72
D19 I was aware of the action of my heart in the absence of physical exertion	Heart aware	0.85	0.75
D20 I felt scared without any good reason	Scared	0.91	0.76
D21 I felt that life was meaningless	Meaningless	0.77	0.77
S1 Difficulty identifying feelings	DIF	19.61	5.06
B1 Difficulty describing feelings	DDF	14.36	3.12
W1 Externally oriented thoughts	EOTS	22.57	3.09

strength = 0.70) had the highest bridge strength, indicating that they are bridge symptoms in the network of alexithymia, depression, anxiety, and stress. According to the edge weighting relationship we found, the symptom “panic” (D15), which has the strongest bridge strength, was strongly related to the depression clusters “Meaningless” (D15–D21, weight = 0.17), “No look forward” (D15–D10, weight = 0.16), and “Worthless” (D15–D17, weight = 0.14). The bridge symptom “Scared” (D20) was strongly associated with “Meaningless” (D20–D21, weight = 0.35) in the depression cluster and “Over-react” (D20–D6, weight = 0.11) in the stress cluster. The bridge symptom “No wind down” (D1) was strongly correlated with “No positive” (D1–D3, weight = 0.21) in the depression cluster, “Dry mouth” (D1–D2, weight = 0.19) in the depression cluster, “Dry” (D1–D2, weight = 0.19) in the anxiety cluster, and “DIF” (D1–S1, weight = 0.19) in the alexithymia cluster. The bridge symptom “No initiative” (D5) was strongly associated with “Breath difficult” (D5–D4, weight = 0.21) in the anxiety cluster, “Intolerant” (D5–D14, weight = 0.14) in the stress cluster, and “Intolerant” (D5–D14, weight = 0.14) in the stress cluster. Finally, we found a close association between the bridge symptom “No positive” (D3) with “No wind down” (D3–D1, weight = 0.21) and “Over-react” (D3–D6, weight = 0.09) in the stress cluster and “DIF” (D3–S1, weight = 0.09) in the alexithymia cluster.

3.5. Results of network comparison

We divided the chronically co-morbid older adults into three categories based on the degree of alexithymia: the non-alexithymia group, the suspected alexithymia group, and the alexithymia group. We then constructed network structure maps of depression, anxiety, and stress for each of these three groups of older adults to test for network structure invariance, global strength invariance, and edge strength invariance, as shown in **Figure 6**. We found a difference in the global network structure between the alexithymia and non-alexithymia groups ($M = 0.305$, $p = 0.013$). The global strength was 9.69 for the alexithymia group and 1.64 for the non-alexithymia group, and we estimated a significant difference between the two groups ($S = 8.046$, $p < 0.001$). However, there were no significant differences in network structure between the suspected alexithymia group and the non-alexithymia group ($M = 0.276$, $p = 0.136$) or the alexithymia group ($M = 0.206$, $p = 0.662$). Using the Holm–Bonferroni correction for multiple comparisons, we found marginal differences in the network between the alexithymia and non-alexithymia groups, including “No initiative” and “Over-react” (D5–D6, $p = 0.000$), “Nervous energy” and “Worried” (D8–D9, $p = 0.000$), “Agitated” and “Meaningless” (D11–D21, $p = 0.000$), and “Scared” and “Meaningless” (D20–D21, $p = 0.000$). Finally,

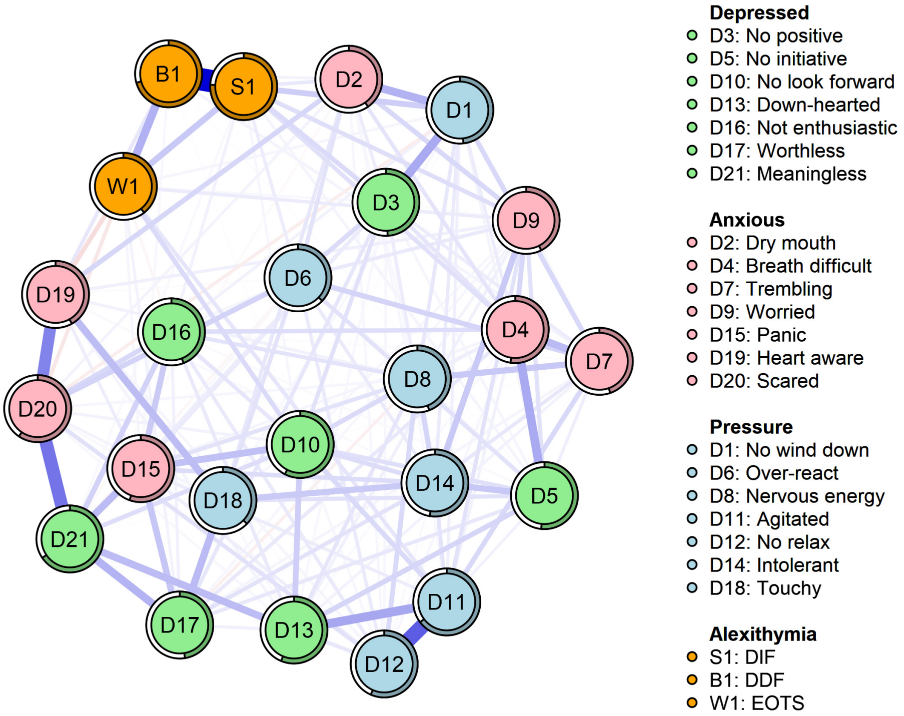

FIGURE 1
Network structure of alexithymia, depression, anxiety, and stress (*N* = 662). The same colors represent the same symptom clusters, where green represents depression, pink represents anxiety, blue represents stress, and orange represents alexithymia. DIF, difficulty identifying feelings; DDF, difficulty describing feelings; EOTS, externally oriented thoughts.

we found significant differences between the two groups in the global strength in all of the 21 nodes ($p < 0.05$). The strength centrality figure for each group are shown in **Supplementary Figure S1**.

4. Discussion

To the best of our knowledge, this was the first study to explore the network structure relationships between alexithymia, depression, anxiety, and stress in older adults with MCC in Chinese communities. We conducted a network analysis to identify the core and bridge symptoms in the network. We also focused on symptoms in the network with strong edge connections. Finally, we analyzed the differences in network structures between the alexithymia and non-alexithymia groups by classifying them according to the degree of alexithymia. We validated the accuracy and stability of the network, which enhanced the reliability and validity of our results (28).

Our focus on identifying core symptoms aimed to determine the main targets for psychological interventions in older adults with MCC (26). DIF tendency had the highest strength centrality in the network, indicating that it is a core node in the psychological problems of older adults with MCC from a mechanistic perspective (24). DIF, a major dimension of the alexithymia cluster, manifests as difficulties in identifying emotions in oneself or others (31). For instance, many people are often unaware of the activities happening within them and do not know if their existing feelings are sadness or anger. Previous total score-based studies (14, 45) have found that DIF scores were highest in chronically ill older adults with alexithymia, further reinforcing its central role. Core nodes can spread their effects to peripheral nodes and thus be the main targets of psychological interventions (26). Therefore, it is recommended to take effective measures to address the tendency of DIF in older adults with MCC in the communities. This may help promote improvement in other dimensions of their alexithymia, as well as alleviate symptoms of depression and anxiety.

In addition, “Meaningless,” “Agitated,” “Scared,” and “No look forward” also play central roles in the psychological problems of older adults with MCC. Among these core symptoms, the marginal strength between “Scared” and “Meaningless” ranked third in the whole network, indicating that the two core symptoms are closely related and often co-occur. Compared to young people, older adults have gone through most of life’s processes and seem to care more about the meaning of life than young people’s desire to pursue life goals (46). Older adults with MCC face multiple illnesses that make them prone to symptoms such as insomnia, irritability, anxiety, a tendency to fear the future, and a lack of expectation in life (4, 47). When these core problems are not addressed and improved, they can lead to a sense of meaninglessness in life, which triggers a chain reaction of negative psychological problems (48). Targeted interventions should be implemented for core symptoms such as “Meaningless” and “No look forward” because they serve as “target symptoms” in the psychological distress of older adults with MCC.

Predictability often represents the degree to which a node can be explained by changes in the surrounding connected nodes (43). In other words, nodes with high predictability can be controlled by controlling the neighboring nodes (44). The average predictability

TABLE 3 Centrality, bridge centrality, and predictability indices for the alexithymia, depression, anxiety, and stress scales.

Symptoms	Predictability	Strength	Bridge strength
D1 No wind down	0.49	−0.04	0.80
D2 Dry mouth	0.40	−1.09	0.52
D3 No positive	0.49	−0.36	0.70
D4 Breath difficult	0.52	0.32	0.66
D5 No initiative	0.52	0.17	0.72
D6 Over-react	0.37	−1.19	0.60
D7 Trembling	0.45	−0.74	0.67
D8 Nervous energy	0.44	−0.42	0.63
D9 Worried	0.43	−0.94	0.58
D10 No look forward	0.58	0.75	0.66
D11 Agitated	0.64	1.47	0.67
D12 No relax	0.57	−0.31	0.35
D13 Down-hearted	0.56	0.09	0.48
D14 Intolerant	0.53	0.64	0.65
D15 Panic	0.56	0.48	0.96
D16 Not enthusiastic	0.44	−1.01	0.55
D17 Worthless	0.47	−0.26	0.55
D18 Touchy	0.37	−1.35	0.54
D19 Heart aware	0.42	−0.46	0.41
D20 Scared	0.60	1.42	0.82
D21 Meaningless	0.65	1.50	0.60
S1 DIF	0.76	2.49	0.56
B1 DDF	0.71	0.06	0.14
W1 EOTS	0.39	−1.22	0.46

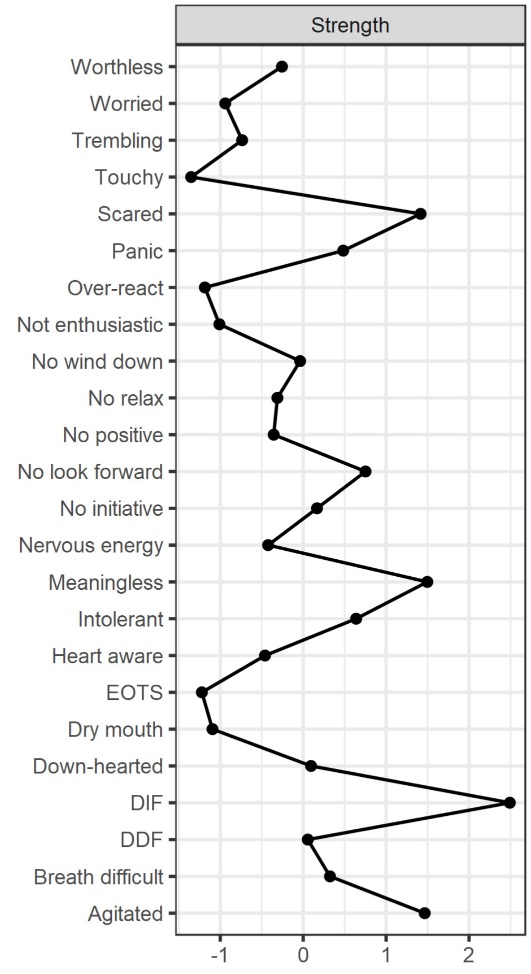

FIGURE 2
Centrality diagram of the network structure. Strength measures the importance of the nodes. DIF, difficulty identifying feelings; DDF, difficulty describing feelings; EOTS, externally oriented thoughts.

of the network constructed in this study was 0.51, indicating that the nodes in the network were moderately intervenable. The nodes with the highest predictability were “DIF,” “DDF,” “Meaningless,” “Agitated,” and “Scared.” This is interesting because we found that these symptoms were almost consistent with the core symptoms we identified. This implies that by controlling these core symptoms and the symptoms with the strongest connections to them, it is possible to effectively disrupt the influence of core symptoms in the network and achieve relief from psychological disorders in older adults with MCC. Specifically, “DIF” and “DDF,” as well as “Meaningless” and “Scared,” emerge as the strongest edge connections and are also identified as core nodes in the network. This further confirms the necessity for clinical healthcare professionals to intervene in these core symptoms, as they hold crucial positions within the network.

The present study identified “DIF” and “DDF” as the strongest edge connections within the alexithymia cluster, which is consistent with findings from previous network analyses in adolescent populations (49, 50). Notably, “DIF” emerged as the most predictable and strongest node in the network. Building upon these findings, we propose that targeting the “DDF” node through interventions may effectively weaken the association between “DIF” and “DDF,” subsequently mitigating the impact of “DIF” in the elderly with MCC. Previous studies have demonstrated the effectiveness of group cognitive interventions (51) and mental health programs (52) in alleviating alexithymia, yet research focusing on core symptoms of alexithymia in older adults remains limited and warrants further investigation. Furthermore, the study highlighted the robust connections between “Agitated” and “No relax” (D11–D12) and “Agitated” and “Down-hearted” (D11–D13) within the stress cluster, with “Agitated” identified as a core and predictable node in the network—excluding “Down-hearted.” Given the disease burden and psychological stress experienced by older adults with MCC, agitation and overstress are common. Previous studies have underscored the close relationship between agitation and frustration (53). Therefore, these connections deserve attention in future research. Moreover, we should not overlook the borderline link between “Heart aware” and “Scared” (D19–D20). Although the strength of “Heart aware” in the network is relatively weak (Strength = −0.46), the presence of the strongest edge with the core symptom “Scared” suggests that triggering “Heart aware” poses a high risk of activating the core symptom in the network, resulting in a global network response. Hence, older adults who

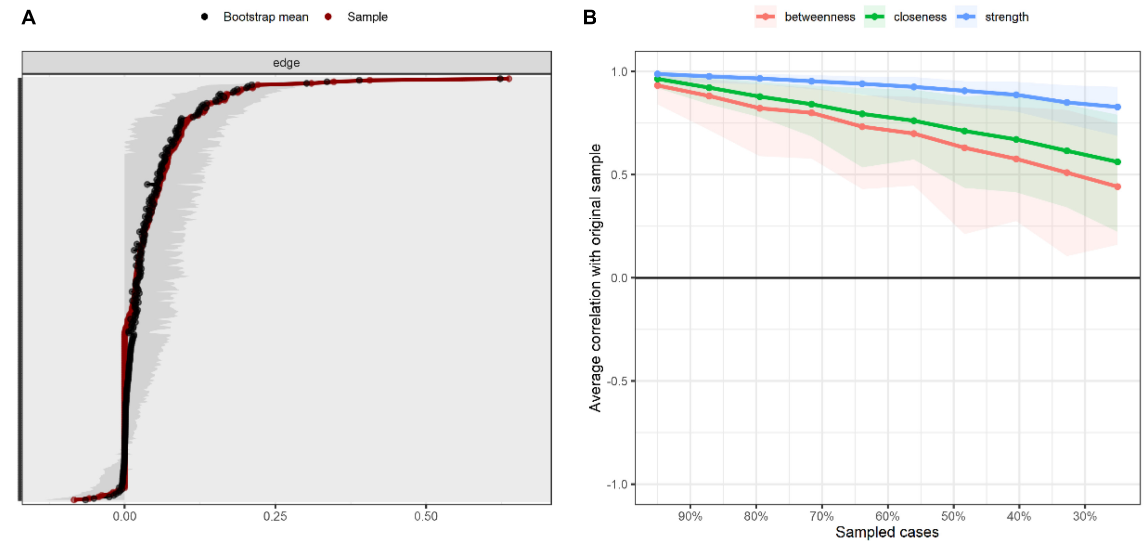

FIGURE 3
Accuracy and stability of network structure. **(A)** Accuracy analysis of edge weights. **(B)** Stability analysis of centrality indicators.

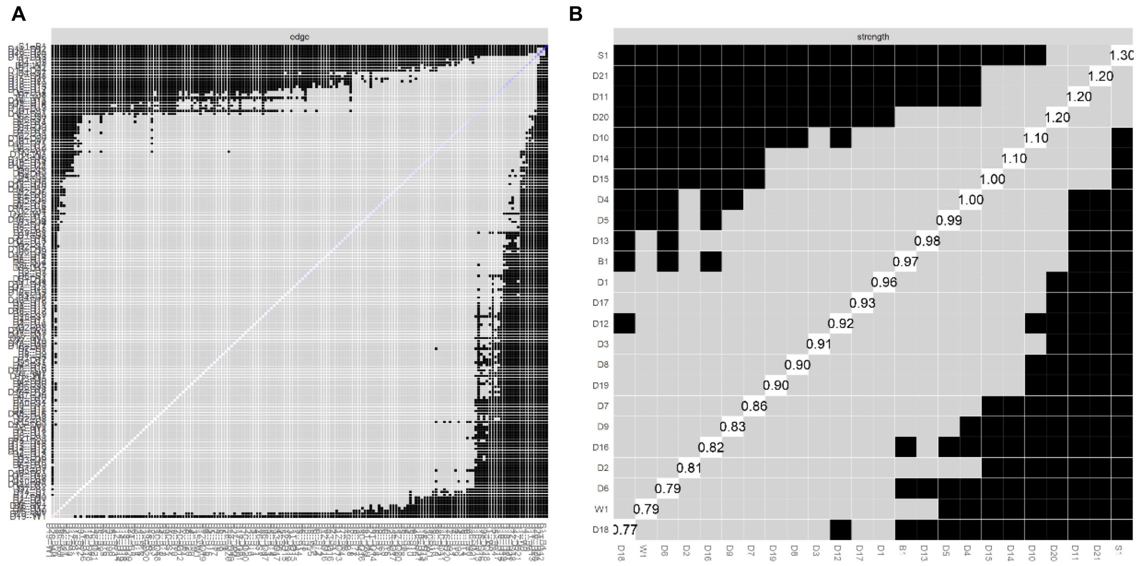

FIGURE 4
Bootstrapped difference tests for edge and strength. **(A)** Bootstrapped discrepancy test for edge weighting. **(B)** Bootstrapped discrepancy test for strength centrality. D1, no wind down; D2, dry mouth; D3, no positive; D4, breath difficult; D5, no initiative; D6, over-react; D7, trembling; D8, nervous energy; D9, worried; D10, no look forward; D11, agitated; D12, no relax; D13, down-hearted; D14, intolerant; D15, panic; D16, not enthusiastic; D17, worthless; D18, touchy; D19, heart aware; D20, scared; D21, meaningless; S1, DIF; B1, DDF; W1, EOTS.

frequently experience unexplained panic or arrhythmia should be mindful of their level of "Scared."

Furthermore, the utilization of the bridge centrality index offers valuable insights into identifying bridge symptoms that play a crucial role in the development and maintenance of psychological issues among older adults with MCC (25). In our current network analysis, we identified five bridge symptoms, namely "Panic" and "Scared" from the anxiety cluster, "No wind down" from the stress cluster, "No initiative" and "No positive" from the depression cluster. These findings suggest that targeting "Panic" and "Scared" in older adults experiencing anxiety may help mitigate the risk of transmitting symptoms to other clusters, such as alexithymia, depression, or stress (25, 54). Similarly, addressing "No wind down" in the presence of stress symptoms or treating "No initiative" and "No positive" in individuals with depressive symptoms may yield similar benefits. Furthermore, we found that the bridge symptom "Panic" in the anxiety cluster was more closely associated with the depression cluster than the alexithymia and stress clusters, including feelings of meaninglessness, worthlessness, etc. This was determined by examining the edges of the bridge symptom that demonstrated the closest connections with the other three clusters. Our findings align with the diagnostic criteria presented

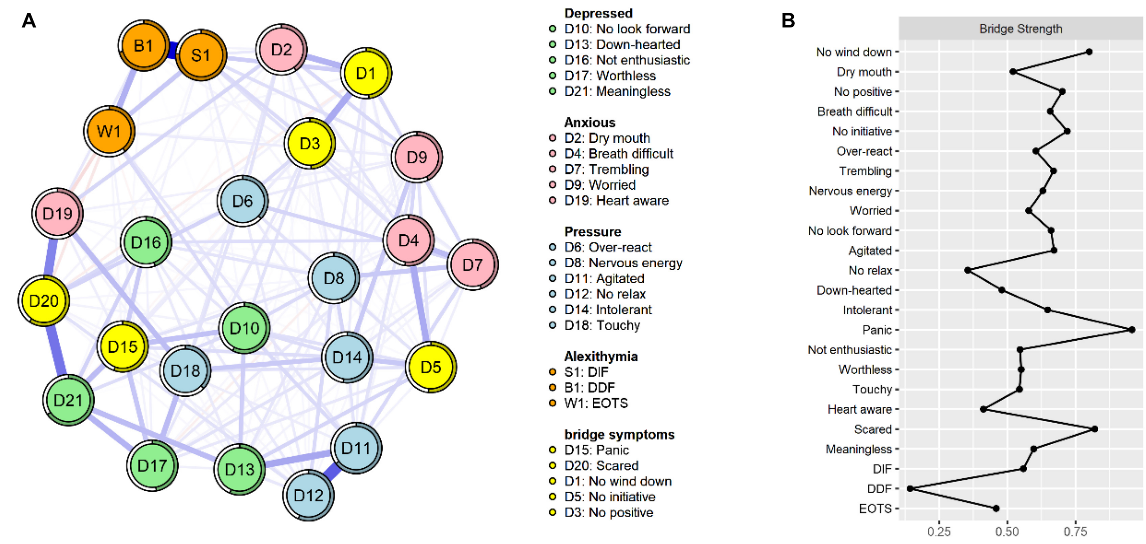

FIGURE 5
(A) Network structure diagram containing bridge symptoms. **(B)** Centrality index of bridge symptoms.

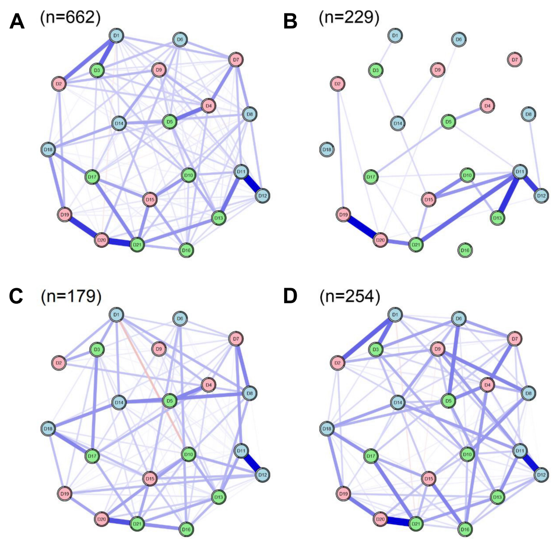

FIGURE 6
Structure of the depression, anxiety, and stress network in older adults with different degrees of alexithymia co-morbidity. **(A)** All elderly (*n* = 662). **(B)** Non-alexithymia elderly (*n* = 229). **(C)** Suspected alexithymia elderly (*n* = 179). **(D)** Alexithymia elderly (*n* = 254).

in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (55) and the ICD-10 (56) at the disease level. Older adults with MCC often experience varying degrees of dysfunction due to physiological degeneration and declining resilience within their bodies (57). Individuals with lower psychological resilience may develop feelings of hopelessness and helplessness (12, 47), which, when combined with the breakdown of their psychological defenses, can lead to a lack of life expectations and the emergence of symptoms such as depression and frustration. This pattern was further supported by a recent study involving older adults (53). Therefore, when older adults with MCC exhibit symptoms of anxiety, particularly feelings of "panic," they are at an increased risk of developing depression.

As shown in **Figure 5**, we can visualize that the bridge symptoms "No initiative" and "No positive" in the depression cluster are between anxiety and stress symptoms. This means that, as bridge symptoms, they are more closely associated with anxiety and stress (25). Of course, relying solely on visuals to make such judgments is not convincing (25, 58). Therefore, we calculated the edge weights and found that the edges most strongly connected to "No initiative" and "No positive" were from the anxiety and stress cluster, thus reinforcing our previous judgments. The symptoms most strongly associated with them included some somatization-oriented symptoms, such as feeling tongue-tied and breathlessness in the anxiety cluster. Indeed, these symptoms are common in patients with anxiety disorders (59, 60), and our study confirms the close link between the bridging symptoms in the depression cluster and these somatization symptoms, which could be the focus of interventions in this population. In the alexithymia cluster, "DIF" had the strongest edge with the bridging symptom "No wind down" in the stress cluster and the bridging symptom "No positive" in the depression cluster. We have already mentioned several times above that "DIF" is the strongest and most predictable node in the network, thus this also needs our attention.

To test our initial hypothesis, we conducted a comparative network analysis by categorizing chronically co-morbid older adults into non-alexithymia, suspected alexithymia, and alexithymia groups. Subsequently, we constructed depression, anxiety, and stress networks for each group. Our results demonstrated that the symptom networks in the alexithymia group exhibited significantly higher global network and global strength measures compared to the non-alexithymia group, thus confirming our initial hypothesis. Consistent with previous studies, alexithymia patients are more likely to experience symptoms of depression, anxiety, and stress (9, 10, 61). Consequently, it is crucial to prioritize the mental health of individuals with alexithymia. To further investigate specific distinctions between the alexithymia and non-alexithymia groups, we examined global and local borderline differences. In comparison to the non-alexithymia group, the alexithymia group demonstrated three stronger limbic connections: “No initiative” and “Over-react” (D5–D6), “Nervous energy” and “Worried” (D8–D9), and “Scared,” and “Meaningless” (D20–D21). These symptoms spanned across depression, anxiety, and stress, indicating a higher prevalence of co-occurring psychological issues within the alexithymia group. Studies in psychopathology have previously identified impaired emotional processing in the occipital region among individuals with alexithymia (62), rendering them less responsive to emotions and more prone to employing negative emotion regulation strategies (49). This may partly explain the elevated incidence of mental health problems among older adults. Furthermore, we discovered that the non-alexithymia group exhibited stronger connections between “Agitated” and “Meaningless” (D11–D21) compared to the alexithymia group. This finding is intriguing and may serve as a focal point for interventions targeting psychological problems in the non-alexithymia group of older adults. Although the differences between the suspected alexithymia group and both the non-alexithymia and alexithymia groups did not reach statistical significance, we observed that the suspected alexithymia group exhibited network connectivity patterns closely resembling those of the alexithymia group. Therefore, it is essential not to overlook the elderly individuals in the suspected alexithymia group. Furthermore, as the Network Comparison Test is a cutting-edge method, the results obtained using this method need to be interpreted with caution, which will also need to be verified in future studies.

To the best of our knowledge, this study represents the first investigation into the relationship between alexithymia and the network structure encompassing depression, anxiety, and stress in older adults with MCC within the Chinese communities. Our findings have important implications for the prevention and intervention of psychological problems in this population. Firstly, we observed that “DIF” exhibited the highest strength and predictability within the network, indicating its central role in psychological problems among older adults. From a network perspective, effective interventions targeting DIF tendency are crucial for alleviating psychological distress in this population. Secondly, our study identified “panic,” “scared,” “No wind down,” “No initiative,” and “No positive” as bridge symptoms within the network. These bridge symptoms suggest an intertwined relationship between alexithymia and other psychological problems. Interventions focusing on these bridge symptoms may be effective in preventing or treating the comorbidity of psychological problems in chronically ill older adults. Lastly, our findings demonstrated significantly higher strength on the edges connecting “No initiative” and “Over-react” (D5–D6), “Nervous energy” and “Worried” (D8–D9), and “Scared” and “Meaningless” (D20–D21) in the alexithymia group compared to the non-alexithymia group. Targeting these specific edges through interventions may be effective in preventing and halting the progression toward alexithymia. Taken together, our study highlights the importance of addressing alexithymia and its associated network structure when designing prevention and intervention strategies for psychological problems in older adults with MCC.

5. Limitations

When interpreting the findings of our study, it is important to acknowledge several limitations. Firstly, we utilized the DASS-21 scale instead of the more commonly used PHQ-9 and GAD-7 scales, which may limit the comparability of our results with other studies and the generalizability of our conclusions. However, previous research has demonstrated the reliability and applicability of the DASS-21 scale in the elderly population, and the inclusion of additional symptoms in our study adds richness to the findings. Secondly, our use of cross-sectional data to construct the network prevents us from establishing causal relationships. A further investigation employing longitudinal approaches, such as cross-lagged network analysis models, is needed to examine the temporal dynamics of the core symptom “DIF” and its relationships with other variables. Additionally, the convenience sampling method used in our study may introduce selection bias, and future research should employ stratified sampling to ensure a more representative sample. Thirdly, our reliance on self-report scales for symptom assessment introduces the potential for self-report bias and may impact the accuracy of our analysis. While a combination of online and offline questionnaires allows for comprehensive participant inclusion, it also introduces additional factors that should be carefully considered. Future research should take into account the role of covariates (e.g., gender, age, and education levels) in network analyses to provide a more nuanced understanding of the relationships between symptoms. Lastly, our sample was limited to a single province in China, which may restrict the generalizability of our findings to other regions. Future studies should expand the sample, particularly among older adults in different provinces and regions, to validate the applicability and generalizability of our results at a national level. In conclusion, our study offers valuable insights into the network structure of psychological problems in older adults with MCC. However, it is important to consider these limitations and address them in future research to further enhance our understanding of the mental health of this population.

6. Conclusion

In conclusion, our study has provided new insights into the structure of the network between alexithymia and depression, anxiety, and stress in older adults with MCC. Our findings suggest that “DIF” is the most central node in the network, followed by “Meaningless,” “Agitated,” “Scared,” and “No look forward.” “Panic,” “Scared,” “No wind down,” “No initiative,” and “No positive” were the bridge symptoms in the network. Furthermore, we also identified differences in the network structure between the alexithymia and non-alexithymia groups. The symptoms and their interrelationships revealed in our study can provide new insights and references for the prevention and intervention of alexithymia and psychological problems in community-based elderly individuals with chronic diseases. However, the above findings should be further validated in future studies.

Data availability statement

The datasets presented in this article are not readily available because the dataset for this study will not be made publicly available due to ethical restrictions. The dataset will be personally available if there is reasonable request. Requests to access the datasets should be directed to BS, sevenage007@163.com.

Ethics statement

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

Author contributions

BS and RC designed the study. FL, JW, XS, and QL collected the data. BS analyzed the data and wrote the original manuscript. CL and RC reviewed and edited the manuscript. All authors had contributed to the article and approved the submitted version.

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Conflict of interest

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

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2023.1209936/full#supplementary-material

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Behavioral and psychosocial factors related to mental distress among medical students

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Introduction: Physicians die by suicide at rates higher than the general population, with the increased risk beginning in medical school. To better understand why, this study examined the prevalence of mental distress (e.g., depressive symptoms and suicide risk) and behavioral and psychosocial risk factors for distress, as well as the associations between mental distress and risk factors among a sample of medical students in a pre–COVID-19-era.

Methods: Students enrolled in a large California medical school in 2018–2019 ($N = 134$; 52% female) completed questionnaires assessing sociodemographic characteristics, depression and suicide family history, health behaviors, and psychosocial wellbeing. Assessment scores indexing mental distress (e.g., depressive symptoms, thoughts of suicide in the past 12 months, suicide risk, and history of suicidality) and risk factors (e.g., stress, subjective sleep quality, alcohol use, impostor feelings, and bill payment difficulty) were compared across biological sex using chi-squared tests, and associations between mental distress and risk factors were determined through logistic regression.

Results: Elevated mental distress indicators were observed relative to the general public (e.g., 16% positive depression screen, 17% thought about suicide in previous 12 months, 10% positive suicide risk screen, and 34% history of suicidality), as well as elevated risk factors [e.g., 55% moderate or high stress, 95% at least moderate impostor feelings, 59% poor sleep quality, 50% screened positive for hazardous drinking (more likely in females), and 25% difficulty paying bills]. A positive depression screen was associated with higher stress, higher impostor feelings, poorer sleep quality, and difficulty paying bills. Suicidal ideation in the previous 12 months, suicide risk, and a history of suicidality were independently associated with higher levels of impostor feelings.

Discussion: Higher scores on assessments of depressive symptoms and suicidal thoughts and behaviors were related to several individual-level and potentially modifiable risk factors (e.g., stress, impostor feelings, sleep quality, and bill payment difficulties). Future research is needed to inform customized screening and resources for the wellbeing of the medical community. However, it is likely that the modification of individual-level risk factors is limited by the larger medical culture and systems, suggesting that successful interventions mitigate suicide risk for medical providers need to address multiple socio-ecological levels.

KEYWORDS

depression, suicidal ideation, suicide, sleep, impostor syndrome, stress, medical students, financial distress

1. Introduction

The COVID-19 pandemic brought the suffering of healthcare workers into sharp focus (1). Although it is still early to speculate, emerging research suggests that the pandemic likely exacerbated an issue that has been a topic of conversation in the peer-reviewed literature for decades (2).

Even prior to the pandemic, physicians suffered an increased risk of depression and suicide compared to the general population (3, 4), and research suggests that this increased risk begins in medical school. Before beginning medical school, matriculating medical students have higher self-reported quality of life and similar rates of depression compared to the general population (5), but this trend does not last. Medical students have a higher prevalence of depression and thoughts of suicide (i.e., suicidal ideation) than both the age-matched population and graduate students in other disciplines (6–9). A large nationwide study found that 58.2% of medical students screened positive for depression and 9.4% endorsed suicidal ideation (SI) within the previous 12 months (6). These rates are much higher than rates of major depression and SI reported by the general population [7.7–13.1 and 4.3–10.5%, respectively (9, 10)]. This shift in mental health during medical training highlights the need for additional research into the specific modifiable risk factors for depression and suicide (e.g., SI, suicide risk, suicidal thoughts, and behaviors) among medical students. Despite the extra attention on mental health that the COVID-19 pandemic has provided, a deep dive into modifiable risk factors for the development of depression and suicidality in this population has yet to be done. This study addresses that gap by examining risk factors in a pre–COVID-19 sample of medical students.

In this study, we concisely refer to depression and suicidality as mental distress, which is a broad and flexible term that encompasses self-reported mental health problems and the individual's experience of these problems. Depression and suicidality can be individually conceptualized as types of mental distress, as they are both mental health problems that individuals respond to uniquely and do not necessarily reflect diagnoses. There are many evidence-based risk factors for depression and suicidality in the general population; however, there is a specific gap in understanding the prevalence of these mental health conditions and their risk factors, and how they are associated among medical student populations. Previous studies have highlighted factors that place medical students at increased risk for depression including female gender (11, 12), burnout (6), lower emotional and mental quality of life (5), academic stress (13), perfectionism (11), stressful life events (11), long work hours (14), and lack of social support (15, 16). Factors that place medical students at increased risk for suicidal ideation have a large degree of overlap with risk factors for depression [i.e., female gender (17), burnout (7), and lower mental quality of life (7)]. Risk factors that are unique to suicidal ideation include dissatisfaction with academic performance (18), substance use (17, 18), being in the clinical years of training (12, 18), and demanding parents (17, 18). The purpose of the present study was to focus on risk factors that could be modifiable at the individual level. This study examined associations between indicators of mental distress [including depressive symptoms, SI, suicide risk, and history of suicidality (i.e., suicidal thoughts and behaviors)] and psychological, financial, and behavioral factors that often contribute to mental distress in the general population [including sleep quality (19–21), stress (22, 23), alcohol use (24, 25), feelings of impostor syndrome (26, 27), and financial distress (28, 29)] among a pre–COVID-19 sample of medical students in their 1st to 4th year of training. While these risk factors have demonstrated associations with mental wellbeing and are prevalent among medical school students, limited investigation has been dedicated to examining their relations with both depression and suicidality among medical students in the US. We also assess whether relations between the risk factors and mental distress indices remain after controlling for individual characteristics, such as biological sex, year in medical school, race, ethnicity, and family history of depression and suicide. Furthermore, we examine whether relations between the risk factors and suicidal risk remain after controlling for depressive symptoms. *A priori* hypotheses included predicted higher depressive symptoms and SI in our sample than typically reported in the general population, as well as predicted high levels of self-reported poor sleep quality, perceived stress, alcohol use, and feelings of impostor syndrome. We hypothesized that poor sleep quality, high perceived stress, high feelings of impostor syndrome, high alcohol use, and financial distress were associated with a positive depression screen, SI, and suicide risk. We also expected to see elevated risk factors among those with a history of suicidality. Given the estimated 3.25-fold higher rates of physician suicide among females compared to males (3), mental distress and risk factors were characterized by biological sex, predicting female students to report higher depression, suicidality, and feelings of impostor syndrome relative to male students. Similar rates of perceived stress, sleep quality, alcohol use, and financial distress were expected between male and female students.

2. Materials and methods

2.1. Study design and participants

All students actively enrolled full-time in a large, southern California medical school from December 2018 to August 2019 were eligible to participate in this cross-sectional study. The only exclusionary criterion was the inability to read English, but this did not exclude any potential participants. Permission was granted by the School of Medicine administration to contact the students through class email distribution lists. Participants were recruited primarily through email announcements sent by the primary author through a password-protected email account that was created for study use and that was only accessible by the primary author. Participants were also recruited through two in-person visits during times when the 3rd- and 4th-year (i.e., clinical stage) students were all in the same room for a required lecture. Students were not approached or emailed on an individual basis during recruitment. Participants who responded to the email announcements, or who emailed the study email after an in-person recruitment visit, were given additional study information, and an in-person appointment was scheduled to obtain informed consent and to fill out the pen-and-paper survey. The survey contained questions about sociodemographic characteristics, family history of depression and suicide, and validated measures of health behaviors and psychosocial wellbeing. Study participation was voluntary, and all survey responses were anonymized. Participants were immediately compensated $25 in cash for their time upon the completion of the survey. Study and recruitment procedures and materials were approved by the University's Institutional Review Board prior to recruitment.

2.2. Measures

2.2.1. Depressive symptoms and depression screen

The Patient Health Questionnaire-9 (PHQ-9) was used to assess depressive symptom severity in the past 2 weeks (30). The PHQ-9 has good reliability and has been validated for use in student and general population samples (31). PHQ-9 scores range from 0 to 27 with a score of 10 used as a threshold for identifying individuals experiencing major depressive disorder with 88% sensitivity and 88% specificity (32, 33). This threshold was used to dichotomize PHQ-9 scores to indicate participants with a positive depression screen (DS; PHQ-9 score $\geq$10) vs. negative DS (PHQ-9 score $<$10).

2.2.2. Suicidality

The Suicidal Behaviors Questionnaire-Revised (SBQ-R) was used to assess three unique indicators of suicidality: SI in the previous 12 months, lifetime history of suicidality, and overall suicide risk based on global scores. The SBQ-R is validated for use in college students and in the general population with good reliability (34). Scores range from 3 to 18 with a cutoff score of 7 having optimal sensitivity (93%) and specificity (95%) to differentiate between non-suicidal and suicidal individuals (34). This threshold was used to dichotomize the suicide risk variable. Due to the distribution of responses, lifetime history of suicidality and SI in the previous 12 months were also dichotomized based on participant answers to items 1 and 2 on the SBQ-R. Item 1 asks, "Have you ever thought about or attempted to kill yourself?" The answer choices include, "Never," "It was just a brief passing thought," "I have had a plan at least once to kill myself but did not try to do it," "I have had a plan at least once to kill myself and really wanted to die," "I have attempted to kill myself, but did not want to die," and "I have attempted to kill myself, and really hoped to die." Item 2 asks, "How often have you thought about killing yourself in the past year?" The answer choices include, "Never," "Rarely (1 time)," "Sometimes (2 times)," "Often (3–4 times)," and "Very often (5 or more times)." If the participant answered "Never" to item 1, they were said to have no history of suicidality. All other responses to item 1 were coded as a history of suicidality. This same process was used for item 2, to determine the presence or absence of SI in the previous 12 months.

2.2.3. Sleep quality

The Pittsburgh Sleep Quality Index (PSQI) was used to assess participants' perceived sleep quality over the past 30 days. PSQI scores range from 0 to 21 with higher scores indicative of worse sleep. The PSQI has been validated in clinical and non-clinical populations (35). A score $\geq$5 differentiates poor sleep quality with 89.6% sensitivity and 86.5% specificity (36). PSQI sum scores were dichotomized using this threshold.

2.2.4. Alcohol use

The Alcohol Use Disorders Identification Test-C (AUDIT-C) was used to assess hazardous drinking and/or active alcohol use disorders (37). AUDIT-C scores range from 0 to 12, with scores $\geq$4 indicative of a positive screen for men and scores $\geq$3 of a positive screen for women (37). The recommended cutoff scores have 86% sensitivity and 72% specificity for identifying hazardous drinking and/or active alcohol use disorders in men, and 66% sensitivity and 94% specificity likewise in women (37). AUDIT-C scores were dichotomized separately for males and females using these cutoff scores for the presence or absence of hazardous drinking.

2.2.5. Perceived stress

The Perceived Stress Scale-10 (PSS-10) was used to assess stress in the past 30 days (38). The PSS-10 has been validated in the general population, adults, college and graduate students, and in clinical populations (39). Scores range from 0 to 40, with higher scores indicating higher perceived stress. Scores $<$13 indicate low perceived stress, 14–26 indicate moderate perceived stress, and $\geq$27 indicate high perceived stress (39). PSS-10 scores were categorized using these thresholds.

2.2.6. Financial distress

Three questions measured financial distress and were adapted from the Center for Disease Control and Prevention's Behavioral Risk Factor Surveillance System Questionnaire (40): (1) "In general, would you say you have more money than you need, just enough for your needs, or not enough to meet your needs?" (2) "How difficult is it to pay your monthly bills—very difficult, somewhat, not very, or not at all difficult?" and (3) "In the past 12 months did you not have enough money to buy food—often, sometimes, rarely, or never?" Due to the distribution of responses, these variables were dichotomized; the financial need was coded as "yes" if the participant selected the "not enough" category, bill payment difficulty was coded as "yes" if the participant selected "very" or "somewhat," and food insecurity was coded as "yes" if the participant selected "often" or "sometimes."

2.2.7. Impostor syndrome

The Clance Imposter Syndrome (CIS) scale was used to assess the extent to which participants feel their accomplishments are due to luck or chance instead of ability and the perceived feeling of impostorism (41). The CIS has been validated for use in clinical and general population samples including student populations (42). Scores range between 20 and 100 with scores $<$40 classified as few impostor characteristics (IC), 41–60 as moderate IC, 61–80 as frequent IC, and $>$80 as intense IC (42, 43). Sum scores were categorized using these thresholds.

2.2.8. Covariates

Participant biological sex (44, 45), year in medical school (12), race, ethnicity (46), and family history of depression or suicide (depending on the model) were included as covariates in models examining the adjusted relations between mental distress indicators and risk factors. Questions about family history were adapted from the Center for Disease Control and Prevention's Behavioral Risk Factor Surveillance System Questionnaire (40).

2.3. Statistical analysis

Descriptive statistics were used to characterize the sample, and chi-squared tests compared mental distress indicators and mental distress risk factors across biological sex. To examine associations between risk factors and mental distress indices, a sequence of logistic regression models was conducted (Figure 1). Separate logistic regression models examined relations between each risk factor and each dichotomized mental distress indicator (DS, SI in the previous 12 months, history of suicidality, and overall suicide risk score). Covariates were added in blocks to assess adjusted associations (Figure 1), and after full adjustment, predicted probabilities were computed and plotted for each model to visualize the marginal effects across mental distress groups [i.e., positive vs. negative depressive screen (DS)] (47).

Model robustness was verified for all logistic regression models through post-estimation analyses examining the linearity of odds, specification error, multicollinearity of independent variables, goodness of fit, and area under ROC curve. Post-estimation analysis included sensitivity analyses based on residuals, leverage, and influence diagnostics to ensure that individual observations were not driving the results. A Bonferroni correction was calculated to adjust for multiple comparisons. There were seven risk factor variables examined in this study, thus $\alpha^1 = \alpha/7 = 0.05/7 = 0.007$. Statistical analyses were performed using Stata/SE 15.1.

3. Results

3.1. Mental distress indicators and risk factors among male and female medical students

Four-hundred and seventeen students were invited to participate, and 134 students enrolled in and completed the study (i.e., 32% of invited students enrolled in the study). Table 1 provides sample sociodemographic characteristics. Table 2 presents mental distress and risk factor data. There were no statistically significant biological sex differences for any mental distress indicator. Half of the sample screened positive for hazardous drinking, and the majority of participants reported poor quality sleep and at least moderate perceived stress. Nearly half the students reported frequent/intense impostor feelings. The only statistically significant difference in risk factors by biological sex was for hazardous drinking with females more likely than males to have a positive screen [$\chi^2_{(1,N=134)} = 9.6, p = 0.002$].

3.2. Risk factors associated with a positive DS

After adjusting for all covariates, poor sleep quality, higher perceived stress, higher levels of imposter feelings, and difficulty paying bills were associated with increased odds of having a positive DS (Table 3A). Among scores indicative of poor sleep quality ($\geq$5), the predicted probability of having a positive DS increased from 8.5% at a score of 5 [$p = 0.004$, 95% CI (0.027–0.142)], to 85.3% [$p = 0.000$, 95% CI (0.655–1.05)] at a sleep quality score of 13 (the highest reported in the sample; Figure 2A; panel a). As perceived stress scores increased from moderate to high, the predicted probability of having a positive DS increased from 24.1% [$p = 0.000$, 95% CI (0.146–0.335)] to 94.6% [$p = 0.000$, 95% CI (0.816–1.076); Figure 2A; panel b]. As impostor feelings

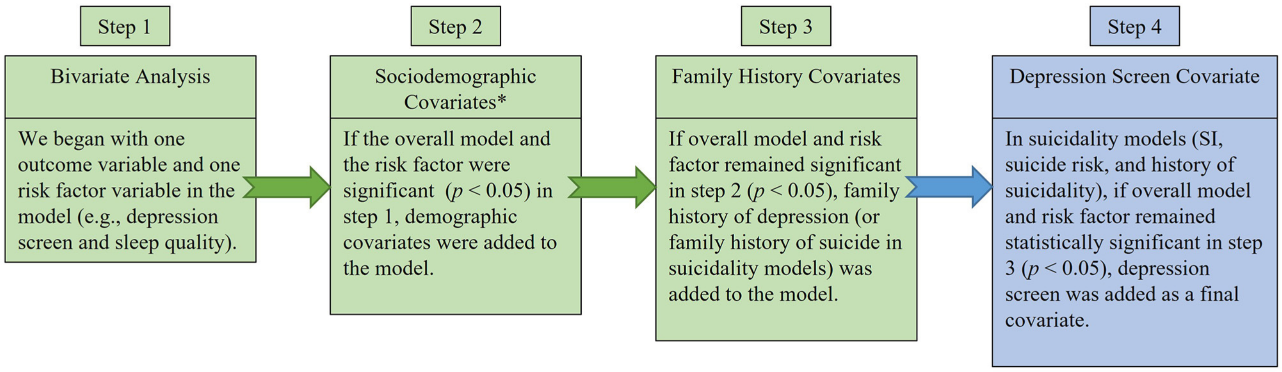

FIGURE 1
Logistic regression flow chart. Purpose of step 1 was to determine if the outcome variable (i.e., depression screen, suicidal ideation in the previous 12 months, suicide risk, and history of suicidality) was statistically significantly associated with each risk factor (i.e., sleep quality, alcohol use, stress, impostor-feelings, difficulty paying bills, financial need, and food insecurity). The purpose of step 2 was to control for *sociodemographic characteristics including sex, race, ethnicity, age, and year in medical school. The purpose of step 3 was to determine if the association between the mental distress outcome and risk factor remained statistically significant even after controlling for a family history of the disease. The purpose of step 4 was to determine if the risk factor was statistically significantly associated with the suicidality outcome, independently of the depression screen.

TABLE 1 Sample sociodemographic characteristics ($N = 134$).

		n (%)
Year in school	First	42 (31.34)
	Second	24 (17.91)
	Third	31 (23.13)
	Fourth	37 (27.61)
		***n* (%)**
Sex	Female	70 (52.24)
	Male	64 (46.76)
	Mean (standard deviation)	**Range**
Age (years)	25.75 (2.3)	22–36
		***n* (%)**
Race*	Asian	62 (46.27)
	White	59 (44.03)
	Black	3 (2.24)
	American Indian/Alaskan Native	1 (0.75)
	Native Hawaiian/Pacific Islander	1 (0.75)
		***n* (%)**
Hispanic/Latino	Yes	23 (17.16)

There was no missing data for any of the variables listed in this table. *n = 8 (5.97%) of participants answered “Prefer not to answer.” These participants were added to an “other” group in analyses, with the n = 1 participant who answered “American Indian/Alaskan Native” and the n = 1 participant who answered “Native Hawaiian/Pacific Islander.” These participants’ data were considered conceptually important to the results, even if they chose not to disclose their race. Thus, there was no missing data for any variables in this table. Age was used as a continuous variable in analyses.

increased from moderate to intense, the predicted probability of having a positive DS increased from 9.24% [$p = 0.003$, 95% CI (0.032–0.152)] to 70.56% [$p = 0.000$, 95% CI (0.446–0.964); Figure 2A; panel c]. The predicted probability of having a positive DS increased from 11.8% [$p = 0.000$, 95% CI (0.052–0.183)] for those who reported no difficulty paying bills, to 28.8% [$p = 0.000$, 95% CI (0.135–0.441)] for those who reported difficulty paying bills. Financial need [OR = 3, $p = 0.040$, 95% CI (1.049–8.576)] and food insecurity [OR = 3.88, $p = 0014$, 95% CI (1.322–11.435)] were also associated with increased odds of having a positive DS in bivariate analyses, but not after adjustment for covariates. A hazardous drinking screen was not associated with the odds of having a positive DS. The effects of sleep quality, perceived stress, and impostor feelings on the odds of a positive DS remained statistically significant at Bonferroni-adjusted alpha levels, while bill payment difficulty did not.

3.3. Risk factors associated with SI

Sleep quality was associated with higher odds of having SI after adjusting for all covariates, including DS (Table 3B). However, sensitivity analyses revealed that one participant was likely driving the association between SI and sleep quality. When this participant was dropped from the sleep quality model, the statistical significance of the sleep quality variable changed from $p = 0.047$ to $p = 0.166$. This participant had a high-risk profile with a positive DS, SI in the previous 12 months, and the highest (poorest) sleep quality score in this sample.

Adjusting for all covariates, higher levels of impostor feelings were also associated with increased odds of having SI (Table 3B). This association remained significant even after controlling for DS (Table 3B). As impostor feelings scores increased from moderate to intense, the predicted probability of having SI increased from 10.4% [$p = 0.002$, 95% CI (0.037–0.170)] to 42.7% [$p = 0.002$, 95% CI (0.162–0.692); Figure 2B; panel b]. Stress, bill payment difficulty, financial need, food insecurity, and hazardous drinking screen were not associated with increased odds of having SI. Neither the effects of sleep quality nor impostor feelings on the odds of having SI remained statistically significant after Bonferroni adjustments of alpha levels.

3.4. Risk factors associated with suicide risk

Higher levels of impostor feelings were associated with an increased odds of having a positive suicide risk screen after adjustment for sociodemographic characteristics (i.e., step 2 in Figure 1; Table 3C). When proceeding to step 3 in the logistic regression flow chart, where we control for family history of suicide, this variable was automatically dropped from the model because none of the $n = 14$ (10.45%) individuals who screened positive for suicide risk had a family history of suicide. When the individuals with a family history of suicide were excluded from the step 3 model, the results remained the same. When controlling for DS (i.e., step 4 in Figure 1), the association between higher imposter feelings and a positive suicide risk screen remained statistically significant (Table 3C). As the impostor feelings scores increased from moderate to intense, the predicted probability of having a positive suicide risk screen increased from 5.1% [$p = 0.030$, 95% CI (0.004–0.096)] to 38.2% [$p = 0.022$, 95% CI (0.055–0.708); Figure 2C]. Poorer sleep quality [OR = 1.24, $p = 0.039$, 95% CI (1.010–1.526)] and higher perceived stress [OR = 1.10, $p = 0.031$, 95% CI (1.01–1.201)] were also associated with increased odds of having a positive suicide risk screen in bivariate analysis, but not after adjustment for covariates. Hazardous drinking screen, bill payment difficulty, financial need, and food insecurity were not associated with the odds of having a positive suicide risk screen. In the step 4 model with the family history of suicide covariate removed, the effects of impostor feelings on the odds of having a positive suicide risk screen did not remain statistically significant after a Bonferroni adjustment of alpha levels.

3.5. Risk factors associated with history of suicidality

Poorer sleep quality was associated with increased odds of having a history of suicidality, even after adjusting for all covariates and controlling for DS (Table 3D). Higher levels of impostor feelings were also associated with increased odds of having a history

TABLE 2 Sample characteristics—mental distress indicators and risk factors ($N = 134$).

		Total	Males	Females
		n (%)		
Depression screen	Positive	22 (16.42)	8 (12.50)	14 (20.0)
	Negative	112 (83.58)	56 (87.5)	56 (80.0)
Depressive symptom severity[a]	Minimal or none	79 (58.96)	40 (62.50)	39 (55.71)
	Mild	33 (24.63)	16 (25)	17 (24.29)
	Moderate to moderately severe	22 (16.42)	8 (12.50)	14 (20)
Family history of depression diagnosis[b]	Yes	49 (36.57)	22 (34.38)	27 (38.57)
	No	66 (49.25)	34 (53.13)	32 (45.71)
Suicidal ideation in the previous 12 months	Yes	23 (17.16)	14 (21.88)	9 (12.86)
	No	111 (82.84)	50 (78.12)	61 (87.14)
History of suicidality	Yes	46 (34.33)	23 (35.94)	23 (32.86)
	No	88 (65.67)	41 (58.57)	47 (67.14)
Suicide risk screen	Positive	14 (10.45)	8 (12.50)	6 (8.57)
	Negative	120 (89.55)	56 (87.50)	64 (91.43)
Family history of suicide[c]	Yes	17 (12.69)	7 (10.94)	10 (14.29)
	No	116 (86.57)	57 (89.06)	59 (84.29)
Hazardous drinking screen	Positive	67 (50)	23 (35.94)	44 (62.86)
	Negative	67 (50)	41 (64.06)	26 (37.14)
Sleep quality	Good	55 (41.04)	28 (43.75)	27 (38.57)
	Poor	79 (58.96)	36 (56.25)	43 (61.43)
Perceived stress	Low	60 (44.78)	39 (60.94)	21 (30.0)
	Moderate	68 (50.75)	21 (32.81)	47 (67.14)
	High	6 (4.48)	4 (6.25)	2 (2.86)
Impostor feelings	Few	7 (5.22)	4 (6.25)	3 (4.29)
	Moderate	63 (47.01)	35 (54.69)	28 (40.0)
	Frequent	45 (33.58)	16 (25.0)	29 (41.43)
	Intense	19 (14.18)	9 (14.06)	10 (14.29)
Bill payment difficulty	Yes	33 (25)	14 (22.22)	19 (27.54)
	No	99 (75)	49 (77.78)	50 (72.46)
Financial need	Yes	23 (17.29)	10 (15.62)	13 (18.84)
	No	110 (82.71)	54 (84.37)	56 (81.15)
Food insecurity	Yes	19 (14.18)	11 (17.19)	8 (11.43)
	No	115 (85.82)	53 (82.81)	62 (88.57)

Depression screen and depressive symptom severity measured by Patient Health Questionnaire-9. Suicidal ideation in the previous 12 months, history of suicidality, and suicide risk measured by the Suicidal Behaviors Questionnaire-Revised. Hazardous drinking screen measured by Alcohol Use Disorders Identification Test-C. Sleep quality is measured by Pittsburgh Sleep Quality Index. Perceived Stress measured by Perceived Stress Scale-10. Impostor feelings are measured by the Clance Impostor Syndrome scale.

[a] Scores of 5, 10, 15, and 20 on the PHQ-9 correspond to mild, moderate, moderately severe, and severe depressive symptoms, respectively.

[b] $n = 19$ (14.18%) participants answered "I don't know" and were considered as missing in analyses.

[c] $n = 1$ (0.75%) participants answered "I don't know" and were considered as missing in analyses. There was no missing data for any other variables in this table.

of suicidality, even after adjustment for all covariates and after controlling for DS (Table 3D). Among scores indicative of poor sleep quality (≥ 5), the predicted probability of having a suicidal history increased as sleep quality worsened (higher score) from 31.8% [$p = 0.000$, 95% CI (0.240–0.397)] at a score of 5 to 62.4% [$p = 0.000$, 95% CI (0.360–0.888)] at a score of 13 (the highest score in this sample; Figure 2D; panel a). As impostor feelings increased from moderate to intense, the predicted probability of having a suicidal history increased from 21.4% [$p = 0.000$, 95% CI (0.121–0.307)] to 72.3% [$p = 0.000$, 95% CI (0.500–0.947); Figure 2D; panel

TABLE 3A Adjusted associations between behavioral and psychosocial risk factors and odds of a positive depression screen among medical students ($N = 134$).

	Odds ratio	*p*	95% CI
Sleep quality model ($n = 115$)			
Sleep quality	2.02	**0.000***	1.430–2.867
Female	3.03	0.168	0.626–14.702
Race: White	0.68	0.661	0.129–3.651
Race: Other	0.19	0.242	0.012–3.002
Hispanic/Latino	3.58	0.190	0.531–24.249
Year in school: Second	0.72	0.751	0.098–5.325
Year in school: Third	0.15	0.119	0.015–1.604
Year in school: Fourth	0.03	**0.016**	0.001–0.519
Age	1.30	0.128	0.914–2.030
Family history[a,b]	0.77	0.727	0.184–3.254
Perceived stress model ($n = 115$)			
Stress	1.268	**0.000***	1.11–1.44
Female	1.51	0.570	0.362–6.327
Race: White	0.60	0.545	0.118–3.088
Race: Other	0.24	0.274	0.019–3.037
Hispanic/Latino	6.49	**0.039**	1.101–38.256
Year in school: Second	0.79	0.784	0.147–4.241
Year in school: Third	0.15	0.074	0.020–1.201
Year in school: Fourth	0.05	0.051	0.007–1.010
Age	1.40	0.061	0.985–1.993
Family history[a,b]	1.42	0.602	0.377–5.363
Impostor feelings model ($n = 115$)			
Impostor feelings	1.10	**0.000***	1.047–1.174
Female	1.21	0.784	0.300–4.911
Race: White	1.83	0.484	0.335–9.995
Race: Other	0.62	0.714	0.049–7.799
Hispanic/Latino	6.52	**0.031**	1.184–35.955
Year in school: Second	1.16	0.870	0.194–6.935
Year in school: Third	0.22	0.170	0.027–1.886
Year in school: Fourth	0.11	0.061	0.011–1.103
Age	1.08	0.641	0.776–1.508
Family history[a,b]	1.22	0.759	0.337–4.443
Bill payment difficulty model ($n = 115$)			
Bill difficulty	3.43	**0.046**	1.02–11.5
Female	1.39	0.563	0.454–4.25
Race: White	0.549	0.359	0.152–1.97
Race: Other	0.177	0.158	0.016–1.95
Hispanic/Latino	3.61	0.099	0.786–16.6
Year in school: Second	0.628	0.561	0.131–3.00
Year in school: Third	0.407	0.269	0.082–2.00
Year in school: Fourth	0.097	**0.025**	0.012–0.745
Age	1.209	0.215	0.895–1.634
Family history[a,b]	1.387	0.568	0.451–4.26

The results presented in this table are from four separate logistic regression models: sleep quality, stress, impostor feelings, and bill payment difficulty. The table presents results from step 3 in the logistic regression flow chart (see Figure 1), where family history of depression was added to each model.

*After Bonferroni correction for multiple comparisons (0.05/7), the new p-value = 0.007. Of the main predictors in the above models, sleep quality, stress, and impostor feelings are robust to this correction. Bill payment difficulty is not.

[a] Family history refers to the family history of depression.

[b] n = 19 (14.18%) participants answered "I don't know" and were considered as missing in analyses.

Bold values correspond to statistically significant covariates.

b]. Perceived stress was associated with increased odds of having a history of suicidality [OR = 1.07, $p = 0.025$, 95% CI (1.08–1.12)], but not after adjustment for covariates. Hazardous drinking, bill payment difficulty, financial need, and food insecurity were not associated with the odds of having a history of suicidality. The effects of impostor feelings on the odds of having a history of suicidality remained statistically significant at Bonferroni-adjusted alpha levels, while sleep quality did not.

4. Discussion

This study provides novel and valuable insight into the prevalence and correlates of mental distress in the pre–COVID-19 era medical school population. The most salient risk factors identified in this study include sleep quality, impostor feelings, stress, and, to a lesser extent, financial distress. The prevalence of positive depression screens in this sample suggests a higher prevalence of depression than is typically reported in the general population but lower than medical students in previous studies (i.e., 27–58%) (6, 48). In contrast, the prevalence of SI in this sample is higher than is reported in both the general population and among medical students in previous studies (i.e., 9–11%) (6, 48). Additionally, approximately one-third of medical students in this sample had a history of suicidality (SI or suicide attempt), which may suggest that at-risk individuals are self-selecting into the medical field. This may partially explain the disparity in physician suicide relative to the general population. Alternatively, this could be an indication of how arduous the path to a career in medicine can be.

Impostor feelings emerged as a prominent risk factor for medical students, as high levels of imposter feelings were associated with increased odds of mental distress for every indicator in this study. These findings were robust to Bonferroni correction in the depression screen and history of suicidality models, suggesting very strong associations in this sample. With every 1-point increase in the impostor symptoms score (with higher scores indicative of higher levels of impostor feelings), the odds of having a positive depression screen increase by a factor of 1.10. In terms of suicidal

TABLE 3B Adjusted associations between behavioral and psychosocial risk factors and odds of suicidal ideation among medical students ($N = 134$).

	Adjustment for family history of suicide			Adjustment for depression screen		
	Odds ratio	*p*	95% CI	Odds ratio	*p*	95% CI
Sleep quality model ($n = 133$)						
Sleep quality	1.30	**0.019**	1.04–1.62	1.27	**0.047**	1.00–1.64
Female	0.25	**0.023**	0.08–0.82	0.25	**0.022**	0.07–0.81
Race: White	0.58	0.419	0.16–2.13	0.58	0.412	0.13–1.81
Race: Other	2.68	0.261	0.47–14.99	2.73	0.252	0.48–15.35
Hispanic/Latino	1.76	0.471	0.37–8.32	1.76	0.476	0.37–8.36
Year in school: Second	0.09	0.056	0.01–1.05	0.09	0.055	0.01–1.05
Year in school: Third	0.90	0.896	0.21–3.80	0.92	0.916	0.22–3.89
Year in school: Fourth	0.46	0.390	0.08–2.66	0.49	0.429	0.08–2.86
Age	0.98	0.929	0.71–1.35	0.98	0.904	0.71–1.34
Family history[a,b]	1.01	0.981	0.22–4.52	1.03	0.968	0.23–4.55
Depression screen				1.30	0.732	0.28–5.95
Impostor feelings model ($n = 133$)						
Impostor feelings	1.05	**0.011**	1.01–1.09	1.05	**0.024**	1.01–1.09
Female	0.23	**0.016**	0.07–0.75	0.23	**0.015**	0.07–0.75
Race: White	0.65	0.537	0.16–2.56	0.64	0.523	0.16–2.54
Race: Other	1.52	0.640	0.23–10.81	1.52	0.668	0.22–10.54
Hispanic/Latino	4.06	0.077	0.85–19.19	3.95	0.087	0.82–19.16
Year in school: Second	0.10	0.053	0.01−1.03	0.09	0.052	0.01–1.01
Year in school: Third	0.66	0.565	0.16–2.70	0.66	0.565	0.16–2.74
Year in school: Fourth	0.29	0.174	0.05–1.71	0.29	0.189	0.05–1.82
Age	0.93	0.677	0.69–1.27	0.93	0.686	0.69–1.27
Family history[a,b]	1.35	0.693	0.30–6.03	1.36	0.685	0.30–6.04
Depression screen				1.18	0.816	0.29–4.78

The results presented in this table are from two separate logistic regression models: sleep quality and impostor feelings. The table presents results from step 3 (i.e., adjustment for family history of suicide), and step 4 (i.e., adjustment for depression screen) of the logistic regression flow chart, as seen in Figure 1. After Bonferroni correction for multiple comparisons (0.05/7), the new p-value = 0.007. Of the main predictors in the above models, sleep quality and impostor feelings are not robust to this correction.

[a] Family history refers to the family history of suicide.

[b] n = 1 (0.075%) participant answered "I don't know" and was considered as missing in analyses.

Bold values correspond to statistically significant covariates.

history, with every 1-point increase in the impostor symptoms score, the odds of having a history of suicidality increase by a factor of 1.05. Although these odds ratios may appear relatively small, the overall effect is quite large given that the range of scores on the impostor syndrome scale is between 20 and 100. Individuals with impostor syndrome constantly doubt their skills and abilities, and are often fearful of being discovered as an impostor, or as someone who does not belong (49). This sample also had a very high prevalence of impostor feelings relative to other studies. A recent review of impostor syndrome in medical students reports prevalence among studies between 20 and 60% (26). Coping with feelings of impostor syndrome in medical students has not been explored in the literature. However, a study of the impostor phenomenon among academic faculty suggests potential intervention strategies for alleviating imposter feelings, such as formal institutional support and increasing the use of peer support networks (27). This is an area of future research with the potential to inform medical school-specific interventions.

As expected, a high proportion of students reported poor sleep quality and this was associated with increased odds of having a positive depression screen, SI in the previous 12 months, and a positive suicide risk screen (19, 20, 50). When adjusting for multiple comparisons, the effect of poor sleep on the odds of a positive depression screen remained statistically significant with a 1-point increase in sleep quality score (with higher scores indicative of worse sleep) corresponding to a 2.02-fold increase in odds of having a positive depression screen. These findings highlight the importance of improving sleep behaviors among medical students. This burden not only lies with the student but also extends to institutional levels and should be seriously considered during curriculum development and implementation. Stress was found to be another modifiable risk factor for

TABLE 3C Adjusted associations between behavioral and psychosocial risk factors and odds of suicide risk among medical students ($N = 134$).

	Adjustment for sociodemographic characteristics			Adjustment for depression screen		
	Odds ratio	*p*	95% CI	Odds ratio	*p*	95% CI
Impostor feelings model ($n = 134$)[a]						
Impostor feelings	1.05	**0.021**	1.01–1.10	1.06	**0.020**	1.01–1.11
Female	0.36	0.163	0.08–1.51	0.35	0.163	0.08–1.51
Race: White	0.80	0.800	0.14–4.44	0.80	0.805	0.14–4.48
Race: Other	9.05	**0.031**	1.21–67.40	8.80	**0.034**	1.18–66.07
Hispanic/Latino	1.75	0.522	0.31–9.72	1.95	0.454	0.33–11.36
Year in school: Second	1.47	0.716	0.18–11.94	1.55	0.681	0.08–1.51
Year in school: Third	2.78	0.263	0.46–16.70	2.63	0.291	0.43–15.98
Year in school: Fourth	0.99	0.997	0.09–10.31	0.87	0.911	0.07–9.59
Age	0.94	0.746	0.64–1.36	0.94	0.789	0.65–1.38
Depression screen				0.60	0.585	0.10–3.63

The table presents results from step 2 (i.e., adjustment for sociodemographic characteristics) and step 4 (i.e., adjustment for depression screen) of the logistic regression flow chart, as seen in Figure 1.

[a] Family history of suicide was ultimately dropped from these models because none of the n = 14 (10.45%) individuals who screened positive for suicide risk had a family history of suicide. After Bonferroni correction for multiple comparisons (0.05/7), the new *p* value = 0.007. Of the main predictors in the above models, impostor feelings is not robust to this correction.

Bold values correspond to statistically significant covariates.

depressive symptoms in our sample. Although much attention has been devoted toward the development of stress reduction programs for medical students [e.g., through mindfulness (51–53) and coping (54) interventions], these programs are not adopted by every institution. There are also mixed findings on the effectiveness of these interventions (51, 54–56). The results of this study support further examination of the mechanisms linking sleep and stress with depressive symptoms among medical students and how best to target intervention programs aimed at reducing depression.

A greater difficulty paying bills was associated with increased odds of having a positive depression screen in this sample, with individuals experiencing bill payment difficulty having a 3.43-fold increase in odds of having a positive depression screen relative to individuals who do not have difficulty paying bills. Although this statistically significant finding did not hold up to the conservative Bonferroni adjustment, the effect size of the odds ratio is so large that it warrants further discussion. Financial distress related to educational debt is associated with burnout in both medical students and resident physicians, and this is significant because burnout is associated with depression and SI in this population (7, 57, 58). This potential risk factor for mental distress may become more salient in the coming years for medical students as the American Association of Medical Colleges works toward expanding the physician workforce to include people from economically disadvantaged backgrounds (59). This means that the percentage of matriculants coming from the lower three quintiles of household income is likely to increase, which may lead to a greater percentage of medical students requiring loans to fund their medical education. This topic warrants further investigation, as the median educational debt for 73% of medical school graduates in 2019 was $200,000 (60). This figure increases yearly, even above what would be expected with inflation (60). Additional research is needed to investigate avenues to alleviate financial distress in medical students, as this is certainly a modifiable risk factor in this population (e.g., through grants, loan forgiveness, and reduction in the cost of medical school tuition).

Although hazardous alcohol use was not associated with a positive depression screen nor indicators of suicidality in this study, the fact that half of the sample screened positive for hazardous drinking is concerning. A nationwide study of physicians found that 12.9% of male physicians and 21.4% of female physicians screened positive for alcohol misuse (61). Although the prevalence was much higher in this study sample, the biological sex differences reported at the national level are also evident in this sample. The observed biological sex differences may be due to the lower threshold for hazardous drinking among females. Other studies report that high alcohol use is associated with depression, SI, low quality of life, recent medical errors, and suicide in physicians (61, 62). Our findings suggest that heavier alcohol consumption may be a symptom of underlying mental distress and co-occurring risk factors that begin early on in medical training, presenting an opportunity to mitigate this risk factor with supportive interventions.

4.1. Limitations

Although this study found high levels of suicidal ideation in this sample relative to other studies of medical students (6, 48), our sample was likely not large enough for statistically significant associations to remain so after adjustment for multiple comparisons. Additionally, we expected that a higher number of individuals would have high-risk profiles similar to the individual who was driving the sleep quality model (see Section 3.3). Our sense, based on the literature, is that a larger sample size including multiple institutions would address the issues of statistical significance. The sample size issue likely also comes

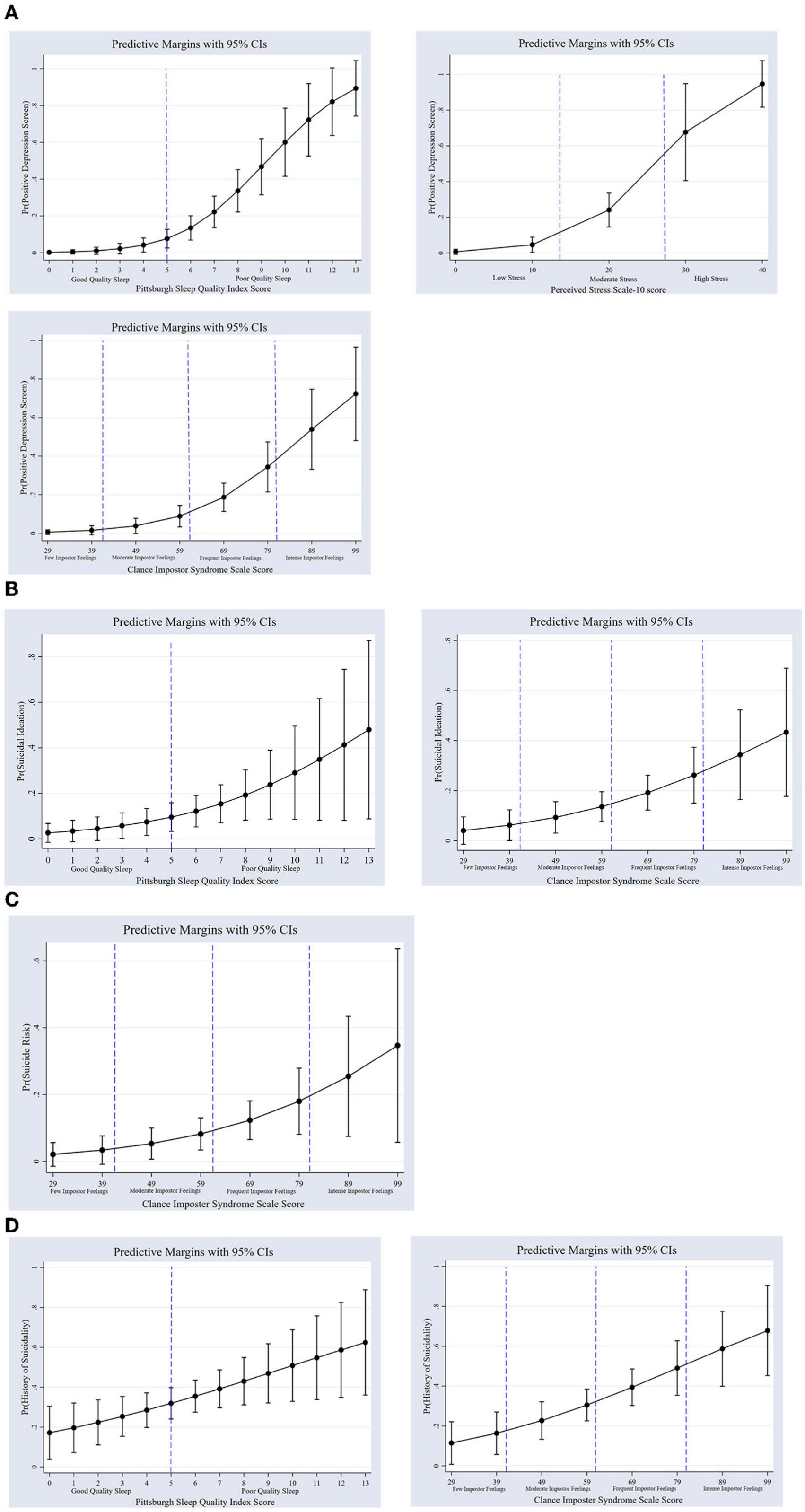

FIGURE 2

(A) Predicted probabilities of a positive depression screen by sleep quality, stress, and impostor feelings among medical students ($n = 115$). Predicted probabilities are from fully adjusted (up to step 3 in Figure 1) models. Dashed lines refer to cutoffs indicating (a) poor sleep quality, (b) moderate stress (14–26) and high stress (≥27), and (c) moderate impostor feelings (41–60), frequent impostor feelings (61–80), and intense impostor feelings (≥81). Depression screen and depressive symptom severity measured by Patient Health Questionnaire-9. Sleep quality is measured by Pittsburgh Sleep Quality Index. Perceived Stress is measured by Perceived Stress Scale-10. Impostor feelings are measured by the Clance Impostor Syndrome scale. **(B)** Predicted probabilities of suicidal ideation by sleep quality and impostor feelings among medical students ($n = 133$). Dashed lines refer to cutoffs

(Continued)

FIGURE 2 (Continued)
indicating (a) poor sleep quality, and (b) moderate impostor feelings (41–60), frequent impostor feelings (61–80), and intense impostor feelings (≥81). Suicidal ideation in the previous 12 months measured by Suicidal Behaviors Questionnaire-Revised. Sleep quality is measured by Pittsburgh Sleep Quality Index. Impostor feelings are measured by the Clance Impostor Syndrome scale. **(C)** Predicted probabilities of suicide risk by impostor feelings among medical students ($n = 134$). Dashed lines refer to cutoffs indicating moderate impostor feelings (41–60), frequent impostor feelings (61–80), and intense impostor feelings (≥81). Suicide risk measured by the Suicidal Behaviors Questionnaire-Revised. Impostor feelings are measured by the Clance Impostor Syndrome scale. **(D)** Predicted probabilities of suicidal history by sleep quality and impostor feelings among medical students ($n = 133$). Dashed lines refer to cutoffs indicating (a) poor sleep quality and (b) moderate impostor feelings (41–60), frequent impostor feelings (61–80), and intense impostor feelings (≥81). History of suicidality measured by the Suicidal Behaviors Questionnaire-Revised. Sleep quality is measured by Pittsburgh Sleep Quality Index. Impostor feelings are measured by the Clance Impostor Syndrome scale.

TABLE 3D Adjusted associations between behavioral and psychosocial risk factors and odds of suicidal history among medical students ($N = 134$).

	Adjustment for family history of suicide			Adjustment for depression screen		
	Odds ratio	*p*	95% CI	Odds ratio	*p*	95% CI
Sleep quality model ($n = 133$)						
Sleep quality	1.19	**0.032**	1.01–1.40	1.26	**0.019**	1.03–1.53
Female	0.54	0.155	0.23–1.25	0.57	0.187	0.24–1.31
Race: White	0.28	**0.009**	0.10–0.72	0.26	**0.007**	0.09–0.67
Race: Other	1.36	0.662	0.33–5.61	1.21	0.789	0.20–5.21
Hispanic/Latino	1.02	0.965	0.28–3.64	1.08	0.903	0.31–4.16
Year in school: Second	0.87	0.833	0.25–2.82	0.84	0.788	0.24–2.91
Year in school: Third	1.05	0.927	0.33–3.34	0.89	0.845	0.28–2.85
Year in school: Fourth	0.28	0.070	0.07–1.10	0.23	**0.047**	0.05–0.98
Age	1.09	0.443	0.87–1.36	1.12	0.321	0.89–1.41
Family history[a]	0.84	0.779	0.25–2.84	0.84	0.796	0.25–2.88
Depression screen				0.51	0.303	0.14–1.83
Impostor feelings model ($n = 133$)						
Impostor feelings	1.05	**0.003***	1.02–1.08	1.05	**0.001***	1.02–1.09
Female	0.51	0.131	0.22–1.22	0.46	0.080	0.19–1.09
Race: White	0.35	**0.038**	0.23–0.94	0.35	**0.037**	0.13–0.94
Race: Other	1.55	0.595	0.31–7.78	1.42	0.675	0.27–7.42
Hispanic/Latino	1.35	0.643	0.38–4.77	1.58	0.483	0.44–5.74
Year in school: Second	0.95	0.944	0.27–3.37	0.94	0.929	0.27–3.32
Year in school: Third	1.01	0.985	0.32–3.24	0.92	0.890	0.28–3.01
Year in school: Fourth	0.26	0.061	0.06–1.06	0.25	0.064	0.05–1.08
Age	1.01	0.923	0.80–1.27	1.03	0.796	0.81–1.31
Family history[a]	0.98	0.982	0.28–3.37	0.98	0.985	0.28–3.44
Depression screen				0.47	0.223	0.14–1.57

The results presented in the table are from two separate logistic regression models: sleep quality and impostor feelings. The table presents results from step 3 (i.e., adjustment for family history of suicide), and step 4 (i.e., adjustment for depression screen) of the logistic regression flow chart, as seen in Figure 1.

[a] Family history refers to family history of suicide.

* After Bonferroni correction for multiple comparisons (0.05/7), the new *p* value = 0.007. Of the main predictors in the above models, impostor feelings is robust to this correction. Sleep quality is not.

Bold values correspond to statistically significant covariates.

into play when considering the impostor feelings and suicide risk model, where we could not control for family history of suicide because none of the individuals with a positive suicide risk screen had a family history of suicide. Although it created issues in our model building, this finding may suggest that one of the strongest predictors of suicide in the general population, family history of suicide (63), may not be as salient among medical students. That is to say, other factors are increasing the risk of suicide in this population, and thus we should focus on literature addressing these factors among medical students when building future studies. More research is needed to understand the construct of suicide risk among medical students. Despite the small sample size, we maintain that the associations observed in this study are conceptually important and warrant further investigation.

Due to the cross-sectional nature of this study, the findings cannot speak to the temporality of the development of depression and suicidality. Risk factors and mental health are often bi-directional and cyclical, and risk/resilience factors tend to occur in clusters. Thus, understanding relationships among risk factors, rather than studying independently, requires further analyses. These findings may also not be generalizable to all medical students as all participants came from one large medical school. However, it is important to note that our sample had greater racial and ethnic diversity than what is seen in medical students at the national level (64), thus findings may be more appropriately generalized to other highly diverse large medical schools.

Another limitation is that the study involved an in-person appointment with a member of the research team and participants completed the written survey in the study room. Given that mental health is more heavily stigmatized in this population, the data may be subject to a social desirability effect. It is important to note that all written responses in this study were anonymous to attempt to minimize this effect. However, any social desirability bias would only underestimate the findings of this study. Nevertheless, future studies should aim to further reduce the possibility of bias in the survey response to ensure participant comfort.

It is also important to mention that by the design of the questions on the Suicidal Behaviors Questionnaire-Revised and because of our coding method, there is an overlap among the SI and history of suicidality groups. Every individual who endorsed SI in the previous 12 months ($n = 23$), also has a history of suicidality ($n = 46$), so they are present in both groups. This overlapping of constructs makes it more difficult to tease apart factors related to the individual mental distress indicators. There was less overlap among individuals in the DS and SI ($n = 6$) groups and among individuals in the DS and history of suicidality ($n = 9$) groups. The overlap between mental distress indicators is not unexpected, given the hypothesized causal relationship between depression and suicidal thoughts and behaviors (65–67). We statistically controlled for this relationship in the suicidality models by adding the depression screen covariate to the logistic regression model as the fourth and final step in model building, as is detailed in Section 2.3.

4.2. Conclusion and implications

This study provides a comprehensive investigation into a broad range of risk factors for depression and suicidality in a pre–COVID-19 sample of medical students early in their training. It is also the first investigation to assess the prevalence of suicidal history in medical students and to consider financial distress during medical school as a potential risk factor for depression and suicidality. With new charges to recruit more diverse medical students in terms of race, ethnicity, and family socioeconomics, this finding is predicted to become more relevant with future cohorts. The findings support the importance of early screening and effective support during medical training. Longitudinal and qualitative studies are needed to determine at what point suicidality develops in (pre)medical students, and the contributing factors need to be further explored.

Our findings point to possible targets for individual and institutional-level interventions to support mental wellbeing among medical students, including mental distress screenings and programs aimed at improving sleep, reducing stress, addressing impostor syndrome, and reducing financial insecurity. Impostor syndrome stood out among all other risk factors in the present sample, thus more research is needed to understand potential mechanisms to inform intervention strategies. Longitudinal research is needed to examine the temporality of these relations to inform customized resources that support individuals at every stage of their medical training and career.

4.3. A way forward

It is important to acknowledge that the modification of individual-level risk factors is limited by the larger medical culture, stigma, and systemic factors. Successful interventions to mitigate suicide risk for medical providers need to address multiple socio-ecological levels. For example, future intervention studies exploring the effect of structural changes (i.e., reducing weekly mandatory class or clinic hours to promote healthy sleep behaviors and stress reduction) on mental distress in medical students are warranted.

The enhanced stigma of mental health issues is another larger cultural and systemic factor that may limit the impact of individual-level interventions. There is concern among physicians and medical students that seeking help for mental illness will jeopardize an individual's reputation, career prospects, and medical board licensure (12, 56, 68, 69). These concerns are well-founded because up until 2019, approximately two-thirds of states had medical licensure applications that asked questions about mental health in a way that violate the American Disabilities Act and the American Psychiatric Association's position that information about past mental health treatment is not a salient predictor of current impairment (70–73). For example, prior to April 2021, Florida's medical licensure application included yes/no questions that asked about mental health or substance use diagnoses, symptoms, and treatments within the past 5 years. If an applicant answered "yes" to these questions, the applicant was required to submit personal medical records, including information about diagnosis and treatment, to the medical board (73). These types of questions have resulted in physicians hiding their treatable mental health conditions, which has implications for not only the health and safety of the physician but also for their patients (56, 74). Within recent years, physicians have been lobbying for change at the state level, which has resulted in less discriminatory language on medical board applications in states such as New Mexico and Florida (73, 75). Currently, 21 states have invasive and inappropriate questions regarding mental health on their medical board licensure applications (72, 73). Although we are moving in a positive direction, more work is needed to protect the rights of physicians and medical students to receive care for treatable mental health conditions.

Personal stories of struggle and rebound are an incredibly powerful tool to fight mental health stigma within the medical community, and we are heartened to see stories being shared in the literature (74, 76–79). A recent commentary on physician suicide details the life and loss of Dr. Lorna Breen and shares stories from physicians who have attempted suicide and/or battled depression and suicidal thoughts (74). This willingness to share personal stories is called the lived experience movement, a movement that is "providing a hopeful arc to mental health experiences, shattering stigma, modeling help-seeking, and contributing to a new culture where mental health can be viewed and addressed openly and without shame" (74).

Finally, the larger community's and global health status is an active contextual factor that can act on these existing mechanisms and increase suicidality risk among the medical community. The present study's data collection was concluded months before the COVID-19 pandemic onset and does not reflect the predicted exacerbation by the global health context placing heightened demands on the medical field. Protecting the mental health of our nation's medical providers should be of utmost importance, given the implications it has for the health and safety of the general public. The disparities in depression, suicidal ideation, and suicide among physicians are clear, and we believe that the present study's findings contribute to the collective call for change.

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 University of California, Irvine Office of Research Institutional Review Board. The patients/participants provided their written informed consent to participate in this study.

Author contributions

KC collected the data, organized the database, and wrote the first draft of the manuscript. KC and HA performed the statistical analysis. KU and JR wrote sections of the manuscript. All authors contributed to conception, design of the study, interpretation of data, manuscript revision, read, and approved the submitted version.

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Conflict of interest

HA was employed by University Statistical Consulting, LLC.

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Milieu-specific differences in symptom severity and treatment outcome in psychosomatic rehabilitation in Germany

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Introduction: Previous studies that focused on socioeconomic differences did not comprehensively explain existing inequalities in psychosomatic rehabilitation in Germany. We applied a social milieu approach, which additionally includes sociocultural factors such as lifestyles, attitudes and values, to investigate differences among patients in symptom severity, psychosocial impairment and improvement over the course of the intervention.

Methods: As a model for social milieus, the empirical *Sinus milieus* were used. 2,000 patients of two psychosomatic rehabilitation clinics in Germany were included and their milieu was assessed with the *Sinus milieu indicator for Germany 10/2018* questionnaire. BDI-II ($N = 1{,}832$) and HEALTH-49 ($N = 1{,}829$) questionnaires were used to measure depressiveness and psychosocial impairment at admission (T0) and discharge after 5 weeks of treatment (T1). Milieu differences in severity and improvement were analyzed by mixed-model ANOVAs.

Results: Milieu distribution was not representative of the overall population of Germany. We found significant differences between patients from different milieus in both BDI-II and HEALTH-49 ($p < 0.001$). Patients from the Precarious Milieu had the highest burden of depressive symptoms in BDI-II and the highest impairment on all HEALTH-49 scales at T0 and T1. Over the course of rehabilitation, patients from all milieus improved significantly in all domains ($p < 0.001$). Significant interaction effects showed milieu-dependent differences in improvement for depressiveness on the BDI-II [$F(9, 1822) = 2.50$, $p = 0.008$] and for three HEALTH-49 scales, namely Psychological well-being [$F(9, 1819) = 3.30$, $p_{adj} = 0.005$], Interactional difficulties [$F(9, 1819) = 2.74$, $p_{adj} = 0.036$] and Activity and Participation [$F(9, 1819) = 4.94$, $p_{adj} < 0.001$], while post-hoc tests only revealed two significant group differences for the last scale. In all domains, patients from the Precarious Milieu retained higher symptoms and impairment at T1 than patients from better-off milieus had at T0.

Discussion: Social milieu was associated with symptom severity, treatment access and outcome of psychosomatic rehabilitation patients. Milieu-specific sociocultural habits, psychosocial needs and therapeutic demands may help describe differences and should be considered in therapy planning and implementation, to improve equal access, quality and effectiveness of rehabilitation. Therefore, further research on milieu-specific differences and needs is necessary.

KEYWORDS

psychosomatic medicine, rehabilitation, treatment outcome, social milieu, mental health disparities, social determinants of health, social inequality, health equity

1. Introduction

Health inequalities are systematic, avoidable differences in health outcomes between social groups (1) and may deprive people of life chances based on their position in society (2). Mental health inequalities, particularly those related to the negative impacts of socioeconomic disadvantage, have been widely documented: for instance, disadvantaged socioeconomic status was found to be related to higher prevalences of negative life events, chronic stress (3), mental health problems (4), and mental disorders (4, 5), such as depression (6). Living in deprived areas (e.g., with low neighborhood income) and low formal education were associated with higher rates of mood disorders (7, 8), psychotic disorders, self-harm, substance abuse, and dementia (8). Neighborhood deprivation was additionally related to higher prevalences of anxiety disorders and poor mental health in general (7). Low education was furthermore associated with higher rates of neurotic disorders (8) and suicide (9). Moreover, disadvantaged people assessed their own health (3, 4) and health-related quality of life more negatively (4).

Socioeconomic disadvantage may also affect the treatment of mental illness, for instance in psychosomatic rehabilitation. In Germany, psychosomatic rehabilitation is an important sector of mental health care, aiming at preventing, treating and compensating for (chronic) mental disorders. Rehabilitation is carried out in specialized clinics throughout the country. It is indicated when patients are impaired by mental illness to such an extent or for such a length of time so that their social or occupational participation is restricted or endangered (10). The overall effectiveness and treatment success of psychosomatic rehabilitation, in terms of symptom improvement, benefit assessment and work and earning capacity, have been demonstrated in many studies (11–13). Previous research has also shown that in psychosomatic rehabilitation, both symptom severity and treatment outcome differ in relation to socioeconomic factors. For instance, higher income, formal education and vocational status were associated with better subjective health at the beginning of the rehabilitation (14). Higher income was also correlated with stronger improvement in depressiveness (15) and higher vocational status was related to stronger improvement in subjective health after rehabilitation (14). While there was no relevant association between education and the improvement of well-being as well as work ability in one study (16), others found that lower formal education was negatively associated with the improvement of psychological stress, depressiveness (17) and subjective health (14). When a stratification index (income, formal education, and vocational status) was applied, the so-called lower class was the most impaired group with regard to almost all of the examined aspects of subjective health at the beginning of rehabilitation; these patients were not able to compensate for the initial differences compared with the so-called upper class (18).

While these studies showed an association between socioeconomic factors and the health status and treatment outcome of patients, they do not give sufficient evidence to comprehensively describe the dimensions and driving factors of inequalities in psychosomatic rehabilitation in Germany. Although there is no generally valid, theoretically sound and empirically proven explanatory model for the phenomenon of health inequality (19), there is agreement on the complexity of its causes (20). Explanatory approaches such as the consideration of socioeconomic factors can thus only partially contribute to the description of health inequalities (20). Comparable to the use of socioeconomic status, class and stratification approaches, milieu approaches have long been used in applied social science to structure large social groups (21). These approaches have the advantage of including other socially structuring factors in addition to socioeconomic ones, as people with similar economic backgrounds may still differ in sociocultural aspects, such as lifestyles, basic values and attitudes (22–24), which could affect both access to and needs regarding health care. In this way, milieu models attempt to represent social groups that better reflect everyday life than the sole categorization, e.g., into different social strata, would be able to do. The social milieus, analogous to different strata in a stratification model, each have different social privileges or disadvantages and thus also different health opportunities (25). Initial studies have shown different health outcomes for people from different social milieus and that these theoretical approaches can help to further describe the phenomenon of health inequality (25, 26).

To complement the existing body of research on socioeconomic differences in symptom severity and treatment outcome in psychosomatic rehabilitation in Germany, we conducted a study applying a milieu approach as it is introduced above. In order to use our available resources most efficiently and to obtain a high level of standardization for the survey, an existing milieu model was used: the *Sinus milieus* (in German: Sinus-Milieus) represent the first and so far only applied empirical milieu model in German-speaking countries (24). The model is theory-based, quantitatively post-modeled and validated and incorporates socioeconomic as well as sociocultural factors (24, 27). It can be used for surveys that aim to quantify different social milieus and determine differences between them. The available extensive characterization of the Sinus milieus offers approaches for theoretical considerations on the causes of observed statistical differences between people from different milieus. The application of the model could thus help to generate hypotheses about further relationships between social structuring and health outcomes, as well as mediating mechanisms (cf. chapter 2.2.).

This is of particular interest and relevance for the care setting of psychosomatic rehabilitation. The statutory pension insurance in Germany, as one of the main providers, has the task and responsibility to offer suitable and effective services to insured persons of different social backgrounds. Following a biopsychosocial model of disease, the therapies in psychosomatic rehabilitation already take into account social aspects of the development and maintenance of mental illness as well as social stresses that affect the patients. For example, stress in the workplace is generally addressed, since most patients are currently unable to work or are at risk of reduced earning capacity. However, it depends on the particular therapists to what extent and in what way they address the individual socioeconomic and sociocultural stresses and resources of the patients. So far, these aspects are neither recorded nor considered in a systematic and standardized way. Thus, current treatment plans, assignment to therapy groups and specific therapy content of patients are not yet systematically oriented to socially unequally distributed factors (cf. chapter 2.1.).

Against this background, we first examined which social milieus are represented in psychosomatic rehabilitation and how the milieu distribution of the study sample relates to that of a representative sample of the total population in Germany. Our aims were to investigate the association between social milieu and the severity of psychological symptoms, psychosocial impairments and symptom improvement over the course of rehabilitation. With our results we want to provide empirical evidence to the discussion whether psychosomatic rehabilitation is sufficiently adapted to milieu-specific differences and demands.

2. Materials and methods

2.1. Sample and intervention

Our survey was conducted between March 2019 and March 2020 in the psychosomatic departments of two rehabilitation clinics in Germany: the Seehof clinic near Berlin, run by the *Federal German Pension Agency*, and the Oberharz clinic in Lower Saxony, run by the regional *Pension Agency Braunschweig-Hannover*. Both clinics are specialized in the treatment of mood (affective), neurotic, stress-related and somatoform disorders. All adult patients who matched the criteria were consecutively included until the predefined sample size of $N = 2{,}000$ ($N = 1{,}000$ for each of the clinics) had been reached. The targeted sample size was chosen for, inter alia, economic and practical reasons. Notably, we estimated that a sample size of $N = 1{,}000$ could be achieved within the intended study duration of 1 year, given the usual admission rate in both clinics. Moreover, as the milieu shares in the study sample were unknown prior to the study, we assumed that this sample size would ensure sufficient group sizes for all milieus in order to enable a meaningful statistical analysis. The following inclusion criteria were applied: present indication for psychosomatic rehabilitation (taken as given on admission to the clinic), full participation in the five-week intervention (cf. next paragraph), adequate German language comprehension (assessed by medical staff), absence of severe cognitive impairment and medical emergencies including acute psychological crises (assessed by medical staff) as well as a completed milieu assignment (cf. chapter 2.3.).

Rehabilitation treatment in the two clinics has a regular duration of 5 weeks and addresses biological, psychological and social factors (although the latter are not considered in a systematic and standardized way; cf. chapter 1). The treatment aims at reducing symptoms, training capacities, helping to cope with chronic impairments and restoring well-being, everyday life and working abilities. Therefore, a multimodal and interdisciplinary treatment approach is applied (10): components of the 20 to 25 h per week program are psychotherapy, sports therapy, physiotherapy, occupational therapy, relaxation methods, creative therapy, socio-medical counseling as well as health, nutrition and psychoeducation. In addition, pharmacological treatment is provided when necessary. Psychotherapy takes place in individual and group sessions. Patients are assigned to two different psychotherapy groups, one on the basis of the time of admission (patients admitted on the same day are assigned to one group) and the second on the basis of individual diagnoses and personal impairments, i.e., there are groups for patients with anxiety, physical problems, and depression as well as life and workplace problems, among others. Most other therapies are also conducted in groups. The selection of specific further therapies, e.g., the type of sports therapy and relaxation methods, is made jointly by the treatment team and the patients, after which the patients are assigned to the respective groups.

2.2. Sinus milieus as an empirical milieu model

The Sinus milieus applied in this study represent an empirical model developed by the privately run *Sinus institute* in Germany (24). It is based on a large number of qualitative interviews and home visits to the country's population. With a validated questionnaire called the *Sinus milieu indicator* (in German: Sinus-Milieuindikator), milieus can be assigned to the respondents. The milieus and questionnaire are continuously re-evaluated and adapted to changing social realities (24, 27). In our study the model of 2020 was applied; the latest version of 2021 was released after the study had been completed.

The Sinus model aims to describe people's "lifeworld" in terms of socioeconomic and sociocultural factors and has the ambition to portray social realities as realistically as possible. To this end, social situations, basic value orientations, lifestyles, everyday attitudes, life strategies, aspirations, fears and future expectations were investigated in a large sample of the population in Germany. The empirical findings of the interviews were condensed into a basic typology, the Sinus milieus. The model groups people on the basis of similarities concerning their social situation, lifestyle and outlook on life, which is how different social milieus can be distinguished from one another and described, with each of them having characteristic features (27). In this way, the model depicts various aspects of social realities in a standardized way. The application thus allows for a complex combined socioeconomic and sociocultural clustering without the necessity and needed resources to collect a large number of individual factors.

In the model of 2020, ten Sinus milieus were defined for the general population in Germany. They can be visualized in a milieu diagram (cf. Figure 1), applying the dimensions "Social Status" (on the vertical axis) and "Basic Values" (on the horizontal axis). In the diagram, each of the two axes is divided into three sections. The dimension Social Status represents factors of the social situation, such as income, formal education level and occupational status (socioeconomic factors). From the bottom to the top, the axis is divided into the categories lower social class/lower middle social class, middle middle social class and upper middle social class/upper social class. The dimension Basic Values represents factors such as lifestyle, orientations, and lifegoals (sociocultural factors). From left to right, there is a classification into the categories tradition, modernization/individualization and new values. This reading direction also refers to the dynamic development of the predominant basic values in society over time (27), as people of higher age tend to be situated in milieus on the left and people of younger age tend to be situated in milieus on the right side of the diagram (28). The position of the Sinus milieus in

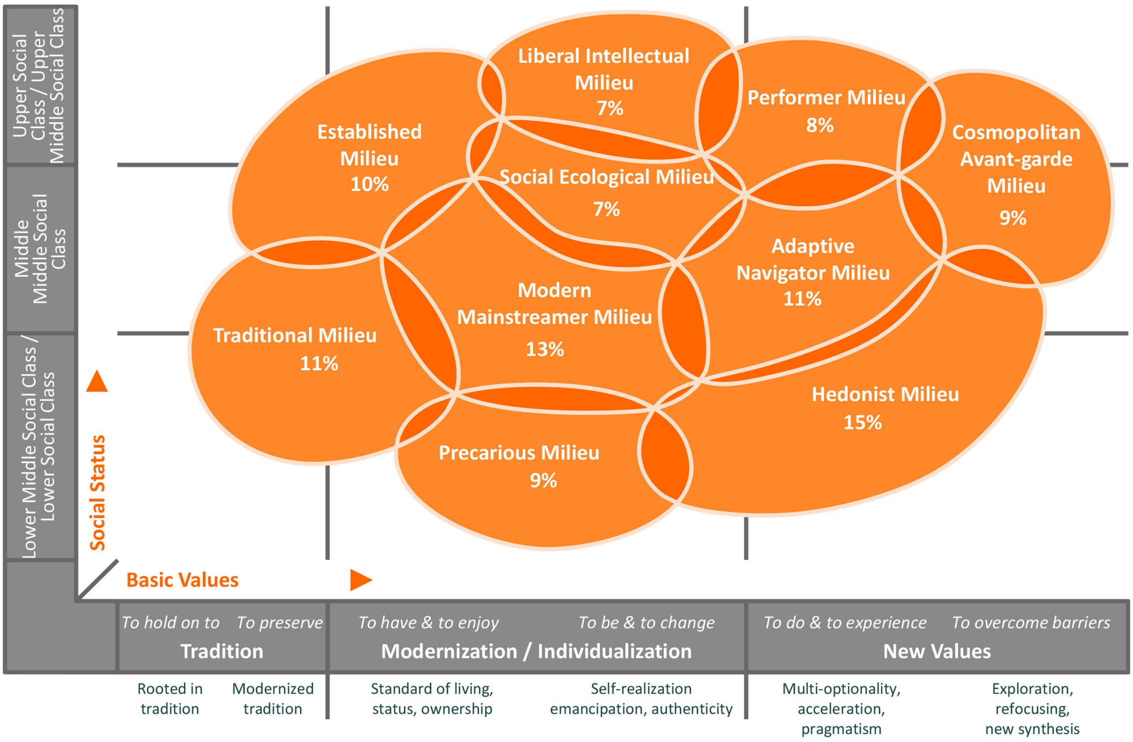

FIGURE 1
Sinus milieus in Germany in the 2020 model and their percentage share of the total population, N = 30,178 (© SINUS 2020).

the diagram is generally not restricted by the imaginary boundaries of the Social Status and Basic Values categories; indeed, most of the milieus reach across different social classes and value orientations. Theoretically, the milieus overlap with others at their edges. Nevertheless, the practical application of the model allows a clear assignment of the best-fitting Sinus milieu to each participant. The milieu designations have emerged from the sociological research tradition and do not comprehensively characterize the respective milieu. They are rather of illustrative character (27).

In the following, we provide a brief description of the 2020 model's milieus as they are characterized by the Sinus institute (27): the "Established Milieu" is considered the classical establishment with status awareness, an ethic of responsibility and success, a claim to exclusivity and leadership and an increasing desire for order and balance. The "Liberal Intellectual Milieu" represents an informed and educated elite with a critical world view, a liberal attitude, post-material roots and desire for self-determination and self-expression. The "Performer Milieu", a multi-optional, efficiency-oriented performance elite, is characterized by global economic thinking, a self-image as consumer and style avant-garde and a high affinity for technology and IT. The "Cosmopolitan Avant-garde Milieu" is regarded as the ambitious creative avant-garde, geographically, culturally and mentally mobile and networking, in search of new horizons and solutions and with an appearance as trendsetters. The "Modern Mainstreamer Milieu", the middle class mainstream that is willing and ready to perform and adapt, affirms the social order, is described as having a desire for secure circumstances as well as for professional and social establishment and at the same time showing growing excessive demands and fears of social decline. The "Social Ecological Milieu" is an engaged and socially critical milieu with normative ideas of the right life, a strong ecological and social awareness, scepticism about globalisation and commitment to political correctness and diversity. The "Adaptive Navigator Milieu" is considered as modern, young and situated in the middle class with strong pragmatism and orientation towards usefulness; it is ambitious, flexible and cosmopolitan and shows a need for roots, belonging and entertainment. The "Traditional Milieu" is depicted as the security- and order-loving older generation, maintaining the petit-bourgeois world or traditional working-class culture, characterized by thriftiness, adaptation to necessities, increasing resignation and feelings of being left behind. The "Precarious Milieu" is regarded as people from the lower class striving for orientation and participation, with a desire to catch up with consumption standards of the broad middle class, with resentments and the experience of exclusion. Finally, the "Hedonist Milieu" represents fun- and adventure-oriented modern lower class or lower middle class people, who are described as spontaneous, often adapted at work and breaking out of everyday pressures in their free time (27).

2.3. Instruments and statistics

Medical staff of the rehabilitation clinics routinely documented the sociodemographic characteristics of the patients and their diagnoses of mental and behavioral disorders (F-diagnoses), according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, German Modification (ICD-10-GM; 29). The *Sinus milieu indicator for Germany 10/2018* questionnaire was answered by the patients at T0 (clinic admission). The assignment of specific Sinus milieus was then performed by the Sinus institute using cluster analysis. For both clinic samples, the number of patients belonging to the respective milieus was counted. Based on the sample size of $N = 1,000$ per clinic, the percentage of the ten milieus in each sample was then determined. A rule of three was used to compare the milieu distribution of the two clinic samples with a representative sample of the total population of Germany. By doing so, the percentage share of a milieu in the clinic sample (e.g., percentage share of the Established Milieu in the Seehof clinic was 7%) was put in relation to the percentage share of the corresponding milieu in the representative reference sample (e.g., Established Milieu in reference sample was 10%). The reference milieu was set equal to 100 (e.g., $7\% \div 10\% \times 100 = 70$; cf. Figure 2). Classification of representativeness was derived from defined threshold values by the Sinus institute. A milieu in the clinic sample was considered as overrepresented compared to the corresponding milieu in the total population of Germany if a value ≥ 120 was calculated in the rule of three, as representative if a value < 120 and > 80 was calculated and as underrepresented if a value ≤ 80 was the case (e.g., with a value of 70, the Established Milieu in the Seehof clinic was underrepresented). To assess symptom severity and outcome, patients completed two questionnaires at T0 and T1 (clinic discharge): the *German version of the revised Beck Depression Inventory* (BDI-II; 30) and the *Hamburg Modules for the Assessment of Psychosocial Health in Clinical Practice* (HEALTH-49; 31).

The BDI-II assesses the presence and severity of depressive symptoms according to the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV; 30, 32). Patients are asked to evaluate the severity of their symptoms (e.g., sadness, loss of interest, changes in sleeping habits) over the last 2 weeks by rating 21 items on four-point Likert scales (0–3 points per item). The points are then added up to a total sum score, with higher scores indicating higher symptom severity, ranging from not present (0–8 points) over minimal (9–13 points), mild (14–19 points), and moderate (20–28 points) to severe (29–63 points). The German version of the BDI-II has been psychometrically tested and meets all relevant test quality criteria. The correlations with the construct-related, self-assessed German short form of the Inventory to Diagnose Depression (in German: Fragebogen zur Depressionsdiagnostik nach DSM-IV, FDD-DSM-IV) ranged from $r = 0.72$ for a sample of depressive patients to $r = 0.81$ for a healthy sample. The reliability (internal consistency; Cronbach's alpha) was $\alpha = 0.93$ in a sample of depressive patients in treatment, $\alpha = 0.92$ in patients with primarily other mental disorders and $\alpha = 0.90$ in a healthy population.

FIGURE 2

Milieu distribution in the rehabilitation clinics Seehof and Oberharz ($N = 1,000$ each) compared to a representative sample of the total population of Germany (cf. Figure 1). Number in percent: milieu share in the study sample; number in brackets: milieu share in the study sample ÷ milieu share in total population × 100; classification of representativeness: ^{1}milieu overrepresented (≥ 120), ^{2}representative (< 120, > 80), and ^{3}underrepresented (≤ 80).

Objectivity of execution, evaluation and interpretation are given with the computer-based application of the normed test (33).

The HEALTH-49 questionnaire consists of 49 items to be rated on five-point Likert scales by the patients (0–4 points per item). Ten scale scores are calculated from the means of multiple corresponding items, with higher scores expressing higher impairments in the specific areas: (1) Somatoform complaints (e.g., pain in muscles or joints), (2) Depressiveness (e.g., feeling of hopelessness), (3) Phobic anxiety (e.g., fear of leaving the house alone), (4) Psychological and somatoform complaints (sum of the previous three scales), (5) Psychological well-being (e.g., feeling of relaxation), (6) Interactional difficulties (e.g., difficulty in raising important concerns with others), (7) Self-efficacy (e.g., ability to achieve personal goals), (8) Activity and Participation (e.g., impairments in occupation, household and free time), (9) Social support (e.g., support from someone when it is needed), and (10) Social stress (e.g., problems are talked down by close persons). The reliability (internal consistency; Cronbach's alpha) of the HEALTH-49 scales can be rated as predominantly high with α between 0.76 and 0.91 in a sample of patients in primary care and between 0.73 and 0.90 in rehabilitation patients with mental illness, respectively. Construct validity was demonstrated by correlations of $r > 0.80$ between the scales Somatoform complaints, Depressiveness, Phobic anxiety as well as Psychological and somatoform complaints and the respective corresponding scales of a short version of the Symptom Checklist 90-Revised (SCL-14) in a rehabilitation sample. For the Somatoform complaints scale, there was also a high correlation with the physical sum scale of the Short-Form Health Survey (SF-8; $r = 0.71$). The Interactional difficulties scale correlated particularly highly with the content-related total score on the German short version of an inventory for the assessment of interpersonal problems (in German: Inventar zur Erfassung interpersonaler Probleme, IIP-25; $r = 0.75$). All HEALTH-49 scales proved to be suitable for differentiating between healthy and mentally ill persons, with healthy persons having significantly lower impairment scores in each case and differences reaching the magnitude of large effect sizes (Cohen's $d > 0.80$) except for the Social support scale ($d = 0.34$). With regard to sensitivity to change during inpatient psychosomatic or psychotherapeutic rehabilitation, seven of the scales showed changes to the extent of at least a medium effect size; changes on the Phobic anxiety scale reached the extent of a small effect size and on the Social support and Social stress scales only less than small change effects were found (34).

The statistical analyses were conducted with IBM SPSS Statistics 28. For this purpose, 168 (BDI-II) resp. 171 (HEALTH-49) patients had to be excluded from the total sample of $N = 2{,}000$ because of missing values or nonresponse to the questionnaires. The test requirements were examined in advance and a significance level of $\alpha \leq 0.05$ was assumed. Mixed-model ANOVAs (split-plot ANOVAs) were performed for the BDI-II ($N = 1{,}832$) and separately for each of the ten scales of the HEALTH-49 ($N = 1{,}829$), applying the Bonferroni correction for the latter and determining adjusted values of p (p_{adj}). Interaction effects (time × milieu) and main effects (time, milieu) were analyzed. No covariates were included in the statistical procedure because there were no assumptions about factors affecting the dependent variables that were not already part of the milieu model. To assess effect sizes, partial eta-squared (η^2_{part}) was used (35), with $\eta^2_{part} \geq 0.01$ describing a weak, $\eta^2_{part} \geq 0.06$ a medium, and $\eta^2_{part} \geq 0.14$ a strong effect (36). To examine group differences (main effect of milieu), Tukey post-hoc tests (in case of variance homogeneity) or Games-Howell post-hoc tests (in case of variance inhomogeneity) were performed for the BDI-II and the ten scales of the HEALTH-49. For significant interaction effects, differences in improvement between patients from different milieus were examined by single-factor ANOVAs with subsequent post-hoc tests on pre-post differential values (variance homogeneity: Tukey test, variance inhomogeneity: Games-Howell test). In all post-hoc tests, the significance level was adjusted for 45 group comparisons in each case (each milieu was compared with each other) with $\alpha_{adj} \leq 0.001$ after the Bonferroni correction.

3. Results

3.1. Sample characteristics and milieu distribution

Sociodemographic characteristics of the patient collectives of the two clinics as well as the prevalence of F-diagnoses among the patients are depicted in Table 1. All Sinus milieus were represented in the samples, but the overall milieu distribution was not representative of the general population of Germany. Milieu proportions also differed between the clinics (cf. Figure 2). In both clinics, the Social Ecological Milieu and the Precarious Milieu were overrepresented and the Performer Milieu, the Cosmopolitan Avant-garde Milieu and the Traditional Milieu were underrepresented compared to the representative sample of the total population of Germany. The Social Ecological Milieu was by far the largest milieu in both samples.

3.2. Symptom severity and treatment outcome

All statements below about patients from a particular milieu refer to the mean of all patients from that milieu.

3.2.1. Depressiveness (BDI-II)

At T0, patients from the Precarious Milieu (Mean 32.76) and the Traditional Milieu (Mean 28.69) had the highest scores, indicating severe depressive symptoms. Patients from the Liberal Intellectual Milieu (Mean 18.40) and the Established Milieu (Mean 18.92) had the lowest scores, corresponding to mild depressive symptoms. Patients from all other milieus had moderate symptoms at admission. At T1, patients from the Liberal Intellectual Milieu (Mean 7.36) and the Established Milieu (Mean 8.07) were in the symptoms "not present" range according to the BDI-II. Patients from the Precarious Milieu still had the highest score (Mean 23.37), indicating moderate symptom severity, with a higher burden remaining at discharge than patients from more socioeconomically privileged milieus, according to the Sinus model, had at the beginning of the treatment. Patients from the other milieus had minimal or mild symptoms after the intervention (cf. Table 2).

Examination of the main effects showed that they were significant for both time and milieu, each with $p < 0.001$, implicating that depressiveness decreased significantly and that patients from different milieus differed significantly from each other. The effects were strong with $\eta^2_{part} = 0.47$ for time and $\eta^2_{part} = 0.14$ for milieu. The

TABLE 1 Sociodemographic characteristics and F-diagnoses among the patients of the two clinic samples.

	Seehof $N = 1,000$	Oberharz $N = 1,000$	Total $N = 2,000$
Age			
M in years (SD)	52.02 (8.99)	50.22 (9.18)	51.12 (9.13)
	N (%)		
Sex			
Female	660 (66.0)	473 (47.3)	1,133 (56.7)
Male	340 (34.0)	527 (52.7)	867 (43.4)
Graduation[a]			
Special school graduation, in education, without graduation	13 (1.3)	24 (2.4)	37 (1.9)
Basic secondary school graduation	90 (9.0)	293 (29.3)	383 (19.2)
Junior high school graduation	437 (43.7)	394 (39.4)	831 (41.6)
High school graduation	287 (28.7)	215 (21.5)	502 (25.1)
Other graduation	1 (0.1)	0 (0)	1 (0.05)
Missing	172 (17.2)	74 (7.4)	246 (12.3)
Professional Qualification			
Without professional qualification	32 (3.2)	115 (11.5)	147 (7.4)
In training	3 (0.3)	9 (0.9)	12 (0.6)
Apprenticeship, technical school, master school	543 (54.3)	636 (63.6)	1,179 (59.0)
University of applied sciences, university	215 (21.5)	86 (8.6)	301 (15.1)
Other degree	35 (3.5)	80 (8.0)	115 (5.8)
Missing	172 (17.2)	74 (7.4)	246 (12.3)
Mental and behavioral disorders according to ICD-10-GM[b]			
F00–F09: Organic, including symptomatic, mental disorders	9	2	11
F10–F19: Mental and behavioral disorders due to psychoactive substance use	111	158	269
F20–F29: Schizophrenia, schizotypal and delusional disorders	3	5	8
F30–F39: Mood (affective) disorders	752	447	1,199
F40–F48: Neurotic, stress-related and somatoform disorders	873	782	1,655
F50–F59: Behavioral syndromes associated with physiological disturbances and physical factors	158	21	179
F60–F69: Disorders of adult personality and behavior	84	27	111
F70–F79: Mental retardation	1	0	1
F80–F89: Disorders of psychological development	24	0	24
F90–F98: Behavioral and emotional disorders with onset usually occurring in childhood and adolescence	12	6	18
Average number of diagnoses per patient	2.03	1.45	1.74

(Continued)

TABLE 1 (Continued)

M, mean; SD, standard deviation.

[a] All categories including equivalent and comparable graduation.

[b] The number of diagnoses assigned to a category is given here; it does not necessarily reflect the number of patients, since a patient can also have several diagnoses from one category.

Games-Howell post-hoc test revealed twenty significant group differences, each with $p < 0.001$. Patients from the Established Milieu and the Liberal Intellectual Milieu showed significantly lower values than patients from six other milieus, most of whom are, according to the Sinus model, in a less socioeconomically privileged position. Patients from the Precarious Milieu showed significantly higher values than patients from eight other milieus, with the exception of patients from the Traditional Milieu. Detailed results of the post-hoc test are reported in Supplementary Table S1.

We further found a statistically significant interaction between test time and milieu, i.e., score decrease from T0 to T1 differed significantly due to milieu: time × milieu $F(9, 1822) = 2.50$, $p = 0.008$ (cf. Figure 3). The effect was weak with $\eta^2_{part} = 0.01$. In the Games-Howell post-hoc test, there were no significant group differences between patients from different milieus in terms of pre-post differences (cf. Supplementary Table S2).

3.2.2. Psychosocial health (HEALTH-49)

Comparing among different scales, patients from most of the milieus had the highest impairment in Psychological well-being at both T0 and T1. Lowest symptom load was generally shown on the Phobic anxiety scale by patients from all milieus at both times. Patients from the Precarious Milieu had the highest scores on all ten scales at both time points, followed by patients from the Traditional Milieu or the Hedonist Milieu on most scales. Lowest scores were generally shown by patients from the Liberal Intellectual Milieu and the Established Milieu. Similar to BDI-II results, patients from the Precarious Milieu still had a higher burden on all HEALTH-49 scales after rehabilitation than patients from, according to the Sinus model, more socioeconomically privileged milieus had at baseline before the intervention (cf. Table 2).

On all scales, main effects for time and milieu were significant with $p_{adj} < 0.001$ (exception: Social support scale with p_{adj} for time $= 0.004$). The respective η^2_{part} ranged between 0.01 and 0.45, indicating weak to strong effects on the different scales. For the main effect of time, the effects were strong for seven of the scales, whereas weak effect sizes were found for the Social support and Social stress scales. Effect sizes for the main effect of milieu were also weak only for these two scales,

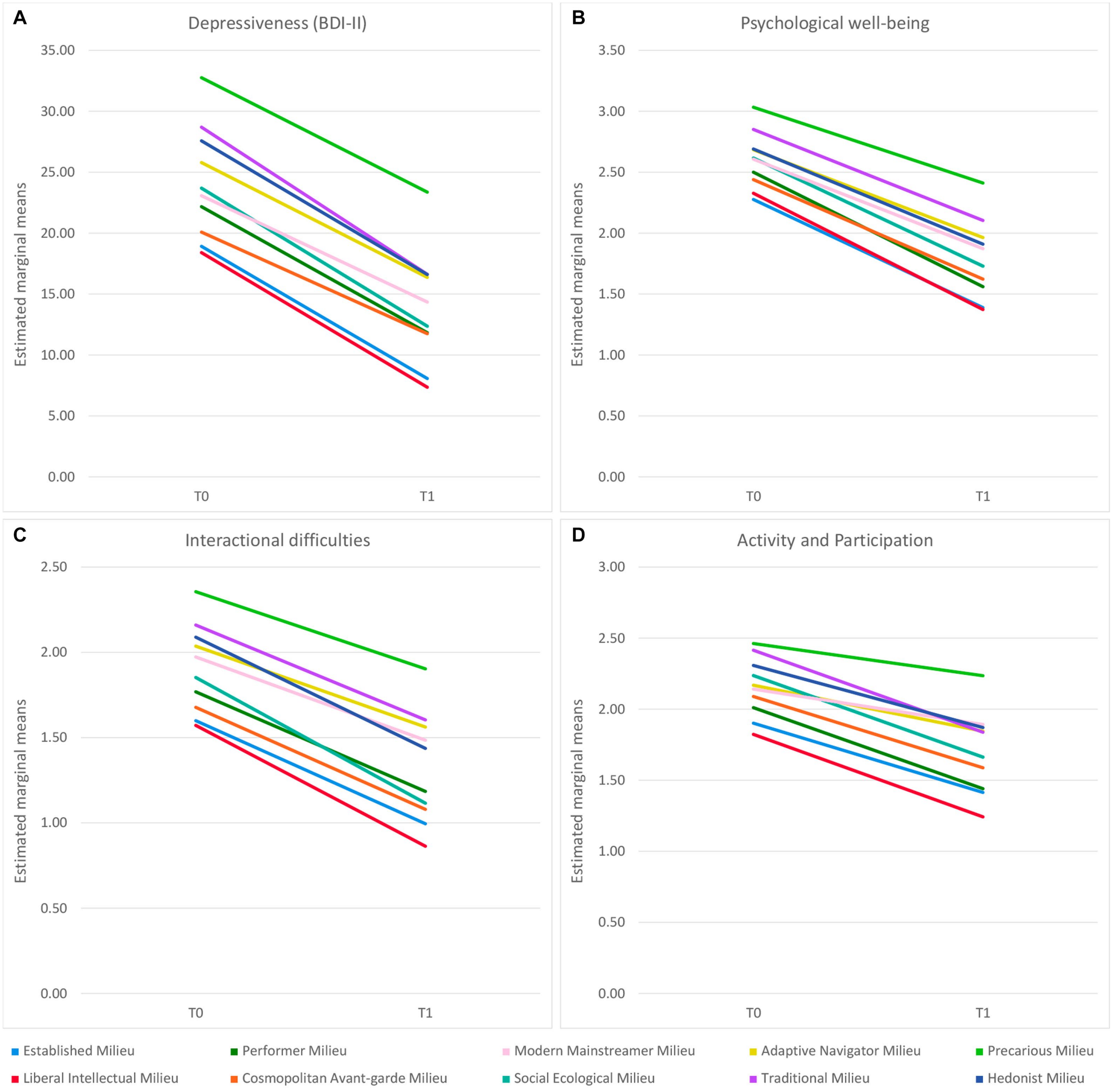

FIGURE 3
Differences in symptom and impairment improvement between patients from different milieus over the course of the five-week rehabilitation treatment in BDI-II Depressiveness **(A)** and HEALTH-49 Psychological well-being **(B)**, Interactional difficulties **(C)**, and Activity and Participation **(D)**. The (adjusted) values of *p* of the interaction effects can be found in Table 2 and the results of the post-hoc tests on pre-post differences in Supplementary Table S2.

reflecting less relevant differences between patients from different milieus in these areas. Otherwise, effect sizes ranged from medium (on five scales) to strong (on three scales). In the Tukey and Games-Howell post-hoc tests, significant group differences with $p \leq 0.001$ were found on all ten HEALTH-49 scales. As in the BDI-II, patients from the Established Milieu and the Liberal Intellectual Milieu had significantly lower values than patients from, according to the Sinus model, less socioeconomically privileged milieus. Apart from the Social support and Social stress scales, patients from the Precarious Milieu showed significantly higher values than patients from at least seven, up to all nine other milieus. Only five and nine significant group differences were found for the Social support and Social stress scales, respectively; these showed a similar pattern to those found for the other scales (cf. Supplementary Table S1).

On seven out of the ten scales, there were no significant interactions, indicating that impairment decreased similarly across all milieus. On three scales, there were significant interaction effects between test time and milieu, i.e., impairment decreased to different degrees depending on the milieu (cf. Figure 3). These were Psychological well-being [time × milieu $F(9, 1819) = 3.30$, $p_{adj} = 0.005$, $\eta^2_{part} = 0.02$], Interactional difficulties [time × milieu $F(9, 1819) = 2.74$, $p_{adj} = 0.036$, $\eta^2_{part} = 0.01$] and Activity and Participation [time × milieu $F(9, 1819) = 4.94$, $p_{adj} < 0.001$, $\eta^2_{part} = 0.02$]. The sizes of η^2_{part} corresponded to weak effects in all cases. For the first two of these scales, Tukey post-hoc tests yielded no significant group differences between patients from different milieus with respect to pre-post differences. In the Tukey post-hoc test for the Activity and Participation scale, patients from the Social Ecological Milieu

TABLE 2 Results of BDI-II and HEALTH-49: Scores at admission (T0) and discharge after five-week rehabilitation treatment (T1), pre-post differences and test statistics for mixed-model ANOVAs.

	EST	LIB	PER	COS	MOD	SOC	ADA	TRA	PRE	HED	df	*F*	*p*	p_{adj}	η^2_{part}
BDI-II[a], *N*=1,832 (91.6)[b]															
N (%)[c]	144 (86.7)	157 (93.5)	76 (91.6)	97 (89.8)	196 (90.3)	412 (94.1)	182 (91.5)	98 (93.3)	229 (90.5)	241 (91.6)					
Depressiveness															
T0 M (SD)	18.92 (11.48)	18.40 (10.12)	22.17 (11.60)	20.08 (10.02)	23.07 (11.36)	23.69 (10.62)	25.79 (12.01)	28.69 (13.13)	32.76 (11.12)	27.57 (11.97)					
T1 M (SD)	8.07 (9.01)	7.36 (9.36)	11.83 (11.77)	11.75 (11.74)	14.35 (12.95)	12.36 (11.06)	16.37 (13.07)	16.62 (13.90)	23.37 (14.03)	16.61 (13.21)					
MD (SD)	−10.85 (8.22)	−11.04 (9.63)	−10.34 (7.69)	−8.33 (9.79)	−8.72 (10.09)	−11.33 (9.62)	−9.42 (10.44)	−12.07 (10.82)	−9.39 (10.17)	−10.97 (10.28)					
Time × Milieu											9, 1822	2.50	**0.008**		0.01
Time											1, 1822	1589.17	**<0.001**		0.47
Milieu											9, 1822	34.06	**<0.001**		0.14
HEALTH-49[a], *N*=1,829 (91.5)[b]															
N (%)[c]	144 (86.7)	157 (93.5)	76 (91.6)	97 (89.8)	195 (89.9)	410 (93.6)	182 (91.5)	98 (93.3)	229 (90.5)	241 (91.6)					
(1) Somatoform complaints															
T0 M (SD)	1.28 (0.89)	1.33 (0.93)	1.55 (0.85)	1.55 (0.81)	1.70 (0.95)	1.71 (0.88)	1.80 (0.92)	1.79 (1.02)	2.25 (0.96)	1.81 (0.93)					
T1 M (SD)	0.81 (0.78)	0.84 (0.79)	0.99 (0.87)	1.16 (0.90)	1.29 (0.99)	1.24 (0.89)	1.41 (0.93)	1.36 (0.98)	1.86 (0.98)	1.32 (0.92)					
MD (SD)	−0.47 (0.69)	−0.48 (0.80)	−0.56 (0.69)	−0.39 (0.75)	−0.40 (0.77)	−0.48 (0.72)	−0.39 (0.72)	−0.43 (0.70)	−0.38 (0.70)	−0.49 (0.87)					
Time × Milieu											9, 1819	0.86	0.562	1	
Time											1, 1819	518.54	**<0.001**	**<0.001**	0.22
Milieu											9, 1819	22.15	**<0.001**	**<0.001**	0.10
(2) Depressiveness															
T0 M (SD)	1.30 (0.93)	1.22 (0.91)	1.56 (1.01)	1.46 (0.92)	1.73 (0.98)	1.63 (0.96)	1.86 (0.99)	2.00 (0.99)	2.46 (0.90)	1.97 (0.95)					
T1 M (SD)	0.66 (0.78)	0.52 (0.71)	0.90 (0.97)	0.91 (0.94)	1.12 (1.04)	0.92 (0.87)	1.20 (0.99)	1.31 (1.01)	1.87 (1.08)	1.32 (1.04)					
MD (SD)	−0.64 (0.69)	−0.70 (0.80)	−0.66 (0.67)	−0.54 (0.78)	−0.60 (0.80)	−0.71 (0.82)	−0.67 (0.86)	−0.69 (0.85)	−0.58 (0.85)	−0.66 (0.84)					
Time × Milieu											9, 1819	0.79	0.625	1	
Time											1, 1819	927.28	**<0.001**	**<0.001**	0.34
Milieu											9, 1819	35.76	**<0.001**	**<0.001**	0.15
(3) Phobic anxiety															
T0 M (SD)	0.60 (0.84)	0.58 (0.86)	0.79 (0.96)	0.53 (0.78)	1.03 (1.03)	0.87 (1.00)	1.04 (1.06)	1.31 (1.08)	1.69 (1.14)	1.08 (1.03)					
T1 M (SD)	0.34 (0.65)	0.33 (0.68)	0.44 (0.80)	0.37 (0.69)	0.70 (0.94)	0.54 (0.85)	0.73 (0.94)	0.96 (1.04)	1.30 (1.16)	0.75 (0.92)					
MD (SD)	−0.27 (0.66)	−0.25 (0.65)	−0.34 (0.69)	−0.16 (0.63)	−0.33 (0.79)	−0.33 (0.72)	−0.31 (0.80)	−0.35 (0.69)	−0.39 (0.77)	−0.33 (0.83)					
Time × Milieu											9, 1819	1.03	0.410	1	
Time											1, 1819	249.26	**<0.001**	**<0.001**	0.12
Milieu											9, 1819	25.84	**<0.001**	**<0.001**	0.11
(4) Psychological and somatoform complaints															
T0 M (SD)	1.02 (0.75)	1.07 (0.78)	1.25 (0.80)	1.19 (0.69)	1.50 (0.86)	1.43 (0.78)	1.59 (0.82)	1.71 (0.85)	2.11 (0.80)	1.67 (0.77)					

(Continued)

TABLE 2 (Continued)

	EST	LIB	PER	COS	MOD	SOC	ADA	TRA	PRE	HED	df	*F*	*p*	p_{adj}	η^2_{part}
T1 M (SD)	0.57 (0.68)	0.57 (0.69)	0.76 (0.75)	0.78 (0.70)	1.08 (0.92)	0.92 (0.76)	1.12 (0.85)	1.19 (0.83)	1.69 (0.93)	1.14 (0.80)					
MD (SD)	−0.46 (0.60)	−0.50 (0.65)	−0.48 (0.56)	−0.41 (0.60)	−0.42 (0.70)	−0.51 (0.63)	−0.47 (0.67)	−0.51 (0.63)	−0.42 (0.66)	−0.53 (0.72)					
Time × Milieu											9, 1819	0.79	0.628	1	
Time											1, 1819	756.94	**<0.001**	**<0.001**	0.29
Milieu											9, 1819	37.91	**<0.001**	**<0.001**	0.16
(5) Psychological well-being															
T0 M (SD)	2.28 (0.80)	2.33 (0.83)	2.50 (0.82)	2.44 (0.70)	2.61 (0.81)	2.62 (0.71)	2.68 (0.75)	2.85 (0.74)	3.03 (0.61)	2.69 (0.65)					
T1 M (SD)	1.39 (0.80)	1.37 (0.83)	1.56 (0.82)	1.62 (0.77)	1.87 (0.95)	1.73 (0.85)	1.96 (0.89)	2.10 (0.92)	2.41 (0.85)	1.91 (0.87)					
MD (SD)	−0.89 (0.77)	−0.95 (0.83)	−0.94 (0.87)	−0.82 (0.78)	−0.73 (0.86)	−0.89 (0.79)	−0.72 (0.80)	−0.75 (0.79)	−0.62 (0.74)	−0.78 (0.80)					
Time × Milieu											9, 1819	3.30	**<0.001**	**0.005**	0.02
Time											1, 1819	1489.33	**<0.001**	**<0.001**	0.45
Milieu											9, 1819	27.46	**<0.001**	**<0.001**	0.12
(6) Interactional difficulties															
T0 M (SD)	1.60 (1.00)	1.57 (1.06)	1.77 (0.92)	1.68 (0.83)	1.97 (0.95)	1.85 (0.94)	2.04 (0.95)	2.16 (0.96)	2.36 (0.94)	2.09 (0.94)					
T1 M (SD)	1.00 (0.87)	0.86 (0.93)	1.18 (0.91)	1.08 (0.88)	1.48 (1.01)	1.12 (0.92)	1.56 (1.00)	1.60 (1.00)	1.90 (1.02)	1.44 (0.95)					
MD (SD)	−0.60 (0.91)	−0.71 (0.94)	−0.58 (0.87)	−0.60 (0.88)	−0.49 (1.02)	−0.74 (0.86)	−0.47 (0.86)	−0.56 (0.96)	−0.45 (0.87)	−0.65 (1.01)					
Time × Milieu											9, 1819	2.74	**0.004**	**0.036**	0.01
Time											1, 1819	594.16	**<0.001**	**<0.001**	0.25
Milieu											9, 1819	21.26	**<0.001**	**<0.001**	0.10
(7) Self-efficacy															
T0 M (SD)	1.86 (0.86)	1.77 (0.90)	2.12 (0.87)	1.87 (0.87)	2.16 (0.94)	2.25 (0.83)	2.24 (0.85)	2.62 (0.98)	2.80 (0.75)	2.44 (0.79)					
T1 M (SD)	1.30 (0.86)	1.11 (0.82)	1.46 (0.93)	1.46 (0.83)	1.69 (0.92)	1.67 (0.93)	1.83 (0.94)	2.07 (1.02)	2.34 (0.78)	1.86 (0.89)					
MD (SD)	−0.56 (0.80)	−0.65 (0.81)	−0.66 (0.77)	−0.41 (0.87)	−0.47 (0.86)	−0.59 (0.87)	−0.41 (0.94)	−0.55 (0.77)	−0.46 (0.77)	−0.58 (0.85)					
Time × Milieu											9, 1819	1.79	0.066	0.657	
Time											1, 1819	589.55	**<0.001**	**<0.001**	0.25
Milieu											9, 1819	34.45	**<0.001**	**<0.001**	0.15
(8) Activity and Participation															
T0 M (SD)	1.90 (0.83)	1.82 (0.87)	2.01 (0.83)	2.09 (0.79)	2.14 (0.78)	2.24 (0.79)	2.17 (0.79)	2.41 (0.87)	2.46 (0.76)	2.31 (0.76)					
T1 M (SD)	1.41 (0.82)	1.24 (0.97)	1.44 (0.96)	1.59 (0.94)	1.89 (0.92)	1.66 (0.97)	1.85 (0.94)	1.84 (0.98)	2.24 (0.86)	1.87 (0.93)					
MD (SD)	−0.49 (0.87)	−0.58 (0.81)	−0.57 (0.83)	−0.50 (0.90)	−0.25 (0.84)	−0.57 (0.92)	−0.32 (0.89)	−0.58 (0.82)	−0.23 (0.86)	−0.44 (0.92)					
Time × Milieu											9, 1819	4.94	**<0.001**	**<0.001**	0.02
Time											1, 1819	387.92	**<0.001**	**<0.001**	0.18
Milieu											9, 1819	17.93	**<0.001**	**<0.001**	0.08
(9) Social support															
T0 M (SD)	1.51 (0.80)	1.33 (0.84)	1.64 (0.81)	1.60 (0.81)	1.65 (0.81)	1.48 (0.77)	1.68 (0.86)	1.59 (0.83)	1.85 (0.93)	1.81 (0.90)					

(Continued)

TABLE 2 (Continued)

	EST	LIB	PER	COS	MOD	SOC	ADA	TRA	PRE	HED	df	F	p	p_{adj}	η^2_{part}
T1 M (SD)	1.43 (0.82)	1.30 (0.76)	1.46 (0.80)	1.54 (0.81)	1.62 (0.87)	1.41 (0.81)	1.59 (0.91)	1.57 (0.84)	1.82 (0.88)	1.77 (0.88)					
MD (SD)	−0.07 (0.73)	−0.04 (0.72)	−0.18 (0.73)	−0.05 (0.72)	−0.03 (0.67)	−0.07 (0.63)	−0.09 (0.75)	−0.02 (0.70)	−0.03 (0.67)	−0.05 (0.66)					
Time × Milieu											9, 1819	0.47	0.898	1	
Time											1, 1819	12.38	**<0.001**	**0.004**	0.01
Milieu											9, 1819	8.79	**<0.001**	**<0.001**	0.04
(10) Social stress															
T0 M (SD)	1.56 (0.84)	1.42 (0.84)	1.69 (0.86)	1.67 (0.77)	1.77 (0.77)	1.63 (0.74)	1.77 (0.81)	1.81 (0.83)	1.97 (0.85)	1.91 (0.80)					
T1 M (SD)	1.46 (0.78)	1.29 (0.77)	1.63 (0.81)	1.52 (0.68)	1.74 (0.77)	1.55 (0.77)	1.77 (0.83)	1.71 (0.85)	1.94 (0.84)	1.79 (0.73)					
MD (SD)	−0.10 (0.75)	−0.13 (0.70)	−0.06 (0.62)	−0.15 (0.78)	−0.03 (0.71)	−0.09 (0.70)	−0.01 (0.71)	−0.09 (0.72)	−0.03 (0.78)	−0.11 (0.69)					
Time × Milieu											9, 1819	0.79	0.627	1	
Time											1, 1819	17.82	**<0.001**	**<0.001**	0.01
Milieu											9, 1819	11.59	**<0.001**	**<0.001**	0.05

EST, Established Milieu; LIB, Liberal Intellectual Milieu; PER, Performer Milieu; COS, Cosmopolitan Avant-garde Milieu; MOD, Modern Mainstreamer Milieu; SOC, Social Ecological Milieu; ADA, Adaptive Navigator Milieu; TRA, Traditional Milieu; PRE, Precarious Milieu; HED, Hedonist Milieu; BDI-II, Beck Depression Inventory; HEALTH-49, Hamburg Modules for the Assessment of Psychosocial Health in Clinical Practice; M, mean; SD, standard deviation; MD, mean difference; df, number of degrees of freedom; F, F-statistic; p, value of p; p_{adj}, Bonferroni adjusted value of p; η^2_{part}, partial eta-squared with $\eta^2_{part} \geq 0.01$: weak effect, $\eta^2_{part} \geq 0.06$: medium effect, $\eta^2_{part} \geq 0.14$: strong effect.

[a] A higher score indicates a higher burden.

[b] Number of patients responding to BDI-II resp. HEALTH-49 and their percentage out of the total sample of $N = 2{,}000$.

[c] Number of respondents from the corresponding milieu and percentage out of the total number of patients from this milieu.

improved significantly more than those from the Modern Mainstreamer Milieu (−0.32, $p = 0.001$) and the Precarious Milieu (−0.35, $p < 0.001$; cf. Supplementary Table S2).

4. Discussion

4.1. Summary of the results

Our study investigated the associations between social milieu and the severity of psychological symptoms and psychosocial impairments as well as treatment outcome of patients in two psychosomatic rehabilitation clinics in Germany. Empirical Sinus milieus were applied as a model for social milieus and symptoms and impairments were assessed by BDI-II ($N = 1{,}832$) and HEALTH-49 ($N = 1{,}829$). Milieu distribution was not representative for the overall population of Germany and the Social Ecological Milieu and the Precarious Milieu were overrepresented in both clinics. We found significant differences between patients from different milieus in symptom severity and impairment with mainly medium to strong effects. Patients from the Precarious Milieu had the highest severity of depressive symptoms in the BDI-II and the highest impairment on all HEALTH-49 scales at T0 and T1. Patients from the Precarious Milieu, the Established Milieu and the Liberal Intellectual Milieu were involved in most of the significant group differences, with the former showing higher burdens and patients from the latter two milieus showing lower burdens than patients from other milieus. Over the course of rehabilitation, patients from all milieus improved significantly in all domains with mainly strong effects. Significant differences in symptom improvement were found between patients from different milieus in BDI-II (Depressiveness) and on three HEALTH-49 scales (Psychological well-being, Interactional difficulties, Activity and Participation). Pre-post differences differed significantly only for the latter scale, where patients from the Social Ecological Milieu showed greater improvement than those from the Modern Mainstreamer Milieu and the Precarious Milieu. However, the weak effect sizes of the interactions generally imply that the differences were rather minor and that the improvement was thus overall comparable, just similar to how it was the case in all other domains for patients from all milieus. In all domains, patients from the Precarious Milieu retained higher symptoms and impairment at T1 than patients from, according to the Sinus model, more socioeconomically privileged milieus had at T0.

4.2. Comparison to other studies on inequalities in mental health care

In the following, we compare our results to other studies on inequalities in psychosomatic rehabilitation and psychiatric care. In some studies, low socioeconomic status was associated with higher claim of psychiatric services utilisation (37) and higher likelihood of being (compulsorily) admitted to psychiatric in-patient care (38). In others, low socioeconomic status was related to lower rates of seeing a psychiatrist (39), higher reports of personal barriers to access mental health services (e.g., having language barriers, being afraid to ask for help; 40) and limited access to outpatient psychotherapy in Germany (41) – which has the potential to prevent the need for rehabilitation. In a population-representative survey in Germany, socioeconomic status did not show any significant associations with the use of psychotherapeutic or psychiatric services when controlling for medical need (42). This ambiguity of results with respect to socioeconomic status can probably be attributed partly to the specific differences in study subjects and methodologies. Against the described background, however, it is not surprising that milieus with comparable socioeconomic conditions according to the Sinus model were represented differently in our study. For example, of the milieus with the most disadvantaged socioeconomic position, only the Precarious Milieu was overrepresented, while the Hedonist Milieu and the Traditional Milieu were on average or underrepresented, depending on the clinic sample.

In the study of Hofreuter-Gätgens et al., socioeconomically privileged patients had the least impairment in most areas of subjective health at the beginning of rehabilitation (14). In line with these results, patients from the Established Milieu, the Liberal Intellectual Milieu, the Performer Milieu and the Cosmopolitan Avant-garde Milieu, all of which are in a socioeconomically privileged position according to the Sinus model, showed the lowest symptom severity and impairment in our study. In the study of Deck, the so-called lower class was the most impaired group at the beginning of rehabilitation concerning different aspects of subjective health (18). In our study, the highest symptom severity and impairment were shown by patients from the Precarious Milieu, who were not able to compensate for the initial differences and remained with greater impairments, as did the lower class in Deck's study. At the same time, our results were more differentiated and suggested more than just a status, class or stratification gradient. Thus, patients from different milieus, which are characterized by similar socioeconomic conditions according to the Sinus model, showed different levels of severity both at the beginning and at the end of rehabilitation. This was also evident in the improvement on the Activity and Participation scale, where patients from the Social Ecological Milieu benefited more than patients from the Modern Mainstreamer Milieu, who are socioeconomically similarly situated according to the Sinus model. To summarize, accessibility, symptom severity and to some extent improvement appear to be associated with other milieu-specific characteristics in addition to socioeconomic factors, which should be considered when describing existing inequalities.

4.3. Milieu-specific reflections on the basis of the study results

In the following, we present some exemplary milieu-specific reflections on our findings. To the best of our research and knowledge, there are almost no studies in the medical field and none at all in psychosomatic rehabilitation that previously used a milieu approach. Accordingly, derivations from or references to already existing literature can be made only to a limited extent. Our considerations are mainly based on the content characterizations of the Sinus milieus by the Sinus institute (cf. chapter 2.2.), which also means that further studies and empirical evidence are required to proof these theoretical hypotheses.

The lack of representativity of the milieu distribution compared to the overall population may indicate that psychosomatic rehabilitation does not reach and appeal to patients from all milieus equally. The overrepresentation of the Social Ecological Milieu and the Precarious Milieu in both clinics might, however, have different reasons. According to the Sinus model, patients from the Social Ecological Milieu are usually engaged in reflecting their feelings and behavior and in acquiring new methods to be in balance with themselves and their environment. The therapy setting in dedicated clinics in calm environments and the applied therapies including relaxation methods, creative therapy and socio-medical counseling might sound particularly attractive to them. On the other hand, according to the Sinus model, patients from the Precarious Milieu tend to be subjects to social exclusion, hidden discrimination and economic deprivation. These factors are likely to cause and increase psychosocial stress, which has been described as an essential mediator between deprived social conditions and adverse health outcomes (43). Increased mental morbidity and long-term impairment might then lead to higher admission rates to psychosomatic rehabilitation in the Precarious Milieu. By contrast, various reasons for the underrepresentation of some milieus in the patient collective are conceivable. Patients from the Traditional Milieu, which is underrepresented in both clinics, belong to one of the milieus that are, according to the Sinus model, primarily prevalent in older generations. Accordingly, people from this milieu likely tend to be of higher age and retired status, which may render them less suitable for admission to rehabilitation, as one major reason for the German pension insurance to grant payment for the treatment is to maintain earning capacity. Another possible reason may be that people from the underrepresented milieus are partly sceptical about psychotherapy, which is the core element of psychosomatic rehabilitation. This consideration is based on the results of population-representative surveys in Germany that showed different attitudes towards psychotherapy in different population groups. For instance, more negative attitudes were found among men (44, 45) and people with lower levels of formal education (45). In addition, more than a quarter of respondents categorically ruled out psychotherapy for themselves (44). Speerforck and Schomerus suggested that stigmatizing attitudes towards and different acceptances of mental health services might differ across social milieus, leading to different risks of underuse (46).

Regarding the single milieu-specific differences in treatment outcome of Activity and Participation, we would like to present the following assumptions. The applied therapies in psychosomatic rehabilitation might suit especially well to patients from the Social Ecological Milieu due to their specific values and needs, as described above. Practising mindfulness, learning to deal with oneself in an even more sustainable way and the slow pace in the quiet rehabilitation setting may especially help these patients increase their self-activation and participation opportunities. On the other hand, regarding the Precarious Milieu, patients could be affected by social exclusion and disadvantage in rehabilitation, as it tends to happen in their everyday life, according to the Sinus model. Perceived social status discrimination, known to be associated with psychological symptoms (47), might also be negatively associated with improvement. Moreover, since a great distance to intellectuality, know-it-all attitude and creativity is described for the Precarious Milieu, several therapy formats such as cognitive psychotherapy, health counseling and creative therapies might be perceived by these patients as inappropriate, patronizing and too abstract. This could then further reinforce resignation prevalent in the milieu, additionally preventing higher levels of activity and participation. The social position in the model also reveals the limited sociocultural and material resources of the Precarious Milieu, which, for example, could continuously restrict the coping capacities of the patients in our sample, despite positive effects of the treatment itself.

Concerning all milieus, the generally low improvements on the HEALTH-49 scales Social support and Social stress might be due to the fact that the corresponding items are predominantly influenced by contextual factors that are hardly affected by rehabilitation. Given the distinct characteristics of the milieus, further differences in improvement beyond those we found would have been conceivable, for example, a comparably stronger benefit of patients from the Liberal Intellectual Milieu. For these patients, according to the Sinus model, it is usually very important to do something for their health, shape life in a holistic way, act autonomously and realize themselves. Rehabilitation with its holistic, sophisticated therapy offer and its approach of strengthening self-efficacy may fit these prerequisites particularly well. In addition, patients from this milieu also have good preconditions for treatment success due to their socioeconomic privileges according to the Sinus model.

In general, patients from all milieus improved over the course of the treatment and essentially to a similar degree, which indicates overall success of the rehabilitation. Although the improvements themselves were comparable, differences in the severity of symptoms and impairments that existed at the beginning of rehabilitation remained. Our study results highlight that the observed differences between patients from different social milieus could be related to a variety of factors and not solely to socioeconomic determinants. In our discussion, we have provided examples of hypotheses that demonstrate the complexity of potential relationships and mediating mechanisms. Such considerations would hardly be possible on the basis of socioeconomic factors alone. The question remains open as to which of the various individual factors included in the model are independently associated with symptom severity and treatment outcome and, more generally, whether and, if so, in what direct or indirect ways they exert causal influence, which could also be of interest for further studies.

4.4. Future perspectives in psychosomatic rehabilitation

The demand for psychosomatic rehabilitation is projected to increase in the future (48, 49) and we do not expect social inequalities to decline substantially in the short term. In addition to improvements at the level of care structure, perhaps the particular care services should be adapted and communicated in a way that is more appropriate and appealing to persons from different milieus (46). In any case, our findings argue for even greater and especially systematic inclusion of socioeconomic and sociocultural aspects in psychosomatic rehabilitation to address and reduce structural inequalities. To improve and maintain equal access, quality and effectiveness of the treatment, the social milieu approach could be incorporated into therapy planning and implementation. With an appropriate approach, socioeconomic and sociocultural factors could be systematically recorded and binding rules established for their quality-assured consideration. In this way, structural disadvantages of specific patient groups due to institutions or therapists could be alleviated. In practical implementation, the assignment of patients to therapy groups and specific therapy content could be more closely aligned with the different socioeconomic and sociocultural stresses and resources of patients. Not only may it be unjust to offer the same treatment to different patients with unequal preconditions (14), but it could also reinforce existing inequalities. Therefore, disadvantaged social groups should be considered with particular care, which is not yet the case in psychosomatic rehabilitation. Accordingly, the social milieu could also be used to identify disadvantaged patients and to develop treatment formats that address their specific demands. In addition, the duration of rehabilitation, the intensity of therapy plans and the design of rehabilitation aftercare could be adjusted. However, inequality affects not only rehabilitation and health care, but life chances in general and it cannot be changed without broader, integrated policy efforts (50).

4.5. Strengths and limitations

Strengths of the study design were the standardized testing, the high response rates (91.60% out of the total sample for BDI-II and 91.45% for HEALTH-49) and the application of instruments of good psychometric quality. In both, BDI-II and HEALTH-49, patients from all milieus clearly showed lower scores at the end of rehabilitation compared to the beginning, which speaks for the instruments' high sensitivity to change. All ten milieus were represented, in part due to the large sample size ($N = 2,000$). It can be assumed that the collective of patients in psychosomatic rehabilitation in Germany was well represented in the sample. In addition, the respective group sizes of the different milieus were large enough for good statistical power. Importantly, the large total sample size was not chosen to foster overestimation of the statistical effects, which is supported by the fact that the single milieu group sizes were comparably small, such as $N = 76$ in the smallest milieu (the Performer Milieu) and $N = 412$ in the largest milieu (the Social Ecological Milieu; N here reflects the number of patients from the milieu for whom an evaluable BDI-II and/or HEALTH-49 was available). The examination of samples of two clinics in different federal states and with different providers further improved representation of the overall sociodemographic structure and milieu distribution among patients in psychosomatic rehabilitation in Germany. Altogether, with the included instruments, patient characteristics and milieu model, we considered several widely used and recommended public mental health indicators (e.g., prevalence of mental disorders, mental health risks such as income inequality in society, treatment success, mental health resources such as self-efficacy, positive mental health indicators such as well-being; 51).

The newly introduced milieu approach extends former research on health inequalities by sociocultural differentiation in terms of specific knowledge, perceptions, values, attitudes and behaviors of patients (52). As described above, the inclusion of such factors has the potential to deliver a more comprehensive understanding compared to approaches that merely focus on socioeconomic aspects. Nevertheless, as common when applying models to describe reality, only a specific selection of factors with potential associations could be analyzed by using the Sinus model. For instance, although sociodemographic characteristics are implicitly included (e.g., in some cases, people of certain age groups are more frequently represented in a milieu than those of other age groups), the model itself does not allow for the analysis of individual factors such as age and gender – even though they may have the potential to independently cause and increase inequalities. Looking at individual factors, on the other hand, would not necessarily be in line with the approach and goal of the milieu model, which integrates several factors in order to be able to describe large social groups on the basis of various dimensions and social realities. The characterization of the different Sinus milieus enabled us to hypothesize possible explanations for assumed relationships between social factors and health outcomes. Thus, the application of the milieu model in the context of this study added value to the description of observable differences, particularly at the conceptual and theoretical levels. At the same time, the study made it possible to derive concrete practical implications for the care setting of psychosomatic rehabilitation. However, our considerations require empirical verification, especially in light of the fact that hardly any studies in the medical field have used a milieu approach so far. Another limitation is that methodical details of the milieu assignment are not published by the Sinus institute for intellectual property reasons (22). This limits reproducibility of the study, but as the Sinus milieus are a validated model that is commonly used in milieu research across Europe (24), this seems tolerable in favor of the high reliability and actuality of the model. Furthermore, our study did not include long-term treatment outcomes which might differ from the immediate rehabilitation effects due to the re-emergence of contextual stressors in everyday life and differences in the consolidation of new skills across patients from different milieus.

In summary, this study has shown differences between patients from different social milieus in terms of representation in psychosomatic rehabilitation, severity of psychological symptoms and psychosocial impairments, and to some extent treatment outcomes regarding improvement. Besides socioeconomic factors, milieu-specific sociocultural habits, psychosocial needs and therapeutic demands should be considered in therapy planning and implementation, for which further research is 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 Landesärztekammer Brandenburg (Brandenburg State Medical Association), Geschäftsstelle Cottbus. The patients/participants provided their written informed consent to participate in this study.

Author contributions

MB and VK conceptualized the study. HK-M ran statistical analyses, interpreted results, wrote the manuscript, and generated tables and figures. LP reviewed statistical analyses. LP, MB, and VK provided feedback on the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

Publisher's note

Supplementary material

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The association between socioeconomic status and health-related quality of life among young and middle-aged maintenance hemodialysis patients: multiple mediation modeling

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Objective: To explore the relationship between socioeconomic status (SES), illness perception, social functioning, and health-related quality of life (HRQoL) of young and middle-aged maintenance hemodialysis (MHD) patients and the internal mechanism of action.

Design: A multicenter cross-sectional study.

Methods: An aggregate of 332 young and middle-aged MHD patients were enrolled from hemodialysis centers in four general hospitals in Guangzhou, Guangdong, China, from June to December 2022. The questionnaires used included one for general demographic data, the Brief Illness Perception Questionnaire (BIPQ), Social Dysfunction Screening Scale (SDSS), and the 12-item Short Form Health Survey (SF-12).

Results: Both SES and HRQoL were negatively correlated with illness perception and social functioning, respectively. SES was positively correlated with HRQoL. Illness perception was positively correlated with social functioning. The indirect effects of illness perception and social functioning on the relationship between SES and HRQoL were 0.33 and 0.31, making up 41.06% and 38.91% of the sum. The chain indirect effect of illness perception and social functioning was 0.10, making up 12.59% of the total effect, while gender did not play a moderating role.

Conclusion: Illness perception and social functioning may independently and accumulatively mediate the association between SES and HRQoL. Nurses should consider developing individual intervention program for young and middle-aged MHD patients with low SES, focusing on establishing targeted counseling and health education strategies corresponding to illness perception and social functioning to help patients improve their HRQoL.

KEYWORDS

maintenance hemodialysis, socioeconomic status, health-related quality of life, illness perception, social functioning

1. Introduction

The end-stage of various chronic kidney diseases (CKD) is also known as End-stage renal disease (ESRD). Approximately 4 million ESRD patients' survival are dependent on renal replacement therapy, and it is expected to reach 5.4 million by 2030 (1). Maintenance hemodialysis (MHD) is the most prevalent renal replacement therapy, taking up about 69% of all renal replacement therapies and 89% of dialysis treatment since number and access to kidney donors are limited and peritoneal dialysis technology has its own limitations (2). In China, the rapid development of the socio-economic level is accompanied by increasing work pressure. These pressures and people's poor health literacy might lead to a younger prevalence of ESRD (3). Data show that there are 120,000 new ESRD patients each year, 80% of whom are young and middle-aged in China (4). Moreover, the average age of MHD patients in China is more than 10 years younger than that in US and Japan (5). Uneven economic development, insufficient medical resources and uneven distribution, as well as low health literacy might be the reasons for the large number of young and middle-aged patients with ESRD in China. At the same time, due to the shortage of kidney resources and the high cost of treatment, most young and middle-aged patients still tend to be treated with MHD (6). MHD patients of young and middle-age have to change from playing the mainstay role of the family to the role of patients. They are more prone to maladjustment to the disease, which will affect the patients' response with treatment and their health-related quality of life (HRQoL). Available studies have shown that socio-environmental, psycho-spiritual, and clinically relevant factors has resulted in a general reduction in HRQoL in young and middle-aged people with MHD (7, 8).

HRQoL refers to the self-assessment of health status in terms of physical, mental, social functioning based on personal experience and perceptions, reflecting the influence of disease and health on quality of life (QoL) (9). The level of HRQoL is important in guiding clinical decisions and has become a prognostic indicator and a survival indicator (10). A systematic review showed that suicidal behavior is closely related to HRQoL, that the lower the HRQoL, the higher the risk of suicidal behavior (11), and that this process is moderated by abnormalities in the hypothalamic–pituitary–adrenal (HPA) axis (12). MHD patients typically report poor HRQoL (13) and earlier studies have found that the total HRQoL scores of MHD patients are lower than abdominal dialysis patients (14), renal transplant patients (15), and patients with other chronic diseases (16). It has been well evidenced that hemodialysis impairs HRQoL in patients with CKD (17). How to help young and middle-aged patients reduce psychological distress, improve HRQoL and return to society to the greatest extent during MHD treatment has become a hot research issue in recent years. Thus, it is called for to have a deeper understanding of HRQoL in MHD patients of young and middle-age.

Many studies have shown that the socioeconomic status (SES) is significantly positively correlated with HRQoL, and SES is an important factor influencing individual QoL (18, 19). Nevertheless, few researches have specifically focused on the relationship between SES and HRQoL of MHD patients in young and middle age, and most of the existing studies only analyzed the direct link between the two, without focusing on the process and specific mechanisms of the impact of SES on HRQoL (20). Currently, most clinical studies on HRQoL in MHD patients have small sample sizes and are mostly single-center studies, with poor reproducibility of results. To sum up, this study aimed at exploring the relationship and mechanism between SES and HRQoL in young and middle-aged MHD patients through a multicenter cross-sectional study, and to provide a basis for the development of healthcare intervention programs to maintain or improve their HRQoL.

2. Background

SES is a social contextual culture that affects everyone who lives in it. SES is the position of an individual, family, or organization in the social structure, reflecting people's ability to access or dispose of resources such as information, power, prestige, etc. (21). SES is usually measured using a combination of three objective indicators: level of education, economic income, and type of occupation (22). In medical sociology, SES is seen as a fundamental factor influencing health levels, and the health inequalities it causes are supported by a large body of research (23, 24). Studies have shown that SES differences lead to changes in the stress-sensitive HPA axis, which reduces the patient's ability to control stress, and thereby increases negative emotions (e.g., anxiety, depression, and negative illness perceptions) (25) as well as suicidal behaviors (26). In addition, studies have found that patients with suicidal intent have higher levels of inflammatory factors compared to patients without suicidal intent (27), and higher levels of inflammation will also lead to a significant increase in drug resistance (28), which will impede the therapeutic efficacy of medications, thus seriously affecting the HRQoL of patients. The correlation between SES and health is also presented in the MHD population, with higher SES predicting good HRQoL scores (29). MHD patients in young and middle age shoulder the burden of family and social responsibilities, and regular dialysis treatment as well as reduced work capacity would lead to unemployment, causing their families' SES to plummet and resulting in a lower QoL (30). Many researches have shown the association between SES and HRQoL in MHD patients, but relatively few studies have comprehensively explained the theoretical mechanisms by which SES affects HRQoL. Although certain factors of SES are difficult to change, the negative impact of a disadvantaged family background on HRQoL can be reduced through nursing interventions to regulate its psychosocial mechanisms and give full play to the patient's initiative.

SES is not only an independent predictor of HRQoL in MHD patients (31) but also the primary factor affecting patients' illness perceptions (32) and social functioning (33). The effect of SES on patients' HRQoL is not always straightforward and is often mediated by psychological factors (34). The Self-Regulatory Model (SRM), states that illness perception, as a psychological representation, is central to an individual's understanding, processing and ultimately coping with illness, reflecting the individual's emotional responses and beliefs when facing health threats, thus guiding the patient's coping style and influencing health outcomes (35). It was found that illness perception is a significant predictor of QoL for hemodialysis patients (36). Previous research has shown an intimate relationship between illness perception and coping styles, emotion regulation, social functioning, therefore had a significant effect on patients' illness prognosis and QoL (37). It was previously found that the more intense the patient's negative illness perceptions, the higher the incidence of social dysfunctions (38). Social functioning include both social roles and social interactions, and each person exhibits social behaviors according to his or her role in social life, and these behaviors and activities are the key elements of people's social life (39). Researches have demonstrated that social functioning, as an important factor, can influence QoL in MHD patients (40). A normal return to work and normal interpersonal interaction can help patients regain confidence in their lives, reclaim a sense of social belonging, enhance their sense of self-worth, reduce psychological stress, enable them to focus more positively on themselves, take better care of themselves and improve their HRQoL (41). Nevertheless, under the combined pressure of economic stress and associated comorbidities (42), the positive psychological defenses of MHD patients can easily be breached, resulting in negative psychology such as panic, anxiety and depression, leading to deterioration in social role adaptation and social functioning, which seriously affects their HRQoL. In summary, based on previous studies, there are correlations between SES, illness perception, social functioning and HRQoL.

In Chinese cultural context, there are significant differences in the SES and social psychology of male and female. Studies at home and abroad have demonstrated that (43, 44) women's health status is weaker than men's due to their weaker SES, resulting in a disadvantageous access and utilization of health services for the female population. Significant gender differences was found in illness perception of people with chronic diseases (45). Also, previous studies have shown that male has a higher incidence of social functioning deficits than female. This suggests that the effect of SES on HRQoL in MHD patients may vary by gender.

The latest Andersen's behavioral model provides a clearer explanation of the relationship between individual SES and health. From a cross-sectional perspective, environmental factors and population characteristics, as antecedents of health outcomes and health behaviors, could affect health outcomes both indirectly by influencing health behaviors and directly (46). Guided by this theory, this study considers health behaviors (illness perception and social functioning) as mediating variables to explore the relationship between population characteristic (SES) and health outcome (HRQoL) and the moderating effect of gender on the mediating model, with the aim of providing a theoretical basis for proposing medical care interventions to improve HRQoL in young and middle-aged patients. Therefore, our research hypotheses are as follows (see Figure 1):

> *H1*: SES will significantly predict HRQoL.
>
> *H2*: SES will influence HRQoL through the mediating effect of illness perception.
>
> *H3*: SES will influence HRQoL through the mediating effect of social functioning.
>
> *H4*: Illness perception and social functioning will jointly play an intermediary role in the association between SES and HRQoL.
>
> *H5*: There may be a moderating effect of gender in the association between SES, illness perception, social functioning and HRQoL.

3. Methods

3.1. Study design

This study was a multicenter cross-sectional observational survey which adhere to the guidelines of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE; see Supplementary File S1).

3.2. Patients and setting

Young and middle-aged patients were selected through a convenience sampling method from hemodialysis centers of The First Affiliated Hospital of Guangzhou University of Chinese Medicine, Guangdong Second Hospital of Traditional Chinese Medicine, Guangzhou Hospital of Traditional Chinese Medicine, and Guangzhou Hospital of Integrated Traditional Chinese and Western Medicine, from June to December 2022. The following were inclusion criteria: (a) patient met the diagnostic criteria of stage 5 chronic kidney disease in the clinical guidelines of the US Kidney Disease Prognosis Quality Initiative (47); (b) Regularly receiving MHD treatment≥3 months; (c) Patients aged between 18 to 59 years old; (d) Ability to read and communicate in writing and orally; (e) Informed consent and voluntary participation in this survey. The following were exclusion criteria: (a) Patients with other serious diseases or malignant tumors; (b) Patients with cognitive dysfunction or mental illness; (c) Patients with visual, hearing, and speech impairments. Initially, 350 patients were selected for the study. 8 patients quit due to emotional distress or fatigue, and 10 participants responded with regularity. At the end, the sample included 332 MHD patients (participation rate = 94.9%; Figure 2).

3.3. Sample size

The sample size calculation was conducted by G*Power 3.1.9.7 software (48). With effect size (0.15), α error probability (0.05), power (0.95), and 21 predictors (three for SES, eight for illness perceptions, and ten for social functioning), we calculated the sample size to be at least 226 participants. The most appropriate sample size for using structural equation modeling (SEM) is 100–400 (49). The final number of participants in this study was 332 cases, which also met the criteria for using SEM.

3.4. Data collection and ethical considerations

Uniformly trained researchers collected the data through interviews, and used identical instructional language to guide patients to fill out the questionnaires during the survey. The purpose, significance, and confidentiality of the study were explained, so as to

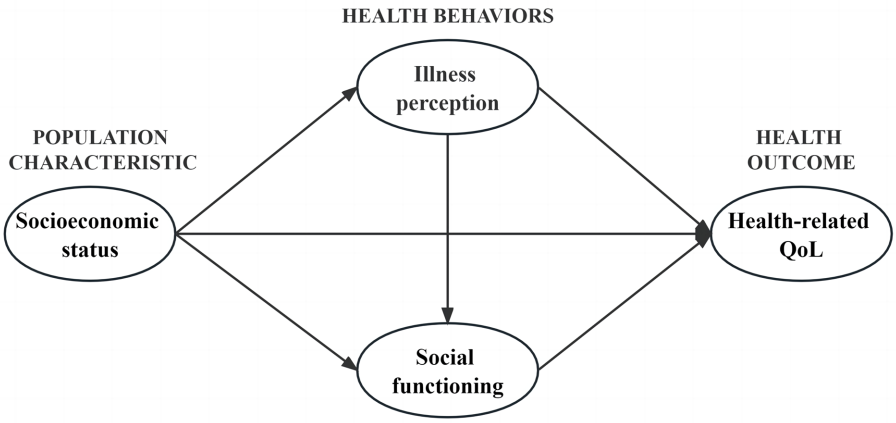


FIGURE 1
Theoretical hypothesis model.

ensure authenticity of the study. Informed consent was obtained from all individual participants included in the study. All procedures of the study were ethically approved by the Ethics Committee of the authors' hospital (K-2022-089).

3.5. Measurements

3.5.1. Demographic and clinical variables

The variables included: age, gender, residence, marital status, medical insurance, dialysis status, comorbidities (cardiovascular disease, diabetes complications, mineral-Bone abnormalities, renal anemia), medication, and primary cause of illness.

3.5.2. Socioeconomic status

In this study, the SES indicator was set according to the study by Pan et al. (50). The three variables, namely types of occupation, education level, and economic income of MHD patients at young and middle age were collected and assigned separately (See Supplementary File S2 for details of the assignments). Finally, the standard scores of these three variables were subjected to principal component analysis, which yielded one principal factor with an eigenroot greater than 1, explaining 56.5% of the variance, and the formula for calculating the indicator of comprehensive SES was obtained as follows: $(0.793 \times Z_{\text{occupation type}} + 0.717 \times Z_{\text{monthly household income } \textit{per capita}} + 0.744 \times Z_{\text{education level}})/0.565$，where 0.793, 0.717, and 0.744 represent the factor loadings of the three variables, respectively, and 0.565 represents the eigenroot of the first factor，with higher scores indicating higher SES. The SES of the patients in this study ranged from −5.27 to 9.82.

3.5.3. The brief illness perception questionnaire

This study used the Chinese version of BIPQ to evaluate the cognitive and emotional representations of an illness in young and middle-aged MHD patients (51). The questionnaire consisted of 9 items, with a total score of 0 to 80. Higher scores represented the higher perceived threat of illness and more negative perceptions by patients. The scale is now commonly used in hemodialysis patients, with a measured Cronbach's alpha coefficient of 0.67 (36). The Cronbach's α coefficient for the scale in this study was 0.757.

3.5.4. Social dysfunction screening scale

The scale was developed by the WHO (52) to assess the degree of social functioning of patients and is applicable to patients with all types of chronic diseases. It consists of 10 items, with a total score of ≥2 indicating deficits in social functioning. The scale demonstrated good validity and reliability in Chinese patients, with a retest reliability coefficient of 0.786 for young and middle-aged Chinese liver transplant recipients (53). The scale's Cronbach's α coefficient in this study was 0.781.

3.5.5. The 12-item short form health survey

The scale is a simplified version of the MOS item short-form health survey (SF-36) and is primarily used to assess the HRQoL of patients (54). By assessing 8 domains, the 12-item scale measures the physical component summary score (PCS) and mental component summary score (MCS). The total HRQoL score is the average of the PCS and MCS scores, with a range from 0 to 100. Higher score indicates a better HRQoL for the patient. It has been proved that the Chinese version of SF-12 has good reliability (55, 56), and Cronbach's α coefficient for the scale in this study was 0.624.

3.6. Data analysis

The outcomes were processed with SPSS version 25.0® and AMOS 28.0.

3.6.1. Primary analysis

The reliability of the measuring tools was evaluated using Cronbach's alpha. Participant demographic and clinical characteristics were tested with descriptive statistics. Furthermore, the samples were inspected for normality with skewness and kurtosis. To make comparison between the groups, a T-test or one-way ANOVA was applied. The presence of multicollinearity was determined using Variance inflation factor (VIF), tolerance, and Pearson's correlation coefficient. The multivariate linear regression model was used to assess the impacts of social demographic characteristics and clinical variables, illness perception, as well as social functioning on HRQoL among MHD patients.

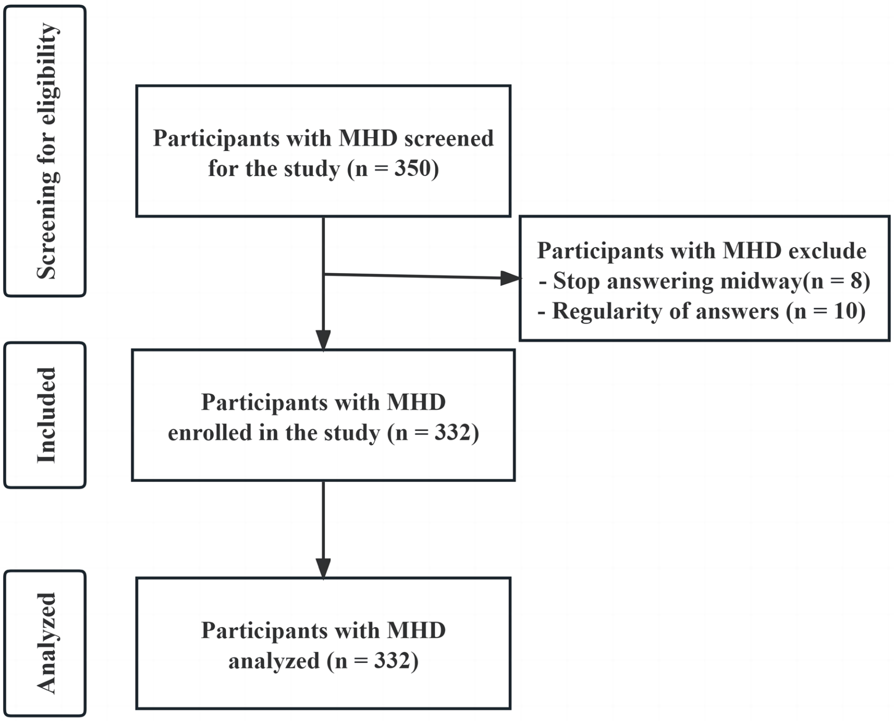


FIGURE 2
Flow chart of the study sample.

3.6.2. Structural equation modeling analysis

The relationship between the latent factors in the hypothetical theoretical model was assessed through the SEM structural model. In the SEM, the maximum likelihood method was applied to determine the interrelationships and parameters among the variables. The bootstrap mediation effect test method was applied to inspect the mediating effects, set the sampling frequency to 5,000 times, and set the confidence intervals (CI) to 95%. A mediating effect exists if the 95% CI contains no 0. Then, the fit relationship between the hypothetical model and the data was tested by calculation of the fit indices. Finally, the moderating effect of gender was tested using a multi-group structural equation model. When modeling structural equations, because of the large amount of items in the existing scale, if the original items are directly used for modeling, the model structure may be more complex, the fitting degree is poor, and the parameter estimation deviation is high (57). From the modeling perspective, it has been proved that the item wrapping method could stabilize parameter estimates and improve model fit; from the measurement perspective, the advantage is to enhance the commonality of indicators and reduce random errors (58). Therefore, this study used item wrapping to enhance the fit and accuracy of the model. BIPQ was converted into three item packs (I1, I2, and I3), and ten items of SDSS were also converted into three item packs (S1, S2, and S3). The Harman single-factor test was applied to assess the common deviation before data analysis, thereby enhance the rigor of the study. The findings indicated that there were 9 factors with characteristic roots were more than 1, and the variation explained by the first factor was 24.13% (less than 40%), showing that there was no significant common.

4. Results

4.1. Participants' demographic and disease-related characteristics

Three hundred thirty-two MHD patients (223 men and 99 women), with a mean age of 46.21 ± 9.49 years old, submitted complete questionnaires. Most of the patients were married (*n* = 251, 75.6%), living in cities and towns (*n* = 246, 74.1%), with medical insurance (*n* = 326, 98.2%), suffering from 3 to 4 kinds of chronic comorbidities (*n* = 168, 50.6%), and regularly taking 3 to 4 kinds of drugs (*n* = 179, 53.9%). 26.2% of participants had kidney disease due to hypertension. Regarding the duration of hemodialysis, 158 participants (47.6%) had hemodialysis duration ranging from 12 to 60 months. The frequency of dialysis was mainly 3 times a week, and the time of dialysis was mainly during daytime (Table 1).

Regarding the SES, the education level of the participants in the sample is mainly middle school (*n* = 134, 40.4%). For financial status, 137 (41.3%) declared a household *per capita* monthly income of 4,001–6,000 Renminbi (RMB) per month, which belongs to the middle income group in China. According to the criteria for occupational classification, the study divided occupations into five grades, of which 225 (67.8%) participants were casual workers, unemployed, or unskilled and agricultural working class (Table 2).

4.2. Descriptive statistics and normality of research variables

Significant differences existed between male and female patients on the means of SES and social functioning, and non-significant differences on other variables. Considering that the absolute value of skewness for all studied variables ranged from 0.06–0.88, and the kurtosis ranged from 0.19–0.83, which indicated that the data conform to a multivariate normal distribution (Table 3).

4.3. Correlations of research variables

There were significant correlations between SES, illness perception, social functioning and HRQoL in young and middle-aged patients on MHD, which provided the prerequisites for the subsequent multiple mediated effects analysis (Table 4). The tolerance was between 0.57 to 0.71, the VIF ranged from 1.40 to 1.76, and the correlation coefficient between variables was between −0.64 and 0.51, showing no significant multicollinearity between the measured variables.

4.4. Multivariate linear regression analysis of factors affecting the HRQoL of young and middle-aged MHD patients

The variables associated with HRQoL in the univariate analysis were included in the model. Multivariate stepwise linear regression analysis was performed with residence, dialysis time period, chronic comorbidities and number of long-term medications as control variables, while SES, illness perception, and social dysfunction as independent variables, and total SF-12 score as a dependent variable, aiming to determine the predictive effect of HRQoL in young and middle-aged MHD patients (Table 5). The outcomes of the Model I indicated that residence ($\beta = -3.78$，$p < 0.05$) and comorbidities ($\beta = -3.73$，$p < 0.01$) demonstrated a notable negative predictive effect on HRQoL. In Model II, SES ($\beta = 1.62$, $p < 0.01$) significantly and positively predicted HRQoL, so *H1* holds. Based on Model II, a significant negative effect on patients' HRQoL was found in Model III with illness perception ($\beta = -1.02$, $p < 0.01$) as the independent variable. In Model IV, when participation in SES, illness perception and social dysfunction were entered into the regression equation simultaneously, the predictive effect of illness perception on HRQoL remained significant, and social dysfunction ($\beta = -1.77$, $p < 0.01$) also significantly and negatively predicted HRQoL. However, the positive predictive effect of SES on HRQoL was decreased and non-significant ($\beta = 0.36$, $p > 0.05$), suggesting that illness perception and social functioning play a fully mediating role between SES and HRQoL. Furthermore, as shown in Table 5, Model IV had the largest adjusted R^2 compared to the first three models, suggesting that SES, illness perception and social functioning together have greater explanatory power for HRQoL.

4.5. Mediation model construction

Based on Andersen's behavioral model and the multilevel regression analysis outcomes previously demonstrated, the mediation model was constructed using AMOS 28.0 analysis software with SES as the antecedent variable, illness perception and social functioning as mediating variables, and HRQoL as the outcome variable. The correlations and effect paths of variables are presented in the final output model (Figure 3), justifying research hypotheses *H2*, *H3*, and *H4*. The fitted indicators of the model were $\chi^2/\mathrm{df} = 1.897 < 3$, SRMR = 0.036 < 0.04, RMSEA = 0.052 < 0.08，CFI = 0.974 > 0.9, NFI = 0.948 > 0.9, TLI = 0.963 > 0.9, which met the criteria of excellent model fit.

4.6. Mediation model validation and effect analysis

As shown in Figure 3, the direct predictive effect of SES on HRQoL was not significant ($p > 0.05$) after bringing in the two intermediary variables: illness perception and social functioning; illness perception ($\beta = -0.61$, $p < 0.001$) and social dysfunction ($\beta = -0.55$, $p < 0.001$) each had a notable negative predictive effect on HRQoL, both consistent with the outcomes of multiple linear regression analysis. Besides, SES was an important negative predictor of illness perception ($\beta = -0.54$, $p < 0.001$) and social dysfunction ($\beta = -0.57$, $p < 0.001$). Social dysfunction was positively predicted by illness perception ($\beta = 0.34$, $p = 0.003$).

Table 6 shows the specifics of the direct and indirect associations between SES and HRQoL. SES had total and indirect effects as 0.79 [95% CI (0.028, 0.985)] and 0.74 [95% CI (0.628, 1.391)], respectively, on HRQoL. The two specific mediating effects of illness perception and social dysfunction were both statistically significant, with the indirect effects of SES on HRQoL via illness perception and social dysfunction being 0.33 [95% CI (0.204, 0.494)] and 0.31 [95% CI (0.148, 0.570)], making up 41.06% and 38.91% of the total effect, respectively. The chain indirect effect of illness perception and social dysfunction was 0.10 [95% CI (0.040, 0.178)], making up 12.59% of the sum. The direct effect between SES and HRQoL was not statistically significant ($p > 0.05$).

4.7. Analysis of gender differences in mediation model

Gender was used as a moderating variable for the multi-group comparisons to test whether the multiple mediation model would be affected. First, the model was tested separately for the male and female patients samples and the results showed (see Table 7) that the model fit well for both male and female patients and could be compared across groups. Next, the unconstrained model (M0) and the model with equal structural weights (M1) were set and the results showed (see Table 7) that the two models M0 and M1 fit well with no significant difference between them ($\triangle\chi^2 = 11.506$，$\triangle\mathrm{df} = 6$, $p = 0.747 > 0.05$), suggesting that gender cannot play a moderating role in the multiple mediation model.

5. Discussion

Based on Andersen's behavioral model, we examined a serial multiple mediation model with illness perception and social functioning in the association between SES and HRQoL. Specific findings and analyzes of the study are as follows.

TABLE 1 Demographic and clinical characteristics of participants (*N* = 332).

Variables	Categories	*N* (%)	HRQoL Mean ± SD	*t/F*
Gender	Male	233 (70.2)	57.09 ± 12.49	0.15
	Female	99 (29.8)	56.87 ± 12.00	
Age (years)	18–44	121 (36.4)	58.68 ± 11.98	1.86
	45–59	211 (63.6)	56.07 ± 12.45	
Marital status	Single	64 (19.3)	57.57 ± 12.65	0.70
	Married	251 (75.6)	57.15 ± 12.08	
	Divorced	11 (3.3)	51.99 ± 15.42	
	Widowed	6 (1.8)	55.21 ± 14.71	
Residence	Towns	246 (74.1)	58.19 ± 12.44	2.96*
	Rural	86 (25.9)	53.67 ± 11.41	
Medical coverage	Self-financed	3 (0.6)	45.31 ± 6.25	1.29
	Resident health insurance	134 (40.4)	56.31 ± 12.59	
	Employee medical insurance	192 (57.8)	57.73 ± 12.06	
	Commercial insurance	3 (0.9)	55.21 ± 20.09	
Duration of HD (months)	3 ~ 6	39 (11.7)	57.09 ± 13.19	0.49
	6 ~ 12	39 (11.7)	56.25 ± 11.44	
	12 ~ 60	158 (47.6)	56.44 ± 12.67	
	≥60	96 (28.9)	58.27 ± 11.83	
Dialysis frequency(times/week)	<3	42 (12.7)	60.34 ± 11.62	1.87
	≥3	290 (87.3)	56.54 ± 12.37	
dialysis time period	Daytime	283 (85.2)	56.45 ± 12.23	−2.05*
	Evening	49 (14.8)	60.33 ± 12.54	
Number of comorbidities	1 ~ 2	48 (14.5)	62.79 ± 11.27	10.89**
	3 ~ 4	168 (50.6)	57.79 ± 11.97	
	≥5	116 (34.9)	53.52 ± 12.27	
Number of medications	1 ~ 2	46 (13.9)	58.76 ± 11.33	2.54
	3 ~ 4	179 (53.9)	57.86 ± 12.46	
	≥5	107 (32.2)	54.86 ± 12.34	
Primary cause	Glomerulonephritis	38 (11.4)	60.32 ± 11.75	2.80*
	Diabetic nephropathy	56 (16.9)	51.53 ± 9.85	
	Hypertensive nephropathy	87 (26.2)	57.29 ± 13.65	
	Polycystic kidney	11 (3.3)	60.94 ± 10.80	
	Obstructive nephropathy	7 (2.1)	58.71 ± 11.30	
	Undetermined etiology	60 (18.1)	56.85 ± 12.36	
	Other	73 (22.0)	58.58 ± 12.03	

HD, hemodialysis; HRQoL, health-related quality of life; SD, standard deviation. *$p < 0.05$, **$p < 0.01$.

5.1. Current status of SES, illness perceptions, social functioning and HRQoL in young and middle-aged people with MHD

Compared with the domestic norm, the HRQoL scores of young and middle-aged MHD patients were lower in this study, which was consistent with previous study (59), suggesting that the HRQoL of young and middle-aged MHD patients was at a low level. The goal of MHD treatment is not only to improve the clinical symptoms of patients and prolong their survival time, but also to improve their QoL, which suggests that improving the HRQoL of patients is a long-term exploration for medical professionals. In this study, young and middle-aged MHD patients' SES was generally low-characterized by low educational attainment, lack of employment and heavy financial burden, which is consistent with the findings of Modi et al. (60). Due

TABLE 2 SES characteristics of participants ($N = 332$).

Variables	Categories	N(%)	HRQoL Mean ± SD	t/F
Occupation	Casual worker / Unemployed /Unskilled and agricultural working class	225 (67.8)	53.47 ± 11.50	20.96**
	Workers / Self-employed / Skilled worker	47 (14.2)	60.67 ± 10.64	
	Grassroots managers /Service industry workers / General professional and technical staff	49 (14.8)	66.80 ± 8.81	
	Middle management / Middle-level professional and technical staff	8 (2.4)	72.27 ± 7.17	
	Senior management staff	3 (0.9)	66.15 ± 23.66	
Monthly household income *per capita*(RMB)	<2,000	10 (3.0)	56.09 ± 12.14	8.71**
	2,000–4,000	126 (38.0)	53.79 ± 12.44	
	4,001–6,000	137 (41.3)	57.32 ± 11.56	
	>6,000	59 (17.8)	63.37 ± 11.57	
Education level	Primary school and below	79 (23.8)	53.78 ± 12.05	
	Middle school	134 (40.4)	56.72 ± 13.02	4.22**
	High school or secondary school	67 (20.2)	57.42 ± 10.78	
	Junior college	36 (10.8)	60.89 ± 11.50	
	≥College	16 (4.8)	65.23 ± 10.64	

SES, socioeconomic status; HRQoL, health-related quality of life; SD, standard deviation; RMB, Renminbi. *$p < 0.05$, **$p < 0.01$. For monthly household income *per capita*, <2,000 represents the low income families, 2,000–4,000 represents the lower-middle income families, 4,001–6,000 represents the middle income families, >6,000 represents the high income families in China.

to frequent hemodialysis treatment and its associated symptoms (8), most hemodialysis patients quit their work or cut down their working hours after starting dialysis treatment, resulting in unfulfilled career goals, which greatly affects their QoL and personal development, and also places a heavy financial burden on their families and society, greatly reducing their SES. Therefore, medical professionals should focus on the low SES group of young and middle-aged MHD. The level of illness perceptions in young and middle-aged MHD patients was in the upper middle range, which is comparable to some results reported in the literature (61), but much higher than scores for other chronic diseases (62). Appropriate illness perceptions can promote a positive outlook on illness and its treatment, but excessive illness perceptions can lead to incorrect or negative perceptions of illness and treatment, and affect long-term QoL (63). This suggests that in the treatment of MHD, medical professionals should promptly assess patients' illness perceptions, grasp their concerns and understanding of the illness, and enhance health education to reduce their negative perceptions. In addition, the current state of social functioning of young and middle-aged MHD patients was not promising, and 68.6% of patients had varying degrees of social dysfunctions. The specific manifestations are decreased work and professional ability, social withdrawal, less social activities inside and outside the family, lack of interest and concern for the outside world, and lack of responsibility and planning. This may be due to the fact that dietary restrictions, various complications, and dependence on hemodialysis for survival have caused patients to position themselves in a patient role, both psychologically and physically, thus reducing their social participation and level of social engagement. A study has shown that good social functioning is vital to the physical and mental health of patients and the treatment of their illnesses (64). Therefore, improving social functioning of young and middle-aged MHD patients and enabling them to adapt to the life changes brought about by hemodialysis as soon as possible is important for improving long-term treatment and HRQoL.

5.2. The influence mechanism of SES on HRQoL

This study focused on the effect of SES on HRQoL and analyzed the internal mediating mechanism of illness perception and social functioning with residence, dialysis duration, and number of chronic comorbidities as well as long-term-medications as control variables. The findings suggested that SES has a significant positive influence on HRQoL of young and middle-aged MHD patients, which is consistent with previous findings that employment status, *per capita* household income, and literacy will affect HRQoL (19, 65). The Andersen's behavioral model states that SES is an important factor affecting health outcomes for vulnerable groups (46). Multiple studies have shown that low SES in patients with MHD is consistently associated with impaired HRQoL (20, 66). SES is closely related to the degree of HRQoL in young and middle-aged MHD patients, but there are few studies on the internal mediating mechanism of SES on HRQoL. In this study, it was noteworthy that the direct predictive effect of SES on HRQoL was insignificant after introducing the two intermediary variables of illness perception and social functioning. These two intermediary variables could take effect separately or jointly, thus established the chain effect of SES → illness perception → social functioning → HRQoL, which suggests that illness

TABLE 3 Descriptive statistics of study variables ($N = 332$).

Variables	Mean ± SD	Male (Mean ± SD)	Female (Mean ± SD)	*t*	Skewness	Kurtosis
Population characteristic						
SES	0.05 ± 3.03	0.29 ± 3.07	−0.50 ± 2.85	2.19*	0.88	0.62
Health behaviours						
Illness perception	51.71 ± 5.85	51.58 ± 5.72	52.00 ± 6.17	−0.59	−0.06	−0.19
Social functioning	3.64 ± 2.93	3.44 ± 2.96	4.13 ± 2.80	−1.98*	0.46	−0.83
Health outcome						
HRQoL	57.02 ± 2.93	57.09 ± 12.49	56.87 ± 11.99	0.15	0.12	−0.78

SES, socioeconomic status; HRQoL, health-related quality of life; SD, standard deviation. *$p < 0.05$.

TABLE 4 Correlation analysis between SES, illness perception, social functioning and HRQoL ($N = 332$).

Variables	1	2	3	4	Tolerance	VIF
1.SES	1				0.62	1.64
2.Illness perception	−0.36**	1			0.71	1.40
3.Social functioning	−0.55**	0.51**	1		0.57	1.76
4. HRQoL	0.44**	−0.59**	−0.64**	1	-	-

SES, socioeconomic status; HRQoL, health-related quality of life; VIF, variance inflation factor. **$p < 0.01$.

perception and social functioning play a fully mediating role between SES and HRQoL, and this result also corroborates the existence of mediating modes in the effect of SES on an individual's health (46).This result may suggest that improving the objective material basis alone does not improve HRQoL in young and middle-aged MHD patients and that other individual factors influenced by SES (illness perception, social functioning) are more closely related to HRQoL.

5.3. Mediating effect of illness perception

The research results showed SES can affect the HRQoL of young and middle-aged MHD patients through a separate mediating effect of illness perception. This result supports the view of the Andersen's behavioral model that the propensity trait of SES needs to interact with positive resources within the individual to have an impact on HRQoL in young and middle-aged MHD patients. Illness perception reflects the psychological representation of MHD patients toward the disease, and affects the patients' cognition and coping behavior toward the disease. The findings that illness perception has a direct effect on HRQoL and that other factors are indirectly related to HRQoL through the mediation of illness perception is consistent with the results of another study (67) and confirms *H2* of this study. Reserve capacity Model also states that groups with low SES experience more stress from internal and external sources, which depletes their own psychosocial resources, therefore leads to more negative emotions and impairs QoL (68). The more negative illness perceptions among hemodialysis patients of lower SES, the lower the overall HRQoL score, a finding consistent with data from the study reported by Chen et al. (36). Patients of low SES tend to perceive more severe disease outcomes, believe their disease will last longer, have more symptoms and more emotional reactions because of their disease, and conversely, those of higher SES have stronger beliefs about disease status control and better disease understanding (34). This may be due to differences in SES affect patients' ways of thinking, interpersonal skills and resilience to stress, as well as their perception and acceptance of the facts of the illness, such that individuals may have positive illness perceptions (seeking relevant information, coping positively, increasing confidence, etc.) or negative illness perceptions (avoidance, denial, negative emotions, etc.) for the same health problem, which could bring positive or negative influence to their health outcomes, respectively.

5.4. Mediating effect of social functioning

Social functioning is also a mediating variable between SES and HRQoL, which confirms *H3*. Social Cognitive Theory states that social class shapes the environment in which individuals live, causing them to develop a social cognitive style appropriate to their class, and that this stable social cognitive style in turn influences their psychological and behavioral responses (69). As a result, there are significant differences in the social cognitive styles and behaviors of individuals of different SES (70). However, the relationship between sociodemographic factors and social functioning remains inconsistent and still needs further verification. In this study, the higher the SES of the patients, the lower the likelihood of social dysfunctions and the higher their level of HRQoL, which supports the Andersen's behavioral model that population characteristics (SES) can influence health outcomes (HRQoL) through the mediation of health behaviors (social functioning).

Sound social functioning is an objective reflection of an individual's QoL; and defective social functioning can lead to disorder in the individual's social function and social behavior dysfunction (71). Enabling people with MHD to function and behave socially in accordance with their role in society can help build confidence in overcoming their illness and is essential to improving their QoL (33). Thus, social functioning becomes one of the intermediate mechanisms linking SES and HRQoL, i.e., differences in SES can lead to inequalities in HRQoL through social functioning.

TABLE 5 Multivariate linear regression analysis of factors affecting the HRQoL ($N = 332$).

Model	Variables	β	SD	Standardized β	F value	Adjust R^2
Model I	Residence	−3.78*	1.50	−0.13	8.16**	0.08
	Dialysis time period	2.77	1.85	0.08		
	Number of comorbidities	−3.73**	1.01	−0.20		
	Number of medications	−1.55	1.02	−0.08		
Model II	Residence	−0.37	1.47	−0.01	17.88**	0.20
	Dialysis time period	1.10	1.74	0.03		
	Number of comorbidities	−1.80	0.98	−0.10		
	Number of medications	−1.78	0.95	−0.10		
	SES	1.62**	0.23	0.40		
Model III	Residence	0.28	1.28	0.01	38.35**	0.40
	Dialysis time period	1.78	1.51	0.05		
	Number of comorbidities	−0.50	0.85	−0.03		
	Number of medications	−1.23	0.82	−0.07		
	SES	1.02**	0.20	0.25		
	Illness perception	−1.02**	0.10	−0.49		
Model IV	Residence	0.16	1.16	0.01	49.07**	0.50
	Dialysis time period	0.29	1.39	0.01		
	Number of comorbidities	0.11	0.78	0.01		
	Number of medications	−1.49*	0.75	−0.08		
	SES	0.36	0.20	0.09		
	Illness perception	−0.71**	0.10	−0.34		
	Social functioning	−1.77**	0.21	−0.42		

HRQoL, health-related quality of life; SD, standard deviation; SES, socioeconomic status. *$p < 0.05$, **$p < 0.01$.

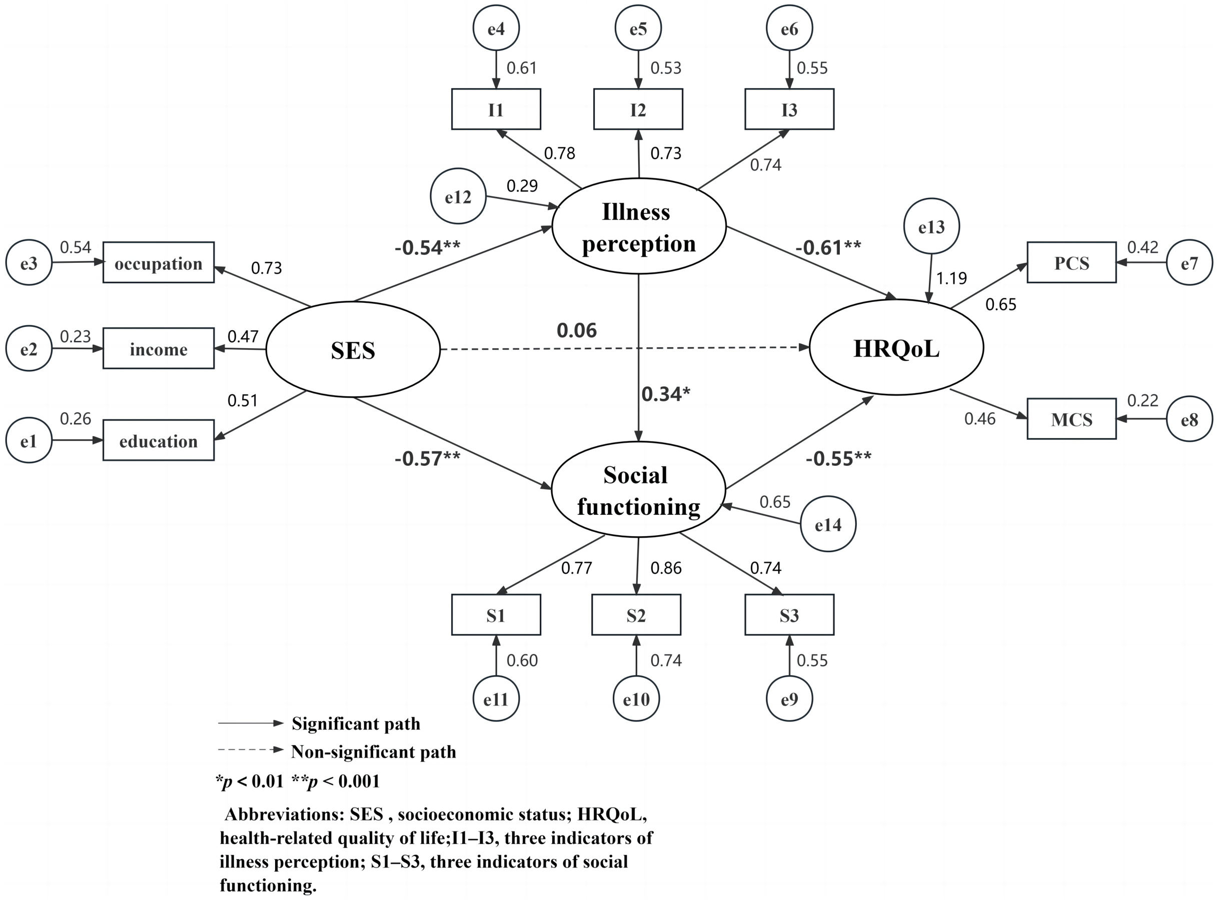
5.5. The chain intermediary of illness perception and social functioning

This study showed that SES has an impact on HRQoL of young and middle-aged MHD patients through the chain intermediary effect of illness perception and social functioning, so *H4* of this study was confirmed. The result suggested that SES directly affects patients' cognitive and emotional responses to illness, and that individuals with lower levels of SES have lower reasoning and cognitive control and are more likely to develop negative illness perceptions, leading to socially deficient behaviors and consequently impaired HRQoL, which mirrors the theoretical view of the Andersen's behavioral model. Heavy family and social roles taken on by middle-aged youth. Once young and middle-aged people suffer from chronic diseases, in the face of multiple blows of disease torture and psychological trauma as well as economic pressure, the low SES patient group is more likely to cause emotional and cognitive behavioral abnormalities toward the disease, thus inducing negative emotions in patients and affecting their social participation (72). Meanwhile, altered physiological functions and partial physical deficits can lead to abnormal social roles and negative attitudes that inhibit behavior and expression in social interactions, thus preventing a successful return to the family and society and resulting in social dysfunction (64). Social dysfunction will lead to the formation of patients' negative values and the aggravation of social behavior withdrawal, which will also affect the patient's disease outcome, cause huge wealth loss to the family and society, increase the economic burden on the family and society, and make health-related diseases worse. Quality of life is severely impaired (73). Current research has identified that people with higher SES tend to cope with stress and regulate their emotions better, and that these strengths further contribute to their behavior and mindset in everyday life and to their physical health (34). Therefore, simultaneous interventions on illness perception and social functioning in young and middle-aged MHD patients are more conducive to HRQoL improvement.

5.6. The moderating role of gender

Although this study found significant gender differences in SES and social functioning in patients, there were no significant gender differences in the mediating role of illness perception and social functioning between patients' SES and HRQoL, suggesting that gender does not have a significant moderating role in this multiple mediation model and that the mediating mechanism between SES and HRQoL is intrinsically similar between patients of different genders.

In conclusion, although there are characteristics of SES that cannot be easily changed, medical staff can pay close attention to the psychological resources of young and middle-aged MHD patients. According to positive psychology, to guide patients to correctly understand the disease, eliminate negative emotions, enhance the sense of belief in disease treatment, and promote patients to actively adapt to social roles and re-engage in social life, thus improving their HRQoL.



p < 0.01 ***p* < 0.001

Abbreviations: SES , socioeconomic status; HRQoL, health-related quality of life;I1–I3, three indicators of illness perception; S1–S3, three indicators of social functioning.

FIGURE 3
The final SEM model.

TABLE 6 Direct and indirect effects of SES and HRQoL.

	Path	Effect	SD	LLCI	ULCI	Relative mediation effect (%)
Direct effects	SES-HRQoL	0.06	0.17	−0.320	0.363	7.43
Indirect effects	SES-IP-HRQoL	0.33**	0.08	0.204	0.494	41.06
	SES-SD-HRQoL	0.31**	0.11	0.148	0.570	38.91
	SES-IP-SD-HRQoL	0.10*	0.04	0.040	0.178	12.59
Total indirect effects		0.74**	0.15	0.628	1.391	92.57
Total effects		0.79**	0.09	0.028	0.985	—

HRQoL, health-related quality of life; SES, socioeconomic status; IP, illness perception; SD, social dysfunction; SD, standard deviation; LLCI, lower limit confidence intervals; ULCI, upper limit confidence intervals. *$p < 0.01$, **$p < 0.001$.

5.7. Implications for practice

The results of the present study suggest that that SES positively predicts HRQoL through the multiple mediating effects of illness perception and social functioning, i.e., higher SES predicts positive illness perception and good social functioning, thus contributing to the maintenance of good HRQoL, which provides a scientific and theoretical basis for developing medical care interventions to maintain or improve patients' HRQoL from multiple perspectives. Specifically, nurses should encourage young and middle-aged MHD patients to return to work, and can promote the recovery of patients' working ability by carrying out health education on MHD and work, formulating targeted vocational rehabilitation programs and conducting relevant vocational skills training, so as to improve their SES. The findings suggest that illness perception and social functioning play multiple mediating roles in SES affecting HRQoL, nurses should appropriately assess and monitor patients' illness perception and social functioning and give timely and targeted interventions. Nursing interventions are of vital importance in shaping a patient's illness perception (74). Pre-dialysis care should be enhanced by combining motivational interviewing with psycho-behavioral interventions, health education care and collaborative care models to reduce patients' negative illness perceptions. During long term dialysis treatments, positive illness perceptions of patient can be built up through group management health education, patient exchange meetings, hope

TABLE 7 Multi-group structural equation model fit indices.

	χ^2	df	χ^2/df	GFI	AGFI	RMSEA	CFI	IFI	NFI
M male	62.772	38	1.652	0.953	0.918	0.053	0.975	0.900	0.941
M female	69.978	38	1.842	0.891	0.811	0.093	0.906	0.910	0.823
M 0	132.928	76	1.746	0.934	0.885	0.484	0.958	0.959	0.909
M 1	144.434	82	1.761	0.929	0.885	0.484	0.954	0.955	0.901

M, model; M0, the unconstrained model; M1, the model with equal structural weights.

therapy, etc. and reinforced by practice in daily life. Therefore, nurses should enhance pre-dialysis care for patients by combining motivational interviewing with psycho-behavioral interventions, knowledge, belief and practice health education care and collaborative care models to reduce patients' negative illness perceptions. During long term dialysis treatments, positive illness perceptions of patient can be built up through group management health education, patient exchange meetings, hope therapy, etc. and reinforced by practice in daily life. At the same time, nurses should develop and implement a comprehensive and dynamic care strategy for young and middle-aged MHD patients with social dysfunction to help them adapt well to the role change and promote the recovery of social function. Young and middle-aged MHD patients should not only actively participate in social activities, establish normal interpersonal and harmonious family relationships, and engage in work that is within their capacity, but also actively communicate with healthcare professionals to improve their overall understanding of the disease and take the initiative to reshape a positive and healthy way of thinking so as to improve their HRQoL.

5.8. Limitations

There are certain theoretical and practical implications of this study, but there are also some limitations. First, we cannot directly derive causal relationships from the cross-sectional design. Therefore, a longitudinal study design would be ideal to examine the complex dynamic effects of SES, illness perception, and social functioning on HRQoL. Second, this study used convenience sampling and self-reporting methods to collect data, which may lead to selection bias and reporting bias, therefore, the results of this study need to be applied with caution. In the future, data collection should combine with self-evaluation and others' evaluation, and sampling methods can also be changed to validate the findings of this study. Thirdly, as there are many factors affecting the explanatory variables, and the SES analyzed in this study is only one aspect affecting patients' HRQoL, the multiple mediator model developed is not the only mediator model, therefore there are many other explanatory and mediator variables that deserve to be tested in the future. Fourthly, SES was measured only based on the types of occupation, education level, and economic income in this study. More indices of SES should be used in future studies.

6. Conclusion

In summary, based on Andersen's behavioral model, we constructed a model of the intrinsic mechanism of action between SES and HRQoL in young and middle-aged MHD patients, which provided a reference for explaining and intervening the effect of SES on HRQoL. Considering the important role of illness perception and social functioning in the SES-HRQoL linkage, clinical nurses should intervene in health differences due to SES in terms of illness perception and social functioning to assist in enhancing HRQoL levels in young and middle-aged MHD patients.

Data availability statement

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

Author contributions

QM made substantial contributions to conception and design, acquisition of data, analysis and interpretation of data, and wrote the manuscript. SX and JH contributed to data collection and drafting of the manuscript. XS has revised this manuscript critically for important intellectual content. GC and ZM contributed to data analysis and revising it critically for important intellectual content. YS and CW supervised the whole process and provided modification advice. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2023.1234553/full#supplementary-material

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Decomposition and comparative analysis of depressive symptoms between older adults living alone and with others in China

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Objective: This research dealt with investigating and measuring the contribution of the factors that impact depression in older adults living alone vs. those living with others (hereafter referred to as "not alone") in China.

Design: This investigation adopts a cross-sectional research design. The dataset employed for this study comprises data from 2018 the Chinese Longitudinal Health Longevity Survey (CLHLS).

Setting: The research involved data sourced from China, specifically from 23 of its provinces. From the 8th CLHLS, 12,197 older adults were selected who met the study requirements.

Measures: Binary logistic regression models were established to delve into the primary factors impacting the depressive symptoms of the individuals. Furthermore, Fairlie models were employed to assess these factors between older adults living alone and those not living alone. This approach facilitated an in-depth analysis of their respective contributions.

Results: It was observed that the demographic of Chinese older adults exhibited depressive symptoms at a rate of 11.92%. Older adults who resided alone (15.76%) exhibited a higher prevalence of depressive symptoms in comparison to their counterparts living in not-alone settings (11.15%). Employing Fairlie decomposition analysis, it was determined that this observed disparity in depressive symptoms, amounting to 55.33% of the overall difference, could be primarily attributed to distinct factors. This encompassed variance in marital status (20.55%), years of school (4.63%), self-reported local income status (7.25%), self-reported sleep status (17.56%), and self-reported health status (4.24%).

Conclusion: The resulting data indicated that depressive symptoms exhibited an elevated prevalence in older adults living alone than in those living not alone. This discrepancy was predominantly attributed to variance in socioeconomic marital status, years of school, self-reported local income status, self-reported sleep status, and self-reported health status by living alone vs. not alone. Mitigating these influential factors could help develop targeted and meticulous intervention strategies, precisely tailored to improve the mental well-being of older adults at high risk.

KEYWORDS

depressive symptoms, older adults, living status, China, Fairlie decomposition

1. Introduction

Depression is a mood disorder that causes a persistent feeling of sadness and loss of interest. The common features of all the depressive disorders are sadness, emptiness, or irritable mood, accompanied by somatic and cognitive changes that significantly affect the individual's capacity to function (1, 2). Because of false perceptions, nearly 60% of people with depression do not seek medical help and depression exerts a negative influence on the quality of life experienced by older adults (2). It primarily impacts older adults who are afflicted with chronic medical conditions and cognitive impairment. This condition precipitates personal distress, familial discord, and functional impairment, exacerbating the prognosis of various illnesses like diabetes, autoimmune disorders like rheumatoid arthritis, lupus, and cardiovascular diseases like coronary heart disease, hypertension (HTN), obesity, physiological aging, cancer, poor hearing, and poor health and heightening mortality rates (3, 4). Furthermore, it catalyzes suicidal tendencies, culminating in adverse health ramifications that result in a considerable burden on both families and society at large (5, 6).

Due to the accelerated process of global aging, the global population of older adults surpassed the 1 billion mark in 2021, constituting approximately 13.5% of the global populace. As projected by the World Health Organization, by the year 2030, an estimated one in six individuals will be age 60 years or older, underscoring the escalating significance of this demographic shift (7). As the country that long had the largest population worldwide, but is now the second largest and shrinking, China is facing an especially serious problem of an aging population. As per the findings of the seventh National Census conducted in 2021, the cohort of individuals aged 60 years and above within China has reached a substantial count of 260 million, comprising 18.7% of the entire population. Within this segment, individuals aged 65 years and above constitute 190 million individuals, equivalent to 13.5% of the total population (8). Projections indicate that the proportion of older adults aged 65 and above in the overall population will reach about 26.9% by the year 2050 (9).

Additionally, the implementation of the family planning policy in China has led to drastic declines in fertility, distinct from the demographic changes even in other countries with fertility declines over the past three decades. The 4 (older adults)–2 (a young or middle-aged couple)–1 (a child) family structure has become mainstream (10). Simultaneously, within contemporary society, adult children increasingly seek autonomy and their own personal "free space." This trend has contributed to the erosion of the traditional family model characterized by multi-generational cohabitation involving three or even four generations. The functioning of family older-adult care is weakening and shifting to social eldercare services. In China, where cultural norms emphasize family structure and collective values, the family has traditionally served as a vital support system for older adults. As their spouses, cohabitants, or important friends die, the issue of older adults living alone has become a social concern and has garnered significant attention (11).

Are there differences in depressive symptoms between older adults living alone and not alone? Numerous investigations have established a robust correlation between loneliness in old age and the occurrence of depression (11, 12). A comprehensive review systematically elaborates on living alone may predispose individuals to an elevated susceptibility to psychiatric conditions such as depression, alcohol abuse, sleep disorders, personality disorders, and Alzheimer's disease (4). One approach to preventing depression in older adults living alone is to identify factors distinguished from older adults living not alone. The factors may include sex, self-perceived financial status, marital status, educational level, living status, self-reported health status (SRH), quality of social relationships, smoking, and alcohol consumption (13–18). Therefore, we must explore the importance and contribution level of each factor between living alone and not alone, which will help us develop targeted measures to reduce depression in older adults living alone.

So further assessment of the elements that result in heightened depression in older adults living alone in comparison with those living with others (hereafter referred to as "not alone") must be executed. Furthermore, this research attempted to establish a foundation for the formulation of effective policies aimed at managing the levels of depressive symptoms experienced by older adults. Therefore, the variance between older adults (aged 65+) living alone and those cohabitating was examined in China. To achieve this, the Chinese Longitudinal Health Longevity Survey (CLHLS) dataset was utilized. Initially, the study delved into the degree to which sociodemographic characteristics, personal lifestyle choices, and health statuses accounted for the variations in depressive symptoms among Chinese older adults living alone and not alone.

2. Methods

2.1. Data sources

The data were retrieved from the 8th CLHLS (PKU Center for Healthy Aging and Development, 2020). Detailed information regarding the sources and design of the datasets can be accessed at https://opendata.pku.edu.cn/dataset.xhtml?persistentId=doi:10.18170/DVN/ WBO7LK (Accessed July 22, 2023). The CLHLS was executed by the Center for Healthy Ageing and Development Studies/National Development Research Institute of Peking University and was subjected to approval by the Ethics Committee of Peking University (No. IRB00001052-13074). The survey comprehensively spanned 23 of the provinces, encompassing approximately two-thirds of the geographical expanse of China. The focal demographic comprised individuals aged 65 years and above. The methodology involved two distinct questionnaires: one aimed at respondents who were alive and another tailored for family members of deceased older adults. The 8th iteration of the CLHLS took place from 2017 to 2018, involving interviews with a total of 15,874 older adults. We selected the participants who completed the full 10-question version of the Center for Epidemiology Studies Depression (CES-D) questionnaire were selected. The exclusion criteria encompassed individuals below the age of 65, as well as those who had not responded to measurements relating to depressive symptoms, demographic and sociological characteristics, personal lifestyle choices, or health status indicators. Finally, 12,197 respondents were selected for this study (Figure 1). Ultimately, including 2029 and 10,148 older adults living alone and not alone, respectively. The process utilized for the exclusion of non-relevant individuals is depicted in Figure 1.

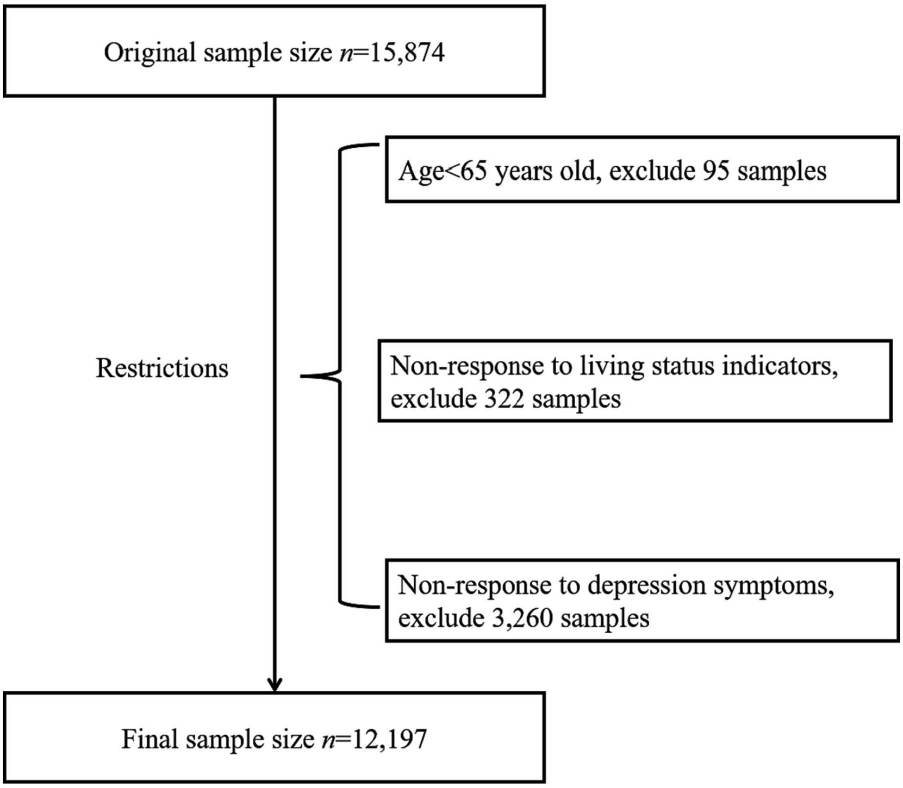

FIGURE 1
Flowchart of participants.

2.2. Depressive symptoms

The CES-D has been widely used as a practical depression screening tool by previous studies targeting older adults in China (19–21). In the 8th CLHLS, the CES-D-10 scale comprises 10 specific items such as "I was bothered by things that usually do not bother me," "I did not feel like eating; my appetite was poor," to comprehensive evaluation of the responders' depression status. The response options for each item range from 0 (*none of the time* or *rarely*) to 3 (*most* or *all the time*) on the questionnaire. Higher scores represent more severe depressive symptom. The questionnaire was centered on assessing depressive symptoms within the context of the past week. In the same way that multiple previous studies defined a score of 10 as a threshold score, participants with a score greater than or equal to 10 were defined as experiencing depressive symptoms (20, 22). Although scoring above a 10 does not directly correlate with a formal diagnosis, it does indicate a need for direct clinical assessment (22).

2.3. Group variables

Respondents were classified as alone or not alone based on whether they cohabited with family or spouse during the survey duration.

2.4. Covariates

The reliability of the acquired data was enhanced further by accounting for multiple potential confounding factors. To acquire comprehensive factors spanning sociological attributes, demographic characteristics, sociological characteristics, personal lifestyle and health status were drawn from existing studies on depressive symptoms.

2.4.1. Demographic characteristics

Age was classified as <70 years, 70–79 years, 80–89 years, 90–99 years, or > =100 years. The residence mainly included city, town, or rural. BMI was calculated by dividing weight (kg) by the square of height (m) and was divided into four categories: <18.5, 18.5–23.9, 24.0–27.9, and > =28.0. Education level was classified according to time in school as 0 years, 1–6 years, and ≥ 7 years.

2.4.2. Sociological characteristics

Marital status included married and living with spouse, widowed, and others (including married but not living with a spouse, divorced, and never married). Self-reported local income status was divided into three categories: poor, average, and rich.

2.4.3. Personal lifestyle

Personal lifestyle included smoking, drinking, exercise, and self-reported sleep status. Smoking, drinking, and exercise were categorized as "Yes" or "No" based on the responses to specific questions. Specifically, questions like "Do you currently drink alcohol," "Do you presently smoke?" and "Do you do regular exercises?" Self-reported sleep status was based on the question "What do you think of your recent sleep situation?" and classified as Poor, Average, and Rich.

2.4.4. Health status

Health status included SRH, hypertension, heart disease, diabetes, and stroke. The assessment of SRH was contingent on the answer to the question "How do you rate your current health?" This was followed by the categorization of the resulting data as average (so-so), good (good or very good), and poor (bad or very bad). We carefully asked each person about the four types of chronic diseases—hypertension, heart disease, diabetes, and stroke—and each item was categorized as "Yes" or "No."

2.5. Statistical analyses

Demographic and sociological characteristics, personal lifestyle choices, and health statuses were investigated using descriptive statistics. The distribution patterns of depressive symptoms among older adults living alone and those living in not-alone arrangements were analyzed using the chi-squared test. Subsequently, the binary logistic regression model was applied to assess the primary influencers of depressive symptoms within the contexts of both living conditions. These statistical analyses were executed utilizing SPSS 21.0 software. To further investigate the dynamics influencing and contributing to the divergence in depressive symptoms between older adults living alone and those cohabitating, the Fairlie model was employed. However, for the missing data of covariates, we used the multiple-imputation mothed to simulate, with each variable supplemented 10 times.

The software Stata MP16.0 was utilized for the assessment of data. *The level of statistical significance was defined as 0.05.*

2.5.1. Fairlie decomposition analysis

Given that the dependent variable takes on two distinct values (a dichotomous variable), the Fairlie nonlinear decomposition approach was applied. This methodology allowed the decomposition of the variations in depressive symptoms by attributing them to different contributing factors. More details are provided in our previous studies (23, 24).

3. Results

3.1. Respondents' general data

In total, this research involved 12,197 individuals. The outcomes of the descriptive statistical analyses for the older adults living alone and not alone in China are illustrated in Table 1. The resulting data indicated that 11.92% of these aged people had experienced depressive symptoms, while 88.08% had none. An elevated proportion of older adults living alone (15.76%) had experienced depressive symptoms in contrast to those living not alone (11.15%) ($p < 0.001$). The resulting data of a chi-squared test depicted variance in the distribution of the 10 covariates across the two living conditions. These encompassed: age, residence, sex, BMI, marital status, education level, self-reported local income status, self-reported sleep status, diabetes, and stroke.

3.2. Comparison of variable distribution across depressive symptoms

The distribution of covariates was assessed across older adults living alone and those living with someone else with different depressive symptoms. The data are depicted in Table 2. The resulting data demonstrated that certain covariates exhibited dissimilar distribution patterns among older adults with and without depressive symptoms. These divergent characteristics were evident in the variables of sex, self-reported sleep status, self-reported health status, diabetes, and stroke.

3.3. Logistic model results

Table 3 reveals the resulting data of the logistic model calculations for depressive symptoms by older adults living alone or not alone in China. Among older adults living alone, age (70–79, OR = 0.352, 95%CI = 0.171–0.722, 80–89:OR = 0.482, 95%CI = 0.240–0.966; 90–99:OR = 0.420, 95%CI = 0.198–0.893), self-reported local income status (average: OR = 0.016; 95%CI = 0.374–0.904), self-reported sleep status (good: OR = 0.262; 95%CI = 0.161–0.425), and SRH (good: OR = 0.297; 95%CI = 0.186–0.472) were noted to act as protective factors. In contrast, self-reported sleep status (bad: OR = 2.613; 95%CI = 1.762–3.874) and SRH (bad: OR = 2.723, 95%CI = 1.781–4.161) were noted to function as risk factors for depressive symptoms. Among older adults living not alone, education level (≥7: OR = 0.639, 95%CI = 0.477–0.856), self-reported local income status (average: OR = 0.406, 95%CI = 0.323–0.511; rich: OR = 0.319, 95%CI = 0.234–0.436), exercise (yes: OR = 0.687-95%CI = 0.563, 0.838), self-reported sleep status (good: OR = 0.396, 95%CI = 0.321–0.489), and SRH (good: OR = 0.524, 95%CI = 0.423–0.650) were protective factors, and marital status (widowed: OR = 1.382, 95%CI = 1.109–1.720), self-reported sleep status (bad: OR = 2.462, 95%CI = 2.015–3.010), SRH (bad, OR = 2.557, 95%CI = 2.080–3.143), and diabetes (yes: OR = 1.304, 95%CI = 1.011–1.682) were risk factors for depressive symptoms.

Hence, the differences in depressive symptoms observed between individuals living alone and those in not-alone arrangements in China can be attributed to 3 primary areas. First, age (70–79: OR = 0.352, 95%CI = 0.171–0.722; 80–89:OR = 0.482, 95%CI = 0.240–0.966; 90–99:OR = 0.420, 95%CI = 0.198–0.893) was a protective factor only in older adults living alone. Second, education level (≥7: OR = 0.639, 95%CI = 0.477–0.856), self-reported local income status (rich: OR = 0.319, 95%CI = 0.234–0.436), and (yes: OR = 0.687-95%CI = 0.563, 0.838) were observed to be protective factors only in older adults living not alone. Third, marital status (widowed, OR = 1.382) and diabetes (yes, OR = 1.304) were risk factors only in older adults living not alone.

3.4. Fairlie decomposition analysis results

Table 4 depicts the resulting data of the decomposition model of the variation in depressive symptoms across older adults living alone and not alone in China. The results showed that 55.33% of the difference in depressive symptoms was owing to observed

TABLE 1 Basic information of participants.

Variables	Alone [*n* (%)]	Not alone [*n* (%)]	c^2	*P*
CES-D 10			34.636	<0.001
<10	1,726 (84.24)	9,017 (88.85)		
^{3}10	323 (15.76)	1,131 (11.15)		
Age (years)			208.752	<0.001
<70	126 (6.15)	1,302 (12.83)		
70–79	512 (24.99)	2,945 (29.02)		
80–89	781 (38.12)	2,618 (25.80)		
90–99	469 (22.89)	2,002 (19.73)		
^{3}100	161 (7.86)	1,281 (12.62)		
Residence			37.464	<0.001
City	376 (18.35)	2,493 (24.57)		
Town	704 (34.36)	3,313 (32.65)		
Rural	969 (47.29)	4,342 (42.79)		
Sex			58.160	<0.001
Female	1,267 (61.84)	5,263 (51.86)		
Male	782 (38.16)	4,885 (48.14)		
BMI (kg/m^2)			8.383	0.039
18.5–23.9	1,048 (51.15)	4,990 (49.17)		
<18.5	306 (14.93)	1,414 (13.93)		
24.0–27.9	451 (22.01)	2,490 (24.54)		
^{3}28.0	186 (9.08)	828 (8.16)		
Missing	58 (2.83)	426 (4.20)		
Marital status				
Married and living with a spouse	114 (5.56)	5,288 (52.11)		<0.001
Widowed	1,771 (86.43)	4,530 (44.64)		
Other	145 (7.08)	227 (2.24)		
Missing	19 (0.93)	103 (1.01)		
education level			78.619	<0.001
0	913 (44.56)	3,741 (36.86)		
1–6	559 (27.28)	3,048 (30.04)		
^{3}7	256 (12.49)	1,995 (19.66)		
Missing	321 (15.67)	1,364 (13.44)		
Self-reported local income status			70.116	<0.001
Poor	277 (13.52)	906 (8.93)		
General	1,426 (69.59)	6,971 (68.69)		
Rich	315 (15.37)	2,197 (21.65)		
Missing	31 (1.51)	74 (0.73)		
Smoking			0.175	0.676
No	1,705 (83.21)	8,425 (83.02)		
Yes	321 (15.67)	1,631 (16.07)		
Missing	23 (1.12)	92 (0.91)		
Drinking			0.015	0.901
No	1,710 (83.46)	8,451 (83.28)		
Yes	309 (15.08)	1,540 (15.18)		

(Continued)

TABLE 1 (Continued)

Variables	Alone [*n* (%)]	Not alone [*n* (%)]	c^2	*P*
Missing	30 (1.46)	157 (1.55)		
Exercise			1.850	0.174
No	1,343 (65.54)	6,528 (64.33)		
Yes	669 (32.65)	3,489 (34.38)		
Missing	37 (1.81)	131 (1.29)		
Self-reported sleep status			24.893	<0.001
General	685 (33.43)	3,216 (31.69)		
Bad	367 (17.91)	1,458 (14.37)		
Good	997 (48.66)	5,474 (53.94)		
SRH			3.787	0.151
General	821 (40.07)	3,871 (38.15)		
Bad	277 (13.52)	1,328 (13.09)		
Good	951 (46.41)	4,946 (48.74)		
Missing	0	3 (0.03)		
Hypertension			0.802	0.371
No	1,029 (50.22)	5,210 (51.34)		
Yes	882 (43.05)	4,269 (42.07)		
Missing	138 (6.73)	669 (6.59)		
Heart disease			0.004	0.948
No	1,485 (72.47)	7,428 (73.20)		
Yes	343 (16.74)	1,723 (16.98)		
Missing	221 (10.79)	997 (9.82)		
Diabetes			4.909	0.027
No	1,644 (80.23)	8,069 (79.51)		
Yes	177 (8.64)	1,050 (10.35)		
Missing	228 (11.13)	1,029 (10.14)		
Stroke			8.195	0.004
No	1,642 (80.14)	7,998 (78.81)		
Yes	175 (8.54)	1,094 (10.78)		
Missing	232 (11.32)	1,056 (10.41)		

factors, whereas 44.67% was owing to factors involving living alone and not alone and other unobserved factors. To ensure the robustness Fairlie model, a multiple-impute model was established for supplementary analysis (supplement Table S1). Among the observed factors, specific elements played a remarkable role in explaining the differences in depressive symptoms ($p < 0.05$). These factors included marital status (20.55%), education level (4.63%), self-reported local income status (7.25%), self-reported sleep status (17.56%), and SRH (4.24%).

4. Discussion

This research delved into the relationship between specific factors (e.g., demographic characteristics, sociological characteristics, and health status) and depressive symptoms among older adults living alone and not alone in China. Additionally, the study quantified the degree to which these factors contributed to the discernible variations in depressive symptoms among older adults. This investigation substantiated the presence of remarkable differences in depressive symptoms between older adults living alone and those cohabitating in not-alone arrangements within China.

This study showed that the prevalence of depressive symptoms among Chinese older adults (age ≥ 65) was 11.92%. Notably, this prevalence was considerably lower than that reported in a meta-analysis which indicated a prevalence of approximately 23.6% for depressive symptoms among Chinese older adults aged over 60 (25). The prevalence was recorded to be higher among older adults living alone (15.76%) than among older adults living not alone (11.15%), which was aligned with the data acquired through prior

TABLE 2 **Alone vs. not alone older adults differential in depression symptoms and non-depressive symptoms by selected background characteristics.**

Variables	Non–depression symptoms			Depression symptoms		
	Alone [*n* (%)]	Not alone [*n* (%)]	*P*	Alone [*n* (%)]	Not alone [*n* (%)]	*P*
Age (years)			<0.001			<0.001
<70	103 (5.97)	1,181 (13.10)		23 (7.12)	121 (10.70)	
70–79	443 (25.67)	2,637 (29.24)		69 (21.36)	308 (27.23)	
80–89	646 (37.43)	2,320 (25.73)		135 (41.80)	298 (26.35)	
90–99	401 (23.23)	1,762 (19.54)		68 (21.05)	240 (21.22)	
^{3}100	133 (7.71)	1,117 (12.39)		28 (8.67)	164 (14.50)	
Residence			<0.001			<0.001
City	341 (19.76)	2,247 (24.92)		35 (10.84)	246 (21.75)	
Town	580 (33.60)	2,915 (32.33)		124 (38.39)	398 (35.19)	
Rural	805 (46.64)	3,855 (42.75)		164 (50.77)	487 (43.06)	
Sex			<0.001			0.055
Female	1,046 (60.60)	4,555 (50.52)		221 (68.42)	708 (62.60)	
Male	680 (39.40)	4,462 (49.48)		102 (31.58)	423 (37.40)	
BMI (kg/m^2)			0.274			0.137
18.5–23.9	883 (51.16)	4,463 (49.50)		165 (51.08)	527 (46.60)	
<18.5	239 (13.85)	1,205 (13.36)		67 (20.74)	209 (18.48)	
24.0–27.9	400 (23.17)	2,257 (25.03)		51 (15.79)	233 (20.60)	
^{3}28.0	156 (9.04)	746 (8.27)		30 (9.29)	82 (7.25)	
Missing	48 (2.78)	346 (3.84)		10 (3.10)	80 (7.07)	
Marital status			<0.001			<0.001
Married and living with a spouse	96 (5.56)	4,800 (53.23)		18 (5.57)	488 (43.15)	
Widowed	1,491 (86.38)	3,922 (43.50)		280 (86.69)	608 (53.76)	
Other	124 (7.18)	201 (2.23)		21 (6.50)	26 (2.30)	
Missing	15 (0.87)	94 (1.04)		4 (1.24)	9 (0.80)	
Education level			<0.001			0.005
0	747 (43.28)	3,198 (35.47)		166 (51.39)	543 (48.01)	
1–6	471 (27.29)	2,752 (30.52)		88 (27.24)	296 (26.17)	
^{3}7	233 (13.50)	1,834 (20.34)		23 (7.12)	161 (14.24)	
Missing	275 (15.93)	1,233 (13.67)		46 (14.24)	131 (11.58)	
Self-reported local income status			<0.001			0.017
Poor	180 (10.43)	646 (7.16)		97 (30.03)	260 (22.99)	
General	1,232 (71.38)	6,238 (69.18)		194 (60.06)	733 (64.81)	
Rich	288 (16.69)	2,068 (22.93)		27 (8.36)	129 (11.41)	
Missing	26 (1.51)	65 (0.72)		5 (1.55)	9 (0.80)	
Smoking			0.819			0.224
No	1,419 (82.21)	7,457 (82.70)		286 (88.54)	968 (85.59)	
Yes	287 (16.63)	1,484 (16.46)		34 (10.53)	147 (13.00)	
Missing	20 (1.16)	76 (0.84)		3 (0.93)	16 (1.41)	
Drinking			0.729			0.139
No	1,433 (83.02)	7,451 (82.63)		277 (85.76)	1,000 (88.42)	
Yes	268 (15.53)	1,429 (15.85)		41 (12.69)	111 (9.81)	

(Continued)

TABLE 2 (Continued)

Variables	Non–depression symptoms			Depression symptoms		
	Alone [*n* (%)]	Not alone [*n* (%)]	*P*	Alone [*n* (%)]	Not alone [*n* (%)]	*P*
Missing	25 (1.45)	137 (1.52)		5 (1.55)	20 (1.77)	
Exercise			0.267			0.609
No	1,105 (64.02)	5,674 (62.93)		238 (73.68)	854 (75.51)	
Yes	592 (34.30)	3,233 (35.85)		77 (23.84)	256 (22.63)	
Missing	29 (1.68)	110 (1.22)		8 (2.48)	21 (1.86)	
Self-reported sleep status			0.029			0.064
General	558 (32.33)	2,779 (30.82)		127 (39.32)	437 (38.64)	
Bad	219 (12.69)	995 (11.03)		148 (45.82)	463 (40.94)	
Good	949 (54.98)	5,243 (58.15)		48 (14.86)	231 (20.42)	
SRH			0.585			0.026
General	664 (38.47)	3,403 (37.74)		157 (48.61)	468 (41.38)	
Bad	157 (9.10)	889 (9.86)		120 (37.15)	439 (38.82)	
Good	905 (52.43)	4,723 (52.38)		46 (14.24)	223 (19.72)	
Missing	0	2 (0.02)		0	1 (0.09)	
Hypertension			0.571			0.603
No	884 (51.22)	4,682 (51.92)		145 (44.89)	528 (46.68)	
Yes	732 (42.41)	3,759 (41.69)		150 (46.44)	510 (45.09)	
Missing	110 (6.37)	576 (6.39)		28 (8.67)	93 (8.22)	
Heart disease			0.740			0.869
No	1,274 (73.81)	6,677 (74.05)		211 (65.33)	751 (66.40)	
Yes	274 (15.87)	1,471 (16.31)		69 (21.36)	252 (22.28)	
Missing	178 (10.31)	869 (9.64)		43 (13.31)	128 (11.32)	
Diabetes			0.075			0.061
No	1,397 (80.94)	7,233 (80.22)		247 (76.47)	836 (73.92)	
Yes	147 (8.52)	899 (9.97)		30 (9.29)	151 (13.35)	
Missing	182 (10.54)	885 (9.81)		46 (14.24)	144 (12.73)	
Stroke			0.080			<0.001
No	1,392 (80.65)	7,183 (79.66)		250 (77.40)	815 (72.06)	
Yes	151 (8.75)	916 (10.16)		24 (7.43)	178 (15.74)	
Missing	183 (10.60)	918 (10.18)		49 (15.17)	138 (12.20)	

investigation of depressive symptoms among older adults in China (26, 27). This is mainly because living alone makes it easier to experience social isolation, and cognitive decline, which are risk factors for depression according to previous research (28–30). Additionally, the 4.61%-point difference in the prevalence of depressive symptoms between alone and not alone suggested that medical personnel must pay attention to older adults living alone and provide them with more professional support to alleviate any anxiety or depression.

Our logistic regression analysis revealed further differences between the covariates of depressive symptoms in Chinese older adults living alone and not alone. Age, marital status, education level, self-reported local income status, exercise, self-reported sleep status, SRH, and diabetes were associated with the presence of depressive symptoms, similar to the findings of other researchers (6, 31). Specifically, older adults living not alone but widowed had more depressive symptoms because this group lives with their children's family and had negative interactions with family members because of the generation gap. In China, older adults are often required to care for their grandchildren, which leads to restrictions on social interactions (32). The group living not alone with shorter learning time had more depressive symptoms. This was likely because older adults with higher education time can find more ways to release their emotions and seek more ways like the Internet to treat depression symptoms, which was inconsistent with previous studies (33). Poor

TABLE 3 Results of the logistic model in older adults living alone and not alone in China.

Variables	Alone			Not alone		
	OR	95%CI	*P*	OR	95%CI	*P*
Age (years)						
<70	Reference			Reference		
70–79	0.352	0.171, 0.722	0.004	1.134	0.856, 1.504	0.380
80–89	0.482	0.240, 0.966	0.040	0.919	0.675, 1.253	0.594
90–99	0.420	0.198, 0.893	0.024	0.884	0.622, 1.257	0.492
^{3}100	0.441	0.177, 1.098	0.079	0.889	0.600, 1.319	0.559
Residence						
City	Reference			Reference		
Town	1.443	0.803, 2.593	0.220	0.908	0.706, 1.168	0.451
Rural	1.488	0.835, 2.653	0.177	0.802	0.626, 1.029	0.083
Sex						
Female	Reference			Reference		
Male	1.095	0.706, 1.699	0.686	0.968	0.788, 1.190	0.758
BMI (kg/m^2)						
18.5–23.9	Reference			Reference		
<18.5	1.335	0.829, 2.150	0.234	1.085	0.853, 1.381	0.505
24.0–27.9	0.729	0.453, 1.173	0.192	1.002	0.809, 1.241	0.985
^{3}28.0	0.976	0.523, 1.824	0.940	1.048	0.763, 1.439	0.774
Marital status						
Married and living with a spouse	Reference			Reference		
Widowed	0.777	0.374, 1.615	0.500	1.382	1.109, 1.720	0.004
Other	0.601	0.218, 1.651	0.323	1.084	0.596, 1.973	0.791
Education level						
0	Reference			Reference		
1–6	0.919	0.606, 1.393	0.690	0.814	0.658, 1.006	0.056
^{3}7	0.771	0.394, 1.508	0.447	0.639	0.477, 0.856	0.003
Self-reported local income status						
Poor	Reference			Reference		
General	0.582	0.374, 0.904	0.016	0.406	0.323, 0.511	<0.001
Rich	0.632	0.323, 1.237	0.181	0.319	0.234, 0.436	<0.001
Smoking						
No	Reference			Reference		
Yes	0.761	0.430, 1.349	0.350	0.943	0.718, 1.239	0.674
Drinking						
No	Reference			Reference		
Yes	0.900	0.517, 1.568	0.710	0.916	0.694, 1.210	0.536
Exercise						
No	Reference			Reference		
Yes	0.864	0.577, 1.294	0.478	0.687	0.563, 0.838	<0.001
Self-reported sleep status						
General	Reference			Reference		
Bad	2.613	1.762, 3.874	<0.001	2.462	2.015, 3.010	<0.001

(Continued)

TABLE 3 (Continued)

Variables	Alone			Not alone		
	OR	95%CI	*P*	OR	95%CI	*P*
Good	0.262	0.161, 0.425	<0.001	0.396	0.321, 0.489	<0.001
SRH						
General	Reference			Reference		
Bad	2.723	1.781, 4.161	<0.001	2.557	2.080, 3.143	<0.001
Good	0.297	0.186, 0.472	<0.001	0.524	0.423, 0.650	<0.001
Hypertension						
No	Reference			Reference		
Yes	1.311	0.909, 1.890	0.147	1.023	0.853, 1.227	0.806
Heart disease						
No	Reference			Reference		
Yes	1.046	0.664, 1.650	0.846	0.836	0.668, 1.045	0.115
Diabetes						
No	Reference			Reference		
Yes	0.960	0.523, 1.762	0.895	1.304	1.011, 1.682	0.041
Stroke						
No	Reference			Reference		
Yes	0.597	0.314, 1.135	0.116	1.190	0.927, 1.526	0.172

self-reported local income status would increase the risk of depressive symptoms, which can be attributed to the fact that older adults with lower income have lower life quality and limited access to treatment for depressive symptoms and other mental health issues (32, 34). The results indicated that lack of sleep was associated with more depressive symptoms in older adults, this was associated with cognitive decline which was confirmed to be prone to depression (35). SRH was based on subjective perceptions of their health, so Poor SRH means they were more dissatisfied with their health and found it difficult to actively participate in their lives (36). Additionally, incongruent with other findings (11, 37), the older adults living alone in this study were less likely to have depressive symptoms; however, the specific reasons for this require further investigation.

The results of the Fairlie model showed that this part of the difference was related to marital status (20.55%), education level (4.63%), self-reported local income status (7.25%), self-reported sleep status (17.56%), and SRH (4.24%). All factors were intervenable. If these intervening factors could be improved, the difference in depressive symptoms between Chinese older adults living alone and not alone could be reduced by about 55.33%. Thus, our study can provide targeted measures to reduce depression in older adults living alone according to the results of the Fairlie model. First, we should help older adults develop healthy lifestyles (i.e., regular exercise, and dietary patterns) while ensuring adequate sleep time and participation in social activities. Second, we should enhance protection for older adults living in poverty, especially in terms of health and other relevant aspects. Third, the government should pay attention to targeted older adults in need and encourage more young people to pay attention to the health of the targeted older adults through publicity, especially younger older adults who live alone, older adults who do not live alone but who have been widowed, and less educated older adults who do not live alone and in poverty. They should be offered an appropriate tilt in health insurance policies, and targeted assistance and aid programs should be formulated for them.

4.1. Limitations

This research was limited in certain respects. First, the definition of depressive symptoms was based on the CES-D-10 scale, which, although widely validated and boasting good reliability, remains reliant on self-reporting, thus introducing potential inaccuracies in contrast to medical diagnoses. Second, the domain of factors influencing depressive symptoms is multifaceted, and while this research encompassed a subset of indicators, other significant variables (such as polypharmacy, dementia, osteoporosis, osteoarthritis, etc.) might not have been accounted for. Last, the expansive older adult population of China poses a challenge, as the CLHLS dataset utilized in this study covers only a fraction of this demographic and therefore cannot fully cover the entirety of older adults within the country.

5. Conclusion

The study findings contribute novel insights into the distinctions between older adults living alone and those living not

TABLE 4 Fairlie decomposition of depressive symptoms disparity between older adults living alone and not alone in China.

Terms of decomposition	DS
Difference	0.04563494
Explained (%)	0.02524908 (55.33)
Non-explained (%)	0.02038586 (44.67)
Explained	

Contribution to difference	*β*	Contribution (%)	(95%CI)
Age	−0.0006219	−1.36	−0.0017896, 0.0005458
Residence	−0.0005276	−1.16	−0.0019317, 0.0008765
Sex	0.0010026	2.20	−0.0001522, 0.0021575
BMI	0.0000908	0.20	−0.0003855, 0.0005671
Marital status	0.0093795	20.55	0.0022295, 0.0165295
Education level	0.0021131	4.63	0.0005509, 0.0036753
Self-reported local income status	0.0033106	7.25	0.0020159, 0.0046053
Smoking	0.0001247	0.27	−0.0003726, 0.000622
Drinking	0.0000453	0.10	−0.0002045, 0.0002951
Self-reported sleep status	0.0080152	17.56	0.0065413, 0.0094892
Exercise	−0.0001395	−0.31	−0.0005734, 0.0002945
SRH	0.0019342	4.24	0.0011865, 0.002682
Hypertension	0.0003598	0.79	−0.0002153, 0.0009349
Heart disease	0.0003736	0.82	−0.0000976, 0.0008448
Diabetes	−0.0000075	−0.02	−0.0002759, 0.0002607
Stroke	−0.0003119	−0.68	−0.0006278, 0.0000040

alone within China. These results are poised to play a pivotal role in the refinement and establishment of mental health prevention and treatment policies targeted toward older adults in China. By accurately identifying the factors that influence living alone versus not alone conditions and their varying impacts on depressive symptoms, the groundwork is laid for the development of targeted and precise intervention strategies, aimed at enhancing the mental well-being of high-risk segments of the older adults. Ultimately, the problem of living alone and not alone differences in depressive symptoms will be effectively addressed.

Data availability statement

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

Ethics statement

The data for this study were taken from the CLHLS, which is organized by the Center for Healthy Aging and Development Studies at Peking University and has been approved by the Research Ethics Committees of Peking University and Duke University. The data analyzed here are available in the public domain, and therefore, separate ethical approval was not required for this study.

Author contributions

CH: Formal Analysis, Funding acquisition, Project administration, Writing – original draft. ZD: Conceptualization, Data curation, Formal Analysis, Writing – original draft. HL: Conceptualization, Methodology, Project administration, Supervision, Validation, Writing – original draft. SL: Conceptualization, Methodology, Project administration, Writing – review & editing. MD: Data curation, Investigation, Project administration, Writing – review & editing. TL: Conceptualization, Investigation, Methodology, Project administration, Writing – review & editing. LY: Data curation, Project administration, Supervision, Writing – review & editing.

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Conflict of interest

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

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1265834/full#supplementary-material

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Quality of life and associated factors in Swiss trans people: a cross-sectional study

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Background: Experiences of stressful life events during transition may have a negative impact on quality of life (QoL) in trans persons. Little attention has been paid to this population in Switzerland, resulting in sparse data on their QoL and associated social factors.

Methods: 30 participants were recruited during their medical transition treatment and surveyed on their experiences within this time period (13 months after the first medical intervention on average). After performing a diagnostic interview to evaluate their mental health, health-related QoL, psychological distress, self-esteem and the impact of life events that occurred in the last six months on participants were further assessed.

Results: Approximately 17% of participants had suffered from major depression, 43% reported having had suicidal thoughts or having attempted suicide, and 43% suffered from an anxiety disorder. Psychological distress was twice as high compared to the norm values of the cis population. With regard to QoL, trans individuals showed impairments in the mental domain. Stressful life events were particularly evident on a psychological and social level. Analysis showed a negative correlation between impact of life events and mental QoL and between psychological distress and mental QoL. At the same time, there was a positive correlation between self-esteem and mental QoL. Psychological distress and self-esteem emerged as independent significant predictors of mental QoL.

Conclusion: This study shows lowered mental QoL and associations of low mental QoL with psychological distress, low self-esteem and stressful life events in trans individuals in Switzerland. The findings concur with the Gender Minority Stress Model and point out that medical transition must not be viewed in isolation but must be embedded in the framework of integrative psychosocial support.

KEYWORDS

gender dysphoria, gender incongruence, LGBT, mental health, discrimination, minority stress, quality of life

Background

Trans persons are subject to stigmatization (discrimination, stereotyped expectations, rejection experiences) (1), which are based on socially embodied cis heteronormative assumptions (2, 3). According to a comparative European analysis, more than half of interviewed trans persons (55%) had been discriminated in the previous year because of their gender identity and 17% had experienced physical and/or sexual attack (4). Switzerland is no exception to this. The latest Swiss LGBTIQ+ Panel reported that surveyed trans people experienced discrimination in the past 12 months via structural discrimination (81%), jokes (80%) and physical violence (14.5%) (5). Furthermore, one fourth (25%) of interviewed trans people have not come out to friends at all and less than half (44%) have come out to most/all family member (5). In the same line, a national report showed a 20% rate of unemployment among trans people. This is highly increased compared to the cis[1] population (2–3%) and can be attributed to the risk of losing one's job at the start of social transition (6).

Members of a stigmatized minority are at higher risk for poor health outcomes, including depression, anxiety, substance use, and suicidality (7, 8). In the trans population, this can be seen in terms of poor mental health (3, 8) and low quality of life (QoL) (9). Specifically, meta-analysis data suggest that mental health-related QoL of trans people is significantly poorer compared to the general population, with a medium to large effect size (standard mean difference = 0.78) (10). Studies identified several factors which influence the QoL of trans populations in a positive way: the non-existence of psychopathological symptoms (11), the performance of a medical transition (12–14), and social support (15). However, not all studies could replicate these findings. For example, in a survey conducted with 143 Swiss trans people after medical transition, only preliminary associations between mental health-related QoL and completion of medical transition measures were established (16). The categories "gender" (male/ female/ non-binary) and "work situation" (as a proxy for status loss) emerged as significant factors. These results are consistent with findings from other studies highlighting effects of social factors (e.g., low income, unemployment, family support) on the QoL in trans persons (15, 17–19). With one exception, these studies did not explicitly investigate how social factors are linked to the stigmatized situation of the trans population in general, which is a significant research gap (19).

Estimates of prevalence of gender dysphoria ranges between 0.1–1.1% and similar values are expected for Switzerland (20). In 2022, the Swiss Federal Statistical Office counted 525 hospitalizations related to gender-affirming interventions concerning 486 trans individuals. Based on these numbers, clinicians in Switzerland expect that about 600 people start medical transition each year in Switzerland (21). However, these numbers should be taken with caution as not all trans individuals transition medically and an unknown portion underwent surgery abroad (22). In Switzerland, health care insurance is mandatory and most medical gender-affirming interventions carried out in Switzerland are covered by the insurances. The ICD-10 diagnosis of "transsexualism" (ICD-10: F64.0) is needed for access to medical measures.

To understand the QoL of this population in a more comprehensive way, the Gender Minority Stress model (GMSM) aims to explain mechanisms on how stigmatizing experiences affect the mental and physical health of the trans population (2, 23). Further, the GMSM does not only postulate direct and indirect ways in which stigmatizing processes can negatively affect the individual trans person. It also explains how certain protective factors such as self-esteem can develop a buffering effect on various negative bio-psycho-social outcomes (24). Systematic reviews and meta-analyses have provided first indications for the plausibility of the GMSM (25, 26).

In line with demands to understand the situation of trans people not only from an isolated medical or even psychiatric perspective, there is a need for studies that examine both QoL and the psycho-social situation concurrently in order to determine relevant relationships between these domains (16). Previous studies did not measure the correlation between stressful life events, intrapsychic resources and QoL using the framework of the GMSM. From a clinical standpoint, this omission is problematic as it fails to consider crucial sources of psychological suffering within the transgender population. Such information could ultimately improve understanding of trans people's needs and provide physicians and psychotherapists with guidance on intervention options to support trans people.

Objectives

The first purpose of this study was to assess the QoL of Swiss trans people during their transition with the hypothesis that participants will have a lower QoL compared to the general population (aim 1). Simultaneously, the study records participants' mental health status, psychological stress level and stressful situations they have experienced as members of a gender minority. We assume that, on average, they will report multiple mental health problems, numerous experiences of discrimination and few intrapersonal protection mechanisms (aim 2). Finally, the study analyzes the associations between QoL, mental health problems, psychological stress level, external stressors and intrapsychic ressources. Based on the GMSM, it can be assumed that both external experiences of discrimination and a lack of intrapsychic protection mechanisms will have a negative impact on the QoL of the respondents (aim 3).

Methods

Participants

Participants ($N = 30$) were recruited through the Department of Psychiatry and Psychotherapy of the University Hospital in

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[1] A person whose sense of personal identity and gender corresponds with their assigned sex at birth.

Abbreviations: DSM-IV, Diagnostic Manual of Mental Disorders IV; GMSM, Gender Minority Stress Model; GD, Gender dysphoria; ICD-10, International Classification of Diseases, 10th Revision; LGBTIQ+, Lesbian, Gay, Bisexual, Transgender, Intersex and Queer; M, Mean Value; MCS, Mental Component Summary; MINI-PLUS, Mini International Neuropsychiatric Interview plus; OSCE, Organization for Security and Cooperation in Europe; PCS, Physical Component Summary; QoL, Quality of Life; RSES, Rosenberg Self Esteem Scale; SCL-K-9, Symptom Checklist 9-K; SD, Standard Deviation; SF-36, 36-Item Short Form Health Survey; SRRS, Social Readjustment Rating Scale; SRS, Sex Reassignment Surgery.

Zurich, trans support groups, and informal peer networks. Participants were included if they had a diagnosis of Gender Dysphoria (GD) and were at least 18 years old. People with no knowledge of German were excluded from the study. Trans persons who were recruited by the psychiatric team ($N = 18$) needed no further diagnostic confirmation of the GD status. For the other 12 participants, a preliminary clinical interview confirmed the GD diagnosis. All participants showing symptoms of an acute psychotic episode or who had acute suicidal ideation were excluded from the study.

Data collection

Participants were screened as part of a larger project to study the psychological consequences of gender minority stress experienced by trans persons. After signing for informed consent, the participants were examined by means of a structured diagnostic interview. Subsequently, they completed a pencil and paper questionnaire. The interviews and survey were carried out between July and December 2013.

Instruments

Aim 1: QoL [short form (36) health survey (SF-36)]

To measure QoL the German version of the SF-36 was used (27). This self-assessment tool evaluates the health-related QoL in eight domains (vitality, physical functioning, bodily pain, general health perceptions, physical role limitations, emotional role limitations, social functioning, and mental health). The Physical Component Summary (PCS) and Mental Component Summary (MCS) are combinations of the eight scale scores listed above (28). For each subscale the scores range from 0 (worst possible health state) to 100 (best possible health state). Reliability alpha coefficients ranged from a low of $\alpha = 0.65$ to a high of $\alpha = 0.94$ across the different scales (Mdn = 0.85) in our sample.

Aim 2: Mental health diagnoses [Mini international neuropsychiatric interview plus (MINI-PLUS)]

The MINI-PLUS is a structured diagnostic interview (29), developed to facilitate the diagnosis of psychiatric patients according to DSM-IV (30) and ICD-10 (31) criteria in both clinical practice and research. It is organized into independent sections to optimize its sensitivity as a diagnostic tool. The MINI 6.0 comprises modules for 17 psychiatric diagnoses according to ICD-10. Questions are phrased to allow only "yes" or "no" answers and examples are provided to facilitate responses.

Aim 2: Psychological stress level [symptom checklist 9-K (SCL-K-9)]

Subjectively perceived overall psychological distress was measured with the German adaptation of the short version of the Symptom Checklist 90-R (SCL-K-9) (32). It consists of 9 items and measures only a general severity factor, where high values correspond to higher psychological distress. This instrument had a satisfactory Cronbach's alpha ($\alpha = 0.87$).

Aim 2: Externally induced stressors [social readjustment rating scale (SRRS)]

The Social Readjustment Rating Scale is a well-established instrument for quantifying the impact of stressful life events and measures the occurrence of 43 different socially burdening situations during the last six months (33). It assesses trans specific life events in addition to general ones. The German version of this questionnaire was used in this study to measure externally induced stressors (stressful life events). The higher the sum, the more stressful events a participant has experienced. In the absence of an instrument validated in German to record minority stress levels, this instrument was selected due to its excellent reliability in both healthy adults ($r = 0.96–0.89$) and patients ($r = 0.91$ to 0.70). The level of stress is classified as low (0–149), mild (150–199), moderate (200–299), or major (>300) according to the total scores of added items.

Aim 2: Intrapersonal protective factor [Rosenberg self esteem scale (RSES)]

Self-esteem was determined with the German version of the RSES, a widely used instrument to measure a person's global self-esteem with 10 questions to be answered on a four-point scale with responses ranging from strongly disagree (1) to strongly agree (4) (34). The scale assesses the degree to which respondents are satisfied with their lives as well as how good or bad participants feel about themselves. A lower score reflects good self-esteem. High reliabilities (Cronbach's alphas) have been reported for various samples that range from $\alpha = 0.77$ to $\alpha = 0.88$ (35).

Sociodemographic questionnaire

During the assessment, important sociodemographic and transition-related variables were collected. These included first experience of gender incongruence, first acceptance of their gender incongruence, changing of name and/or pronouns, start of hormonal therapy, and time since surgical interventions.

Data analysis and statistics

After performing a statistical analysis of the descriptive data (aim 1 and 2), bivariate correlations and regression analysis were used to analyze the association between each of the independent variables (impact of live events, self-esteem, and psychological distress) and the dependent variable (QoL) (aim 3). To identify statistically significant differences, a value of $p < 0.05$ was employed. All statistical analyses were performed using R Version 4.1.

Results

Descriptive statistics

Sociodemographic data

Regarding gender identities, 14 participants referred to their gender as "female," 11 as "male" and five as "other" (four participants were assigned female at birth, one participant was assigned male at birth) (see additional data). We will refer to participants as "trans feminine" and "trans masculine," instead of "trans women" and "trans men," respectively. This partition groups them better in terms of their

TABLE 1 State of transition.

	Trans population M ± SD	Trans feminine M ± SD	Trans masculine M ± SD	*p*
Social transition (age in years)				
First Experience	6.81 ± 3.48	7.47 ± 3.70	6.00 ± 3.13	0.301
First Acceptance	19.79 ± 12.75	22.27 ± 14.86	16.92 ± 9.58	0.447
Outing	29.04 ± 12.13	32.20 ± 13.81	25.38 ± 9.04	0.240
Medical Transition (months)				
Hormone Therapy	22.45 ± 16.13	19.49 ± 13.06	25.72 ± 19.14	0.557
SRS	36.37 ± 45.94	67.70 ± 90.58	23.85 ± 20.67	0.063
Additional Measures (N)	14	10	4	0.067

SRS: Sex Reassignment Surgery. The analysis of all variables was conducted with chi-square for qualitative data and Wilcoxon test for quantitative data (trans feminine vs. trans masculine).

TABLE 2 Quality of life.

	Trans population M±SD	Trans feminine M±SD	Trans masculine M±SD	*p*
Physical Component Summary (PCS)	54.40±6.39	54.07±6.08	54.74±6.88	0.903
Physical Functioning	93.83±9.80	93.67±9.54	94.00±10.39	0.894
Physical Role Limitations	85.83±25.16	83.33±27.82	88.33±22.89	0.663
Bodily Pain	82.77±19.33	83.73±20.42	81.80±18.83	0.741
General Health Perceptions	77.43±19.37	75.00±19.89	79.87±19.21	0.368
Mental Component Summary (MCS)	46.89±10.72	46.77±11.00	47.01±10.81	0.903
Vitality	55.83±19.21	55.67±21.20	56.00±17.75	0.967
Social Functioning	86.67±18.55	87.50±21.13	85.83±16.28	0.490
Emotional Role Limitations	78.89±32.14	80.00±30.34	77.78±34.88	0.962
Mental Health	70.67±18.77	69.07.56±20.92	72.27±16.93	0.692

The analysis of all variables was conducted with Wilcoxon test (trans feminine vs trans masculine).

undertaken medical interventions. In the final sample, the mean age of the 15 trans feminine and 15 trans masculine individuals was 34.6 ± 12.6 years. There was no significant difference between the two groups except for the circumstance that trans feminine subjects tend to live alone more often ($p = 0.020$). For all the sociodemographic categories, no significant difference was found between participants recruited by the psychiatric team and those recruited outside the clinic.

State of transition

Eight trans persons (four feminine/ four masculine) had exclusively undertaken social transition measures at the time of the study (Table 1). Nine trans feminine and six trans masculine persons were taking hormone therapy but had not performed surgical interventions yet. Finally, seven participants (two feminine/ five masculine) also had undergone surgeries. There were no statistically significant differences between the transition groups, as well as between participants recruited by the psychiatric team and those recruited outside the clinic. However, trans feminine persons (four individuals) were taking significantly more antidepressants than trans masculine persons (one individual).

Aim 1: Quality of life

Health-related quality of life (QoL) is a broad concept that focuses on physical, psychological and social aspects of the life conditions of a specific patient group. In this study, four somatic (physical functioning, physical role limitations, bodily pain, general health perceptions) and four mental (vitality, social functioning, emotional role functioning, and mental well-being) components of QoL are surveyed (Table 2). No statistically significant difference was found between the two gender groups concerning the QoL physical as well as mental health-related component summary scores of the SF-36. Similar results were found when comparing participants recruited outside the clinic to those recruited by the psychiatric team. Bullinger and Kirchberger (36) have assessed SF-36 values for a German speaking norm population. In comparison with the reported scores by trans individuals in this study, both standard values for physical component summary scores (PCS) in the feminine and masculine norm population were lower (feminine: M ± SD = 49.09 ± 10.6; masculine: M ± SD = 51.42 ± 9.62) compared to those of trans persons. This ratio was reversed for the mental component summary scores (MCS). Both the feminine (M ± SD = 50.71 ± 8.39) and the masculine (M ± SD = 52.44 ± 7.7) norm population showed higher values than the participants of the respective gender.

Aim 2: Mental health

No significant gender-specific differences were found concerning psychiatric diagnosis, even considering the two different recruitment patterns (Table 3). Out of five (16.67%) participants who had a major

TABLE 3 Psychiatric diagnoses.

	n (%)	Trans feminine	Trans masculine
Affective Disorders			
Previous Depression	1 (3.33%)	1	0
Melancholic Features	1 (3.33%)	1	0
Dysthymia	3 (10%)	1	2
Obsessive-Compulsive Disorder	0 (0%)	0	0
Anxiety Disorders			
Agoraphobia	5 (16.67%)	3	2
Social Phobia	3 (10%)	2	1
Generalized Anxiety Disorder	5 (16.67%)	3	2
Post-Traumatic Stress Disorder	0 (0%)	0	0
Psychoactive Substance Use Disorders			
Alcohol Abuse Disorder	0 (0%)	0	0
Alcohol Misuse Disorder	3 (10%)	1	2
Substance Abuse Disorder	1 (3.33%)	1	0
Earlier Psychotic Episode	1 (3.33%)	1	0
Somatoform Disorders			
Somatization Disorder	2 (6.67%)	0	2
Pain Disorder	2 (6.67%)	1	1
Attention Deficit Disorder	2 (6.67%)	0	2
Eating Disorders			
Anorexia nervosa	0 (0%)	0	0
Bulimia nervosa	0 (0%)	0	0

depression, four of them were trans feminine. In total, six trans feminine and seven trans masculine persons (43.33%) reported suicidal thoughts or had attempted suicide during their lifetime. Further, the highest prevalence was found for anxiety disorders (agoraphobia: 16%, social phobia 10%, generalized anxiety disorder 16%). The gender ratio for anxiety disorders was unbalanced with a higher percentage of trans feminine individuals (60%) affected compared to trans masculine individuals (40%). In total, 20 (66.67%) trans individuals had at least one psychiatric diagnosis, 17 (56.67%) at least two and 12 (40%) at least three. Regarding comorbidities, no significant gender difference was observed.

Aim 3: Psychological distress

Participants' values for the SCL-K-9 ranged from 0 to 22 (trans feminine: M ± SD = 8.20 ± 6.97; trans masculine M ± SD = 8.93 ± 6.95), without any statistically significant difference between genders (Wilcoxon test, $p = 0.724$). The values of the trans population were twice as high compared to the norm values of the cis population (cis feminine: M ± SD = 3.91 ± 4.95; cis masculine: M ± SD = 3.28 ± 4.53) (37).

Aim 2: Stressful life events

Life events burdened subjects in a different manner, with values ranging from 0 to 643, with participants already in therapy at the University Hospital Zurich having a slightly higher but not significantly different mean of burdening events (moderate vs. mild life stress: 203 vs. 150; $p = 0.267$) (see additional data). The Wilcoxon test showed also no statistically significant difference between trans feminine and trans masculine subjects for the sum of the SRRS ($p = 0.901$). In the last six months (i.e., during the timespan participants have been in social or/and medical transition), about 33% of participants had been subjected to "major business readjustment" and 30% had experienced a "major financial change." Simultaneously, 11 people had had a "major change in usual type and/or amount of recreation," while nine had had a change in personal habits such as quitting smoking. Concerning stress-related behaviors, 30% had gone through a modification of eating habits and 40% of sleeping habits. Approximately 43% reported a change in living conditions (i.e., a lot more or less food intake) and 30% changed residence.

Aim 2: Self-esteem

The maximum score in the RSES is 40, with a range from 11 to 30 in our participants and a mean value of 25.1 for trans feminine and 22.4 for trans masculine subjects and no significant difference between individuals; this was independent of whether participants were already followed by the psychiatric team or not. However, these numbers are much higher compared to those of the general population (M ± SD = 4.92 ± 0.82) found in literature (38). This suggests a much lower self-esteem in the trans population.

Aim 3: Bivariate analyses

Correlations between QoL (SF-36 and its subscales) and the dependent variables are listed in Table 4. Correlation analysis indicated that the impact of stressful life events (SRRS) has a significantly weak negative correlation with mental health subscales ($p < 0.05$). Further, besides physical functioning, all subscales of SF-36 were significant negatively associated with psychological distress (SCL-K-9). Significant positive correlations were reported between the mental subscales of SF-36 and self-esteem (RSES). Analyses showed a negative correlation between stress impact (SRRS) and mental health-related QoL (MCS) respectively between psychological distress (SCL-K-9) scores and MCS (Table 4). Conversely, a positive correlation between self-esteem (RSES) and MCS was found (note the reverted scale). No significant correlations were found for physical health-related QoL (PCS).

Aim 3: Regression analyses

Based on the outcomes of the bivariate analyses, the influence of the independent variables on mental health-related QoL (MCS) was assessed. Table 5 presents the results of the linear regression models to predict MCS. The three independent variables were entered using forward stepwise regression (see model 1–3). The analysis in model 2 showed an inverse association with psychological distress (SCL-K-9) and a positive association with self-esteem (RSES). Furthermore, the analysis in model 3 revealed that stressful life events (SRRS) did not provide significant additional information to predict MCS. The explained variance of the model was 78% (R-squared = 0.78).

Discussion

To our knowledge, this is the first study to examine the quality of life (QoL) (aim 1) and simultaneously the mental health status,

TABLE 4 Bivariate Correlations of the SF-36 and its Subscales (QoL) and related factors.

SF-36	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
SRRS	−0.15	−0.06	−0.56 **	−0.23	−0.33	−0.36	−0.28	−0.37 *	0.15	−0.48 **
SCL-K-9	−0.35	−0.49 **	−0.57 **	−0.52 **	−0.80 ***	−0.78 ***	−0.72 ***	−0.83 ***	−0.21	−0.82 ***
RSES	0.20	0.42 *	0.16	0.38 *	0.58 ***	0.50 **	0.67 ***	0.60 ***	−0.06	0.67 ***

The analysis of all variables was conducted using Spearman's correlation. SF-36: Short Form 36; PF = physical functioning, RP = role physical, BP = bodily pain, GH = general health, VT = vitality, SF = social functioning, RE = role emotional, MH = mental health, PCS: Physical Component Score, MCS: Mental Component Score; SCL-K-9: Symptom Checklist short version-9, SRRS: Social Readjustment Rating Scale2, RSES: Rosenberg Self Esteem Scale.
* indicates $p < 0.1$. ** indicates $p < 0.01$. *** indicates $p < 0.001$.

TABLE 5 Regression models for MCS.

	Beta	*SD*	*t-value*
Model 1: MCS ~ SCL			
SCL	−1.370	0.143	−9.617 ***
Model 2: MCS ~ SCL + RSES			
SCL	−1.152	0.182	−6.344 ***
RSES	0.421	0.231	1.824 *
Model 3: MCS ~ SCL + RSES + SRRS			
SCL	−1.184	0.216	−5.490 ***
RSES	0.403	0.243	1.658
SRRS	0.002	0.001	0.281

The analysis of all variables was conducted with linear regression models. MSC: Mental Health Score of SF-36: Short Form 36; SCL-K-9: Symptom Checklist short version-9; SRRS: Social Readjustment Rating Scale; RSES: Rosenberg Self Esteem Scale.
* indicates $p < 0.1$, *** indicates $p < 0.001$.

psychological stress level and stressful situations (aim 2) in Swiss trans people during their transition. A special focus was given on the impact of self-esteem and life events' impact on QoL (aim 3). As assumed, trans individuals showed below average mental health QoL levels. The results indicate that trans individuals are exposed to a high degree of psychological burden and that a large amount of trans persons have poor mental health with a large spectrum of variability and a high prevalence of psychiatric diagnoses. Furthermore, participants reported more stress, especially in social (job loss and moving in a new home) and psycho-somatic domains (change of eating and sleeping habits). Finally, the results suggest significant relationships between life events, self-esteem, psychological distress and QoL in transitioning individuals which is in concordance with the gender minority stress model (GMSM).

Low QoL during transition

Corresponding to an earlier study on Swiss trans persons, participants had a lower QoL compared to the cis population (16). However, while mental health-related QoL (MCS) of the trans feminine groups in both studies hardly differed from each other, our trans masculine group showed lower MCS values. This difference could be related to the differing participants' transition stages in both surveys. While this study included trans individuals who were in social and/or medical transition, Jellestad et al. examined a cohort of post-transitioned trans persons (16).

A comparison of our results with the QoL of people with serious medical condition shows that patients with very severe chronic obstructive pulmonary disease have a similarly poor mental health-related QoL (MCS: 47.7 ± 4.4) (39). Similarly, individuals suffering from multiple sclerosis without fatigue show a QoL (MCS: 46.6) on the same level as our cohort (40). In contrast, chronic pain patients, individuals suffering from schizophrenia and persons with obsessive-compulsive disorders have a lower MCS (M ± SD) (41–43). The interpretation of these data is not straightforward, because although many of the people studied had one or more psychiatric disorders, they were already undergoing transitional medical treatment, which can have a positive impact on both mental health and QoL. Nevertheless, the persistence of deficits in QoL suggests that the entire transition process may still pose a significant burden.

Multiple and diverse mental health issues and life stressors

The study population shows a high prevalence of depressive and especially anxiety disorders as well as self-damaging behaviors such as attempted suicide. These results correspond to the observations from foreign studies (44) and reflect the data from other research in Switzerland (45–48) where up to 45.2% of the participants suffered from mood disorders and up to 16.7% had previously had suicidal thoughts. Especially the amount of people (mostly trans feminine: 60%) affected by anxiety disorders (in particular, social phobia and generalized anxiety disorders) is alarming.

In our view, this high rate and type of anxiety disorders could be rather a result of the exposure to transition-related stigma than of a higher predisposition to anxiety disorders of the trans population. Due to the changes regarding appearance and perception during transition, trans individuals may be exposed to (more) stigmatization and may experience distress when staying in public space (19). As a result, they can internalize these messages in the sense of a "felt stigma" (48) and develop expectations about their own situation and consequently social avoidance behaviors. If one considers these symptoms in a decontextualized manner, as the MINI-PLUS does, then there is a risk that these understandable psychological defense reactions will be viewed as autonomous psychopathology. Consequently, a stigma aware psycho-diagnostic instrument would be needed to get more evidence regarding social phobia and generalized anxiety disorders for trans individuals.

Most of the stressors were recorded in the social sphere: trans persons are especially confronted with financial and housing problems and couple conflicts, which again shows that in some cases the transition sets off a complex dynamic of trans-negative exclusion that can lead to social withdrawal. Trans individuals with lower socioeconomic status may also more affected by housing problems and job loss than those with high socioeconomic status due to their lower financial reserves (15, 17–19). In addition, this effect may be amplified by the below average trans-protective laws in Switzerland compared to other OECD countries (49). A qualitative study carried out in parallel supports this supposition (50). Trans individuals reported that many of the events mentioned above were related to their social transition and that the consequences of certain life events are also reflected in the high rates of stress related behavioral changes (e. g. sleep and eating disturbances). Even if the life events' impact on participants was at most moderate (for trans people recruited in the hospital), it is comparable to that of patients who suffer from serious health problems such as ankylosing spondylitis (51) or schizophrenia (52).

Is there a connection between stressors and QoL?

A positive association was found between self-esteem and QoL (corresponding with the negative correlation between RSES and MCS due to the reversed scale of the RSES). As expected, the picture was reversed regarding the reported stress experiences and psychological distress: they were both negatively associated with QoL. These dynamics are also seen in other medical conditions, where elevated stress levels correlate with a poor QoL (53). There are also studies that show a negative correlation between distal stressors (e.g., stigmatization), proximal stressors (e.g., self-stigmatization) and mental health in trans persons (46). In this study, stressful life events and self-esteem are surrogates of distal and proximal stressors, respectively. Although these surrogates are not trans-specific, the circumstance that they were applied during the transition phase turns them to our opinion into feasible instruments to measure these stressors. Accordingly, our findings provide another indication of the validity of the GMSM.

In concordance with the correlation analyses, the regression analysis revealed that psychological distress and self-esteem are significant predictors of QoL, however, the stressful life events (SRRS) seem not due to a too weak statistical power. Furthermore, the regression analysis could confirm the interaction between the proximal stressors and QoL in view of the GMSM, but statistical power was also here too weak for the distal ones.

Limitations

Some limitations must be addressed. First, the small number of participants – even if greater than in past studies in Switzerland (45, 47) – limits the generalization of our results. Second, recruitment bias could have skewed the results as participants in hospitals tend to have more mental health problems and a lower QoL compared to the general trans population. This risk had been reduced by including participants outside the university clinic. However, the results showed no statistically significant difference between these groups. Third, in the absence of an instrument validated in German that could have measured the gender minority stress burden, a well-known instrument in stress research was chosen to directly measure the impact of distal live events. Although the participants associated many of the life events with their social transition, the utilization of the SRRS caused our data to also include a broad spectrum of negative situations and not only those generally faced by gender minorities. Therefore, a specialized tool with more selective parameters should be used in future studies. Finally, the cross-sectional nature of the study does not allow us to draw conclusions on the etiology of the phenomenon. Accordingly, a larger, prospective study would be needed to deepen our knowledge on the Swiss trans population. Thus, further research addressing this important question of the actual extent of the psychiatric burden on trans individuals is required.

Conclusion

Our results have shown a low QoL for trans individuals associated with low self-esteem and stressful life events. These demand that the transition process should not be considered a solely "medical" matter, but a multifactorial one including psychological, physical and social processes. Therefore, more systemic interventions (e.g., involvement of family members, school, employers) provided by the care system but also by peers are needed.

Moreover, our findings indicate a disproportionately high rate of anxiety disorders and depression in the cohort studied and point to the important role of self-esteem, stigmatization by self and others, and the impact that nonconformity with cis heteronormative norms can have. For these reasons, therapists should not focus on isolated gender incongruence symptoms. In contact with trans people, it is important to integrate the impact of the underlying stigma to which they are permanently exposed (54).

Data availability statement

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

Ethics statement

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

Author contributions

GF: data analysis and writing. LP: data analysis, writing, interpretation, and editing. TJ: supervision of data analysis. VS: supervision of the manuscript. RvK: supervision of the manuscript.

DGN: conceptualization, interpretation supervision, and writing of the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

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

Publisher's note

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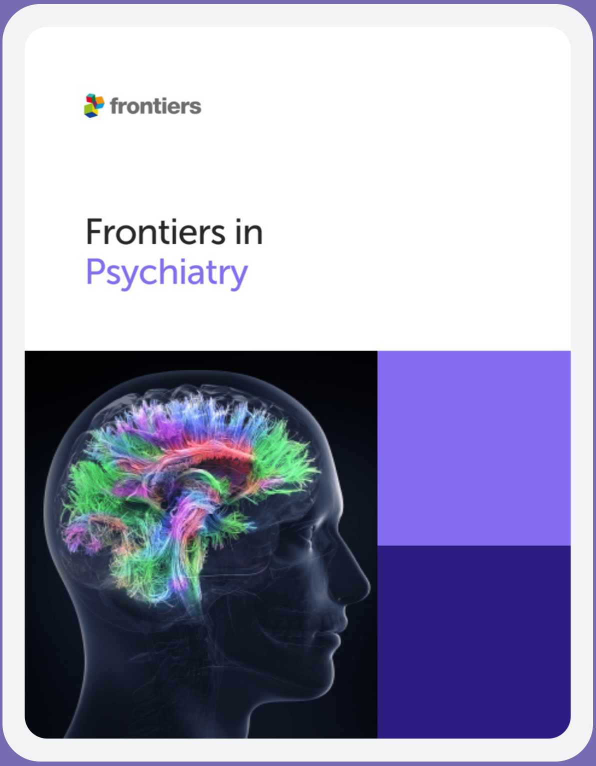

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