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Justice, diversity, equity and inclusion (J-DEI) in substance use & mental health research and practice

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Justice, diversity, equity and inclusion (J-DEI) in substance use & mental health research and practice

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Mental health and Multiracial/ethnic adults in the United States: a mixed methods participatory action investigation

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Introduction: Addressing gaps in the integration of justice, diversity, equity, and inclusion (J-DEI) in public health research and practice, this study investigates the mental health of Multiracial and multiethnic adults in the United States (U.S.). A rapidly growing racial/ethnic group in the U.S., Multiracial and multiethnic populations are often excluded or underrepresented in standard public health research and practice, and little is known about their mental health or associated risk and protective factors.

Methods: To investigate this knowledge gap, an electronic cross-sectional survey was conducted in two waves in 2022, pulling from various community sources, with 1,359 respondents in total. Complementing this, seventeen semi-structured interviews were performed with a subset of survey participants. Data were analyzed using a mix of statistical methods and staged hybrid inductive-deductive thematic analysis.

Results: Findings indicate over half of the participants endorsed at least one mental health concern with prevalence of anxiety, depression, post-traumatic stress disorder, and suicidal thoughts and behaviors surpassing available national estimates. Exposure to trauma, discrimination, and microaggressions were found to play a significant role in these outcomes. Conversely, strong social support and strong ethnic identity emerged as protective factors. Qualitative insights brought forward the challenges faced by individuals in navigating bias and stigma, especially in the context of mental health care. Despite these barriers, emerging themes highlighted resilience, the importance of secure identity formation, and the critical role of community and cultural support.

Conclusions: The marked prevalence of mental health concerns among Multiracial and multiethnic populations emphasizes the pressing need for tailored interventions and inclusive research methodologies. Recognizing and addressing the unique challenges faced by these communities is imperative in driving mental health equity in the U.S. The findings advocate for community-engaged practices, interdisciplinary collaborations, and the importance of addressing mental health challenges with cultural sensitivity, particularly in historically oppressed and marginalized groups. Future efforts must focus on refining these practices, ensuring that public health initiatives are genuinely inclusive and equitable.

KEYWORDS

mental health, public health, racial groups, diversity, equity, inclusion, protective factors, risk factors

1 Introduction

Until 2020, Multiracial and multiethnic people, or people who identify with two or more racial and/or ethnic groups, were thought to be a relatively small proportion of the United States (U.S.) population. Data on the health status of people with two or more races and/or ethnicities were infrequently reported in national data surveillance reports and scientific literature, and studies among Multiracial and/or multiethnic populations often included small samples with limited generalizability. However, information from the U.S. Census Bureau in 2020 illuminated a stark undercount of Multiracial people: following a slight change in question structure and coding procedures, the U.S. Census Bureau calculated a 276% increase in the population between 2010 and 2020 (1). While part of this increase is attributable to population growth, we can estimate the impact of this classification change on population estimates by using the American Community Survey (ACS) population estimates for 2019 and 2021: the 2019 ACS estimated people with two or more races to make up 3.5% of the population, versus 12.6% as estimated in 2021 (2). When comparing these two population estimates, we also see that the proportion of each generation that is Multiracial increased from 1.4 to 7.7% for Baby Boomers, 2.3 to 11.7% for Gen-X, 3.5 to 12.9% for Millennials, and 5.8 to 16.6% for Gen-Z (2). This is likely an undercount as the current approach has limited inclusion of people identifying as Hispanic/Latino, requires individuals to identify with available categories, and uses a measurement approach that has resulted in low estimates of the Multiracial and/or multiethnic population when compared to other approaches (3–6).

Such discrepancies in data representation do not merely skew demographics but, more alarmingly, they directly influence public health strategies, resource allocation, and interventions. The elimination, erasure, misclassification, and concealment of populations from public health data perpetuates structural racism and impacts progress toward health equity (7, 8). Before and throughout the COVID-19 pandemic, data have been used to drive decision making, allocate resources, and monitor health inequities. However, even after over 100 million documented cases and 1 million deaths, the Centers for Disease Control and Prevention (CDC) COVID-19 Data Tracker continues to exclude cases for people with multiple races (9). This results in Multiracial/ethnic populations remaining invisible and not receiving the attention and resource allocation from policies and programs that could reduce disparities and improve health and wellness.

The U.S. has a complicated history with Multiracialism. Examples such as the "one-drop rule," a legal classification system in the U.S. requiring anyone with a single ancestor with Black heritage to be classified as Black, and anti-miscegenation laws, which banned marriage and sometimes even intimate relations between people of different races, demonstrate the complex legal history for Multiracial and multiethnic communities within the U.S. There is additional complexity within U.S. military history, with notable examples from World War II and the Vietnam War of mixed-race children fathered by U.S. soldiers during military involvement overseas. Unfortunately, the very existence of Multiracial and multiethnic people continues to be challenged in the U.S. The sociopolitical decisions resulting in the many ways the U.S. Census Bureau has collected data on race/ethnicity are a clear example of systemic racism (10). Before the U.S. Census Bureau added the ability to select more than one race in the 2000 Census, there was much debate and controversy about the need, legality, or utility of quantifying the Multiracial population (11). Even more recently, although state laws banning miscegenation were deemed unconstitutional in 1967 by the Supreme Court decision Loving v. Virginia, a rise of social movements against miscegenation required the U.S. to pass a law providing federal protection for interracial marriages in 2022 (12). A historic event, the social context necessitating federal protections for interracial marriages gives some indication of the current environment.

Such chronic societal stresses can lead to "weathering," a phenomenon where individuals consistently coping with race-related stress experience detrimental health outcomes (13). Evidence suggests weathering is exacerbated among individuals belonging to fewer social groups and individuals with multiple structurally disempowered identities, while strong ethnic identity can serve as a protective factor (14–16). Research conducted before and during the COVID-19 pandemic has elucidated mental health disparities with more rapidly increasing rates of anxiety, depression, and suicidal thoughts and behaviors (STB) in historically marginalized groups (17–20). There has also been increased attention to the impact of adverse experiences, including trauma and discrimination, on health (21–23). Associations between minority stress and mental health have been well established for monoracial populations, yet are lacking for Multiracial and multiethnic populations (24–26). A 2023 article described the impacts of experiences unique to the Multiracial and multiethnic community, such as rejection from monoracial communities and "monoracism," or discrimination for being a member of multiple groups, and the importance of social support and multiethnic identity integration for this diverse population (27).

As we emerge from the acute phases of the COVID-19 pandemic, the U.S. is grappling with a mental health crisis (28). Unfortunately, data on the mental health status of Multiracial and multiethnic populations are rarely reported out in national or local public health surveillance efforts or in scientific research. During the COVID-19 pandemic, information from the Centers for Disease Control and Prevention's Household Pulse Survey provided critical data updates on the mental health status of the population: the racial group that combined people who identify as non-Hispanic and either "Other" or as "Multiple Races" consistently had the highest prevalence of symptoms of anxiety and/or depression compared to other racial groups for almost every time point (29). For example, in a recent round of data reporting (July 26–August 7, 2023), the prevalence of symptoms of anxiety disorder or depressive disorder was 43.3% (95% CI: 39.5–47.1) for respondents identifying as non-Hispanic, other races and multiple races; 36.7% (95% CI: 34.2–39.1) for Hispanic or Latino, 32.5% (95% CI: 30.2–34.8) for non-Hispanic Black, single race; 31.9% (95% CI: 31.1–32.6) for non-Hispanic White, single race; 23.2% (95% CI: 20.3–26.2) for non-Hispanic Asian, single race. However, combining "Other" and "Multiple Races" into a single category, paired with the known challenges with capturing racial and ethnic data, limits the utility of these data to drive public health action and resource allocation.

In recent years, several studies have suggested Multiracial and multiethnic people could have some of the highest rates of mental health concerns out of any other racial or ethnic group. Studies among adolescent and young adult populations identified Multiracial youth to have poorer mental health than monoracial youth (30–32). In August 2022, the Trevor Project released "The Mental Health and

Well-Being of Multiracial LGBTQ Youth," a report that found that Multiracial lesbian, gay, bisexual, transgender, queer or questioning (LGBTQ) youth reported more mental health challenges than monoracial peers (33). Several months later, the Substance Abuse and Mental Health Services Administration (SAMHSA) released data from the 2021 U.S. National Survey of Drug Use and Health (NSDUH) with detailed information by race and ethnicity. For what appears to be the first time, NSDUH provided specific data for Multiracial populations as compared to other racial and ethnic groups: Multiracial adolescents had the highest proportion of past year major depressive episode (27.2%) and Multiracial adults had the highest proportion of any mental illness (34.9%) and serious mental illness (8.2%) (34). These two reports provide concerning indications of mental health inequities experienced by Multiracial and multiethnic populations and provide concerning indications of the impacts of the absence of consistent, high quality, actionable public health data on mental health for Multiracial and multiethnic populations across the U.S., let alone for individual localities. Despite these data becoming available over recent months, these reports lack information on risk factors, protective assets, or unique health needs of this diverse community. Additionally, few studies have assessed mental health among older Multiracial and multiethnic adult populations and a 2019 review of studies from 1990 to 2009 highlights methodological challenges and inconsistency across studies, limiting comparability of results and understanding of the growing Multiracial population (4). With millions of federal dollars being allocated to address mental health in the U.S., the limited visibility of mental health among Multiracial and multiethnic populations could impact resource allocation; the SAMHSA Office of Behavioral Health Equity does not list "Multiracial" as a priority population (35, 36).

The increasing rate of mental health concerns among historically excluded and underrepresented groups, especially during and post-COVID-19 pandemic, and the unique stressors associated with being Multiracial and multiethnic, underline the imperative need to promote research centered around justice, diversity, equity, and inclusion (J-DEI) in mental health and substance use research. This is crucial, not only for the sake of accurate representation but for the well-being of a significant and growing segment of the U.S. population. For Multiracial and multiethnic people, mental health is complex and dynamic. Aspects of language, culture, and history influence mental health (37). Acculturation mismatch, intergenerational culture conflict, historical trauma, perceived discrimination, and racism are associated with adverse mental health outcomes that impact racial and ethnic groups in different ways (21, 38–41). A recent article highlights the unique experiences of discrimination, social exclusion, and ethnic identity formation experienced by Multiracial and multiethnic people (27). With the Multiracial and multiethnic demographic being the fastest-growing racial group in the U.S., there's an urgent requirement to understand the complexities of their mental health challenges (1).

The aims of this study are to (1) illuminate the mental health landscape of Multiracial and multiethnic adults in the U.S., emphasizing the disparities and unique challenges they face, (2) highlight the impact of data erasure, exclusion, and underrepresentation in public health systems, urging for more inclusive methodologies, and (3) advocate for a proactive shift in public health research and practice, integrating J-DEI principles, to bridge critical knowledge gaps and drive mental health equity.

2 Methods

2.1 Sample populations

The Johns Hopkins Bloomberg School of Public Health Institutional Review Board (IRB) approved this study (IRB Protocol 18,482). Two nonprobability-based convenience samples were obtained through an online anonymous survey collected from February to June 2022 (Sample A) or October 25 to December 6, 2022 (Sample B). Participants were eligible to participate in the study if they were 18 or older, lived in or were from the U.S., confirmed high level of ability in reading the English language, identified as Multiracial and/or multiethnic, and identified with two distinct categories from eight available options for racial/ethnic identity (White, Black or African American, Asian, Native Hawaiian or Pacific Islander, American Indian or Alaska Native, Middle Eastern or North African, Hispanic or Latino, Other). Respondents for Sample A were not compensated and were recruited through social media (Facebook, Reddit, Twitter, LinkedIn), organizations and groups supporting Multiracial and multiethnic people, public health listservs, and ResearchMatch. In an effort to achieve a larger sample size, respondents for Sample B were recruited from multiple market research panels facilitated by Qualtrics, which aims to mirror census representation, and compensated up to $9.50 (42). To participate in this anonymous study, non-identifying informed consent involved participants individually verifying they met each of the eligibility criteria, including being at least 18-years of age. They were then required to read the consent document, acknowledge that they read and understood it, and consent to participate in the study. A subset of participants from the cross-sectional studies were invited to participate in semi-structured interviews. Interviews were conducted via videoconference or audio call from December 2022 to January 2023 with adults 18 or older who identified as Multiracial and/or multiethnic, live in or are from the U.S., and endorsed at least one symptom of a mental health condition in the survey. Informed consent was obtained verbally. For participating in the qualitative interview, participants received a $25 Amazon gift card as a small token of appreciation. Participants were provided with contact information for both the study team and the IRB and were provided with information for crisis help lines at the beginning and end of the survey, within informed consent materials, and in each correspondence related to the interview.

2.2 Participatory action approach

These studies were conducted with the principles of participatory action research (PAR), a powerful approach to research and practice that serves to shift the power balance back to the populations of focus to inform action (43). Led by the community of focus, PAR systematically includes the population being researched at every level of research and results in a research design that utilizes community-responsive methods and analytic approaches, with action-oriented findings developed by and for the community (44–46). Led, guided, and championed by the community of study, participatory approaches can explore and address the cultural challenges of assessing mental health status within diverse populations. This is an essential public health activity as tools typically used to assess mental health status

may not translate properly with all cultures and PAR approaches provide the opportunity to integrate known and unknown cultural norms and practices within the study design (47). Studies have demonstrated the clinical utility of idioms of distress, which vary by culture and context and may not be widely recognized by healthcare providers (48). Assessing the mental health needs of multicultural individuals, who are known to adjust to different environments, presents additional challenges (49, 50). The American Public Health Association recommends the use of participatory approaches by leaders from the impacted community to achieve meaningful progress toward health equity (51). As examples for how the authors utilized PAR throughout this body of work, the lead author identifies as Multiracial and multiethnic and was joined by an advisory group of three individuals who identify as Multiracial and/or multiethnic that participated in developing the study design and final instruments. Qualitative data in were analyzed by two analysts who identify as Multiracial and/or multiethnic. Participants from the qualitative study were invited to review and provide comments on the preliminary findings; these recommendations were incorporated.

2.3 Definition of Multiracial and multiethnic

National standards for racial and ethnic data collection set by the federal government include five categories for race (American Indian or Alaska Native (AI/AN), Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White, Other) and two categories for ethnicity (Hispanic or Latino, not Hispanic or Latino) (52). To the authors' knowledge, most public health entities and scientific research studies do not incorporate Hispanic and Latino populations within their definition of Multiracial. As this study includes Hispanic and Latino populations as well as populations identifying as "Middle Eastern or North African," this study refers to the sample population broadly as Multiracial and/or multiethnic. Racial categories are socially constructed and have changed throughout history (53, 54). Scholars argue that these seven groups are distinct racial groups due to their uniquely racialized experiences, and this is reflected in the drafts for the updated 2030 census format, which no longer asks separately about Hispanic ethnicity but include all of seven groups in one question (53). Please note that this approach to gathering racial/ethnic background does not fully or adequately capture the rich diversity of the study population, nor the language used by each individual participant to describe their background.

2.4 Measures

Mental health symptoms were assessed using several instruments validated for self-reported symptoms of psychiatric conditions. Depressive symptoms were assessed using the 9-item Patient Health Questionnaire (PHQ-9), a validated tool based on the DSM-5 criteria, allowing clinicians to grade the severity of a patient's symptoms (55). Symptoms of anxiety were assessed using the 2-item General Anxiety Disorder Scale (GAD-2) (56). For each of the nine items of the PHQ-9 and the two items of the GAD-2, participants were asked to provide a response on a 4-item Likert Scale (0: Not at all, 1: Several Days, 2: More than half the days, 3: Nearly every day) how often they had been bothered by the item over the past weeks. Symptoms of post-traumatic stress disorder (PTSD) were assessed using both the Life Events Checklist for DSM-5 (LEC-5) and PTSD Checklist for DSM-5 (PCL-5), tools validated for self-assessments (57, 58). The LEC-5 is designed to assess exposure (personally experienced, witnessed, learned about it, exposed as part of one's job) to 16 potentially traumatic events over their lifetime. To be classified as having clinically significant symptoms of PTSD, a participant must have endorsed exposure to at least one item on the LEC-5. The PCL-5 is a 20-item instrument that asks participants to provide a response on a 5-item Likert Scale (0: Not at all, 2: A little bit, 3: Moderately, 4: Quite a bit, 5: Extremely) of how much the participant had been bothered by each problem in the past 30-days. History of suicidal thoughts and behaviors (STB) were assessed using five items from the National Survey on Drug Use and Health that ask the respondent to provide a response (Yes, No, Prefer Not to Say) if they had experienced each STB in the past 12 months (34).

To better understand the context of individuals participating in the study, the survey collected information on social support, stress, discrimination, harassment, and microaggressions. Self-reported stress was measured by the Perceived Stress Scale (PSS-4), a widely used, validated instrument for measuring non-specific perceived stress (59). Exposure to discrimination was measured through the two subscales of the Perceived Discrimination Scale to establish exposure to up to 11 types of Lifetime Discrimination and volume of exposure (maximum score of 36) to Daily Discrimination; this instrument has been previously tested among racially diverse populations (23, 60). Exposure to 45 different microaggressions was assessed using the Racial and Ethnic Microaggressions Scale (REMS), an instrument designed to measure these experiences among people of color (61). Perceived social support was assessed using the 12-item Multidimensional Scale of Perceived Social Support (MSPSS), a tool validated for use within a non-White population (62, 63).

Strength in ethnic identity was measured across three domains (exploration, resolution, affirmation) of the 17-item Ethnic Identity Scale (EIS) (64). Exploration had a maximum possible score of 28, resolution 16, and affirmation 24; higher scores indicated greater strength in each domain of ethnic identity. Multicultural identity integration was measured across three domains (categorization, compartmentalization, integration) of the 22-item Multicultural Identity Integration Scale (MULTIIS) (65). Categorization had a maximum possible score of 35; compartmentalization, 63; and integration, 56; higher scores indicated stronger configuration of each domain of multicultural identity. For example, higher scores in categorization and compartmentalization suggest a respondent endorses more separation of their cultural identities while higher scores in integration suggest a respondent endorses more blending of their cultural identities. The survey also collected demographic data on race and ethnicity, gender identity, sexual orientation, age, place of birth, educational attainment, and household income level.

A semi-structured interview guide was developed to explore attitudes and practices related to mental health, perceived barriers to achieving optimal mental wellness, concepts of resilience, and opportunities identified by the participants for improving mental health services for Multiracial communities. Intersectionality was explored to assess the added impact of colorism, gender, sexuality, age/generation, disability status, and socioeconomic status among Multiracial communities.

2.5 Strengths and limitations

This study has several strengths. One of the standout attributes is its utilization of diverse sampling methods to demonstrate the potential to rapidly assess the health status and needs of an underrepresented population. By employing both a social media-driven approach and one that mirrors the U.S. census, the research attempts to provide a holistic picture. Additionally, the inclusive approach taken by integrating Hispanic and Latino Multiracial and multiethnic populations offers an enriched perspective, broadening the scope of Multiracial categories. As the study utilized mental health instruments commonly used in clinical and community settings as diagnostic screening assessments and for psychiatric epidemiological research, we can compare our findings to national samples and other studies using these instruments. The adaptability of this study provides ample opportunity for public health practitioners to rapidly assess and respond to the unique needs of communities excluded/underrepresented by current infrastructure.

The study is not without limitations. Primarily, the cross-sectional nature of the research, which focused on English-speaking Multiracial and multiethnic adults with internet access, limits the generalizability of the results, comparability to monoracial groups, ability to establish temporality, and may not be reflective of the general population of Multiracial and multiethnic adults. As we included Hispanic and Latino Multiracial and multiethnic people in our study population, our results may have limited comparability to data that exclude Hispanic and Latino people from Multiracial categories. As the survey assessed mental health and took place following and during potentially traumatic global pandemics of COVID-19 and racialized violence, as well as mass social movements targeting minoritized communities, all known to have increased mental health concerns in the general population, the sample population may express a higher volume of mental health concerns than pre-pandemic times and has limited comparability to studies using data from prior decades. This study was not designed to assess differences over time. Additionally, a common challenge with mental health studies is the varying recall period. This study utilized the recall proposed by the instruments themselves and accepted a varying recall across mental health indicators ranging from 2 weeks to past year, and exposure to potentially traumatic and prejudice events ranging from daily to lifetime. Although selected instruments demonstrated reliability and validity within diverse populations, to the authors' knowledge few instruments have been psychometrically tested within Multiracial and multiethnic adult populations in the U.S. As the qualitative study was limited to participants of a previously administered cross-sectional study who endorsed at least one mental health symptom and agreed to participate in a follow-up interview via videoconference or phone, the results have limited generalizability to Multiracial and multiethnic adults as a whole. Subgroup analyses were dependent on the demographics of the participants of this phase of the study. Additionally, this study is limited to participants who are alive at the time of the study and does not capture the experiences of people who did not survive a behavioral health crisis.

2.6 Data analysis

Statistical analyses were performed using STATA/SE 17.0. Self-reported mental health status was assessed by computing the scores for each mental health outcome according to the instrument's guidelines. Severity was ascribed based on the results of the instrument. Endorsement of mental health conditions was established using cutoffs for clinically significant symptoms of anxiety (GAD-2 score $\geq$ 3), depression (PHQ-9 score $\geq$ 10), PTSD (exposure to at least one event on LEC-5 & PCL-5 score $\geq$ 33) or endorsement of any of the five measures for STB.

Respondents were categorized into racial and ethnic groups based on their self-reported racial and ethnic identity to assess differences within the Multiracial and multiethnic population. As this survey is for people who identify as Multiracial and multiethnic, ethnicity was incorporated with race as a component of multiethnic identity. Categories for Multiracial and multiethnic people with White and Non-White and Non-White racial/ethnic identities were developed to explore findings as compared to prior research, and to assess within-group differences (31). Differences by racial and ethnic heritage were further explored by categorizing the population into populations with any White, Black or African American, Asian, Native Hawaiian or Pacific Islander, American Indian or Alaska Native, Middle Eastern or North African, or Hispanic or Latino identity. Domains of exploration, affirmation, and resolution of the EIS and domains of categorization, compartmentalization, and integration of the MULTIIS were computed as continuous variables according to each instrument's guidelines.

Adverse experiences were constructed as linear variables. Potentially traumatic experiences, lifetime discrimination, and microaggressions were computed by calculating the number of different situations experienced. Everyday discrimination was computed by summing the total of the Likert scale responses for the Daily Discrimination subscale. The differences between the different coding approaches to establish exposure to prejudice events will not be discussed in this paper, but are worth noting for future research (66). Perceived stress was viewed both continuously and then tested as a binary variable with the cutoff $\geq$6 indicating high levels of stress based on recent population norms; there is no established cutoff for the PSS-4 (67).

Variables were constructed for age, gender identity, sexual orientation, socioeconomic status, and place of birth as potential confounders or effect modifiers. As Multiracial and multiethnic populations have increased over time and rates of depression and STB have increased in younger generations, a generational analysis was conducted to explore the differences between Gen Z (born after 1996), Millennials (born between 1981 and 1996), Gen X (born between 1965 and 1981), and Baby Boomers (born before 1965). Descriptive statistics were computed for each mental health outcome for the overall sample and by Multiracial and multiethnic classification, generation, gender identity, sexual orientation, educational attainment, language spoken at home, and income.

Following overall descriptive statistics, simple logistic regression models were tested to explore the association between mental health outcomes and Multiracial and multiethnic group status, demographic variables, potentially traumatic events, experiences of unfair treatment, strength in ethnic identity, and multiethnic identity integration. Following an exploratory bivariate analysis of each sample, multivariable analyses were developed for Sample B, which had a sufficient sample size (N = 1,012). Significant variables from the bivariate analysis for each individual mental health outcome were added into a multivariable regression model one at a time; model fit

was assessed using both AIC and BIC. The model with the best fit was retained.

Interview transcripts were analyzed using staged hybrid inductive-deductive thematic analysis using Dedoose (68). The research team created an initial codebook based on interview questions, which were based on the study questions of interest, *a priori* knowledge on the subject, and notes from the interviews. After three members of the study team piloted the codebook by coding two random transcripts from the first five interviews, the team met to discuss interpretation and adjust codes and definitions. Two members of the study team then double coded two transcripts and met to discuss any adjustments to the codebook. The final codebook was used by a primary coder who identified as Multiracial and multiethnic to code the remaining transcripts, which were reviewed by a secondary Multiracial/multiethnic coder. After coding was completed, the study team analyzed narratives using thematic analysis; common sentiments, domains, and themes were summarized and accompanied by illustrative quotes (Supplementary material S1). Subgroup analyses were conducted among subsets by racial and ethnic composition of the participants, gender identity, sexual orientation, and age. As part of the participatory approach, preliminary results were shared back with the interview participants; feedback was incorporated.

3 Results

3.1 Quantitative findings

Sample A ($n = 347$) was comprised of majority female-identifying (75.5%, $n = 259$), straight (63.5%, $n = 214$), and college graduates (71.7%, $n = 246$), with the majority reporting a household income of at least $60,000 (58.5%, $n = 203$). The majority of participants (71.1%, $n = 244$) were classified as having White & Non-White heritage, 28.9% ($n = 99$) were classified as having Non-White heritage. Almost over a quarter (28.0%, $n = 97$) of the sample reported having any Black or African American heritage, 37.2% ($n = 129$) any Hispanic or Latino heritage, 35.2% ($n = 122$) any Asian heritage, 13.0% ($n = 45$) any American Indian or Alaska Native heritage, 4.6% ($n = 16$) any Middle Eastern or North African heritage, 2.9% ($n = 10$) any Native Hawaiian or Pacific Islander heritage, and 21.3% ($n = 74$) heritage from another racial or ethnic group. About half (50.9%, $n = 173$) of participants were Millennials, 21.5% ($n = 73$) Gen-X, 16.2% ($n = 55$) Gen-Z, 11.2% ($n = 39$) Baby Boomers or prior generations (Table 1).

Sample B ($n = 1{,}012$) was comprised of majority female-identifying (67.5%, $n = 683$), straight (80.1%, $n = 798$), attained less than a college degree (62.3%, $n = 627$), and a household income less than $60,000 (57.4%, $n = 552$). The majority of participants (55%, $n = 557$) were classified as having White and Non-White heritage, 45.0% ($n = 455$) as having Non-White heritage. Almost half of respondents (48.2%, $n = 488$) reported any Black or African American heritage, 48.1% ($n = 487$) any Hispanic or Latino heritage, 16.3% ($n = 165$) any Asian heritage, 29.4% ($n = 298$) any American Indian or Alaska Native heritage, 8.5% ($n = 86$) any Native Hawaiian or Pacific Islander heritage, 8.1% ($n = 82$) any Middle Eastern or North African Heritage, 8.9% ($n = 90$) heritage from a racial or ethnic group not listed. Almost half (43%, $n = 435$) of respondents were born between the years 1981–1996 and classified as Millennials; 27.4% ($n = 277$) between 1965 and 1980, classified as Gen-X; 15% ($n = 152$) after 1997, classified as Gen-Z; and 14% between 1946 and 1964, classified as Baby Boomers. Less than 1% of the sample were born before 1946 (Table 1).

3.1.1 Exploratory analysis: mental health and social factors

More than half of each Sample A (57.1%, $n = 198$) and Sample B (58.0%, $n = 587$) endorsed one or more clinically significant mental health concerns. Respondents endorsed clinically significant symptoms of depression (A: 40.6%, B: 42.1%), anxiety (A: 41.5%, B: 40.5%), PTSD (A: 32.9%, B: 40.4%), and STB (A: 21.1%, B: 25.4%) including suicide attempt (A: 2.4%, B: 6.1%) (Figure 1).

Differences in the unadjusted odds of endorsing symptoms for one or more mental health condition between White/Non-White and Non-White Multiracial and multiethnic groups were found in Sample B, with Non-White having greater odds as compared to White/Non-White (OR = 1.37, $p = 0.015$). The difference between these broad groups was not significant in Sample A. Bivariate analyses for Sample A suggest that participants with American Indian or Alaska Native heritage had significantly greater odds of having any mental health condition as compared to those with no heritage from that group (OR = 2.60, $p = 0.009$). This was not found in Sample B; however, unadjusted analyses for Sample B suggest increased odds of endorsing one or more mental health concern for respondents with any Black or African American heritage as compared to those without any, and decreased odds for those with any White heritage (OR = 0.73, $p = 0.015$) (Table 1).

Both samples found significantly reduced odds of endorsing one or more mental health condition for college graduates (A: OR = 0.41, $p = 0.001$; B: OR = 0.68, $p = 0.003$) as compared to those with less than a 4-year degree. Sample B had significantly reduced odds for people with a household income $60,000 or greater (OR = 0.73, $p = 0.019$); although the difference was not significant for Sample A, the data suggested a similar trend. People born outside of the U.S. in Sample B had significantly reduced odds of endorsing one or more mental health condition (OR = 0.61, $p = 0.022$); this difference was not significant in Sample A (Table 1).

As compared to straight respondents, Sample B found significantly increased odds of endorsing one or more mental health condition for people who identify as lesbian or gay (OR = 2.61, $p = 0.001$) and both samples found significantly increased odds of endorsing one or more mental health condition for people who identify as bisexual or something else (A: OR = 1.73, $p = 0.025$; B: OR = 4.71, $p < 0.001$). As compared to people who identify as male, Sample A found significantly increased odds for people who identify as female (OR = 1.94, $p = 0.018$) and both samples found significantly increased odds for people who identify as transgender or gender expansive (A: OR = 4.96, p = 0.009; B: OR = 16.54, $p = 0.007$) (Table 1).

As compared to Baby Boomers, both samples found significantly increased odds for Gen-Z respondents (A: OR = 2.74, $p = 0.024$; B: OR = 13.26, $p < 0.001$); Sample B also found significantly increased odds for Gen X (OR = 3.19, $p < 0.001$) and Millennials (OR = 4.57, $p < 0.001$). Both samples found significantly increased odds for respondents endorsing greater levels of stress (A: OR = 7.92, $p < 0.001$;

TABLE 1 Survey population demographics and unadjusted odds of at least one mental health condition.

	Sample A	Any mental health condition			Sample B	Any mental health condition		
		57.1% (198)				58.0% (587)		
	N = 347	OR	95% CI	*p*-value	*N* = 1,012	OR	95% CI	*p*-value
Multiracial category								
White/Non-White	71.1% (244)	1.00			55.0% (557)	1.00		
Non-White	28.9% (99)	1.07	[0.67, 1.72]	0.784	45.0% (455)	1.37	[1.06, 1.76]	0.015
Racial and ethnic identity								
White	71.5% (248)	0.92	[0.57, 1.47]	0.717	55.0% (557)	0.73	[0.57, 0.94]	0.015
Black or African American	28.0% (97)	1.10	[0.68, 1.77]	0.690	48.2% (488)	1.36	[1.06, 1.75]	0.016
Hispanic or Latino	37.2% (129)	0.92	[0.59, 1.43]	0.718	48.1% (487)	1.27	[0.99, 1.63]	0.064
American Indian or Alaska Native	13.0% (45)	2.60	[1.27, 5.33]	0.009	29.4% (298)	0.93	[0.71, 1.22]	0.590
Asian	35.2% (122)	0.83	[0.53, 1.29]	0.412	16.3% (165)	0.82	[0.59, 1.15]	0.248
Native Hawaiian or Pacific Islander	2.9% (10)	1.78	[0.45, 7.02]	0.408	8.5% (86)	1.18	[0.75, 1.86]	0.477
Middle Eastern or North African	4.6% (16)	2.34	[0.74, 7.40]	0.148	8.1% (82)	1.02	[0.65, 1.62]	0.919
Other	21.3% (74)	0.92	[0.55, 1.54]	0.746	8.9% (90)	1.15	[0.74, 1.79]	0.532
Educational attainment								
Less than college graduate	28.3% (97)	1.00			62.3% (627)	1.00		
College graduate +	71.7% (246)	0.41	[0.24, 0.67]	0.001	37.7% (379)	0.68	[0.53, 0.88]	0.003
Household income								
Less than $60 K	36.2% (115)	1.00			57.4% (552)	1.00		
$60 K +	63.8% (203)	0.67	[0.42, 1.06]	0.088	42.6% (409)	0.73	[0.57, 0.95]	0.019
Place of birth, respondent								
In the United States	84.1% (290)	1.00			88.1% (892)	1.00		
Puerto Rico or Other U.S. Territory	1.7% (6)	3.79	[0.44,32.83]	0.227	1.9% (19)	0.95	[0.38, 2.38]	0.909
Outside of the United States	13.6% (47)	0.94	[0.50, 1.74]	0.840	9.3% (94)	0.61	[0.40, 0.93]	0.022
Sexual orientation								
Straight	63.5% (214)	1.00			80.1% (798)	1.00		
Gay or Lesbian	5.0% (17)	2.23	[0.76, 6.54]	0.145	6.2% (62)	2.61	[1.46, 4.69]	0.001
Bisexual or something else	31.5% (106)	1.73	[1.07, 2.80]	0.025	13.7% (136)	4.71	[2.92, 7.59]	<0.001
Gender identity								
Male	19.0% (65)	1.00			30.1% (303)	1.00		
Female	75.5% (259)	1.94	[1.12, 3.36]	0.018	67.9% (683)	1.25	[0.95, 1.63]	0.115
Transgender or gender expansive	5.5% (19)	4.96	[1.48,16.57]	0.009	2.0% (20)	16.54	[2.19,125.10]	0.007
Generation								
Gen Z—1997+	16.2% (55)	2.74	[1.14, 6.57]	0.024	15.0% (152)	13.26	[7.56,23.27]	<0.001
Millennials—1981–1996	50.9% (173)	1.83	[0.88, 3.81]	0.108	43.0% (435)	4.57	[3.00, 6.95]	<0.001
Gen X—1965–1980	21.5% (73)	1.71	[0.76, 3.85]	0.197	27.4% (277)	3.19	[2.05, 4.95]	<0.001
Baby Boomers—1946–1964	10.3% (35)	1.00			14.0% (142)	1.00		
Perceived stress								
Low or no stress	37.8% (131)	1.00			26.1% (264)	1.00		
High levels of stress	62.2% (216)	7.92	[4.84,12.95]	<0.001	73.9% (748)	14.70	[10.15,21.29]	<0.001

B: OR = 14.70, $p < 0.001$) as compared to those with lower levels of stress (Table 1).

Both survey populations were exposed to a high volume of potentially traumatic experiences in their lifetime (A:0.8.3, SD = 4.3; B: 8.2, SD = 4.9), lifetime discrimination (A: 3.1, SD = 2.9; B: 3.6, SD = 3.3), everyday discrimination (A: 12.8, SD = 9.6, B: 15.4, SD = 11.9), and microaggressions (A: 20.1, SD = 11.4, B: 25.4, SD = 13.9). The majority of respondents in both samples reported high levels of perceived social support (A: 71.0%, B: 53.7%). Both samples reported similar levels of ethnic identity exploration (A: 20.2, SD = 5.4; B: 20.9, SD = 5.3), affirmation (A: 22.0, SD = 3.0; B: 21.8, SD = 3.8), and resolution (A: 11.3, SD = 3.4; B: 13.2, SD = 2.9), as well as multicultural identity categorization (A: 16.1, SD = 8.2; B: 16.1, SD = 8.7), compartmentalization (A: 26.3, SD = 12.9; B: 26.2, SD = 13.3), and integration (A: 30.6, SD = 11.0; B: 36.5, SD = 11.1) (Table 2).

Both samples found that increased exposure to potentially traumatic experiences (A: OR = 1.06, $p = 0.016$; B: OR = 1.18, $p < 0.001$), lifetime discrimination (A: OR = 1.19, $p < 0.001$; B: OR = 1.30, $p < 0.001$), everyday discrimination (A: OR = 1.10, $p < 0.001$; B: OR = 1.08, $p < 0.001$), and microaggressions (A: OR = 1.04, $p < 0.001$; B: OR = 1.06, $p < 0.001$) increased the odds of endorsing symptoms of one or more mental health condition, while high levels of perceived social support reduced the odds (A: OR = 0.19, $p = 0.036$, B: OR = 0.11, $p < 0.001$) when compared to low levels of perceived social support. Both samples also found that greater affirmation of ethnic identity (A: OR = 0.86, $p = 0.001$; B: 0.85, $p < 0.001$) reduced the odds, while greater categorization (A: OR = 1.03, $p = 0.025$; B: OR = 1.03, $p < 0.001$) and compartmentalization (A: OR = 1.04, $p < 0.001$; B: OR = 1.03, $p < 0.001$) of multicultural identities increased the odds (Table 2).

3.1.2 Multivariable analysis: depression, anxiety, PTSD, and STB

Adjusting for age, educational attainment, sexual orientation, gender identity, potentially traumatic experiences, lifetime discrimination, microaggressions, perceived social support, and affirmation of ethnic identity,[1] analyses of Sample B suggest an increase in the odds of depression, anxiety, PTSD, and STB for each generation as compared to Baby Boomers. Gen-Z had the greatest odds of depression (OR = 9.00, $p < 0.001$), anxiety (OR = 12.12, $p < 001$), PTSD (OR = 5.53, $p < 0.001$), and STB (OR = 8.63, $p < 0.001$). The odds of having depression (OR = 2.12, $p = 0.001$), PTSD (OR = 2.13, $p = 0.002$) or STB (OR = 1.83, $p = 0.019$) were significantly greater for those with high school graduation or less compared to those with a college degree or higher. The odds of having depression (OR = 1.87, $p = 0.009$), anxiety (OR = 1.76, $p = 0.015$), or STB (OR = 1.88, $p = 0.009$) were significantly greater for respondents who identify as bisexual or something else as compared to straight. The odds of having STB were also elevated for respondents who identify as lesbian or gay (OR = 2.59, $p = 0.006$) as compared to straight (Table 3).

There was a dose–response relationship between the odds of having depression, anxiety, PTSD, or STB with each additional potentially traumatic experience and lifetime discriminating event. There was also a dose–response relationship between each additional microaggression experienced and the odds of depression, PTSD, and STB. Greater perceived social support was protective of mental health conditions, with significantly greater odds of having depression, anxiety, PTSD, or STB among those with low social support as compared to high social support. Greater affirmation of one's ethnic identity was associated with lower odds of having depression, PTSD, or STB. Odds ratios, 95% CIs, and p-values are available in Table 3. Models, AIC, and BIC are available in Appendix.

3.2 Qualitative findings

A total of 17 interviews were conducted and a codebook was developed to elucidate domains, themes, and subthemes (Supplementary material S1). Twelve of the Multiracial/multiethnic interviewees selected the racial/ethnic option for White; eight, Asian; seven, Black or African American; four, American Indian or Alaska Native; two, Hispanic or Latino. Eleven participants identified as female; four, male; two, gender expansive. Fourteen of the participants identified as straight and three as bisexual or another sexuality. Nine participants were Millennials; six, Gen X; one, Gen Z; and one, Baby Boomer.

3.2.1 Experiences of mental health during childhood

Participants recalled a general absence of support for mental health from their family and community while growing up. Common sentiments about mental health included denial, avoidance, criticism, stigma, and dismissal of mental health challenges. Many participants reflected on their childhood and recognized experiences as being related to mental health that were not previously acknowledged, even when the mental health issue experienced was quite severe. When experiencing a mental health challenge, some participants were told it was not real and to ignore it. Others were explicitly forbidden from seeking mental health care by their family. In other extreme circumstances, people recall family members being "thrown away" or isolated from the family until the mental health issue was able to be ignored. For people who grew up in more socioeconomically disadvantaged environments, there was a general understanding that there were more pressing issues, such as meeting basic needs.

> "Ignore it, avoid it, push it to the side, it will work itself out."

When discussing cultural perceptions of mental health, participants unveiled several culturally specific terminologies. Many of the terms had spiritual or possession connotations, such as "possessed by a demon," "being haunted," and "seeing or hearing spirit" while others denoted a sense of brokenness, like "broken head." There was a shared understanding among participants that employing such terms in a clinical setting could potentially lead to misunderstandings or adverse repercussions. Participants also shed light on various complementary mental health practices rooted in their cultures that were more positively received. These included seeking guidance from a traditional healer, the therapeutic act of journaling, and forging a deeper connection with nature.

1 Affirmation of ethnic identity worsened model fit for anxiety and was dropped from the model.

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TABLE 2 Survey population factors: potentially traumatic experiences, discrimination, social support, strength in ethnic identity and unadjusted odds of at least one mental health condition.

	Sample A	Any Mental health Condition			Sample B	Any Mental health Condition		
		57.1% (198)				58.0% (587)		
	N = 347	OR	95% CI	*p*-value	*N* = 1,012	OR	95% CI	*p*-value
PTEs, exposed	8.3 (4.3)	1.06	[1.01, 1.12]	0.016	8.2 (4.9)	1.18	[1.14, 1.21]	<0.001
PTEs, witnessed	2.7 (2.9)	1.00	[0.93, 1.08]	0.980	2.9 (3.3)	1.20	[1.14, 1.25]	<0.001
PTEs, experienced	3.9 (2.8)	1.18	[1.09, 1.29]	<0.001	4.0 (3.1)	1.24	[1.18, 1.30]	<0.001
Lifetime discrimination	3.1 (2.9)	1.19	[1.10, 1.30]	<0.001	3.6 (3.3)	1.30	[1.24, 1.37]	<0.001
Everyday discrimination	12.8 (9.6)	1.09	[1.06, 1.12]	<0.001	15.4 (11.9)	1.08	[1.06, 1.09]	<0.001
Microaggressions	20.1 (11.4)	1.04	[1.02, 1.07]	<0.001	25.4 (13.9)	1.06	[1.05, 1.07]	<0.001
Assumptions of inferiority	3.0 (3.1)	1.14	[1.06, 1.22]	0.001	4.5 (3.2)	1.22	[1.17, 1.27]	<0.001
Second-class citizen and assumption of criminality	1.8 (2.3)	1.16	[1.05, 1.28]	0.003	3.2 (2.8)	1.28	[1.22, 1.34]	<0.001
Microinvalidations	4.8 (3.3)	1.15	[1.07, 1.23]	<0.001	5.3 (3.1)	1.23	[1.17, 1.28]	<0.001
Exoticization and assumptions of similarity	4.2 (2.9)	1.17	[1.08, 1.27]	<0.001	5.1 (3.1)	1.26	[1.21, 1.32]	<0.001
Environmental microaggressions	4.9 (2.2)	0.94	[0.85, 1.04]	0.200	5.0 (2.3)	1.15	[1.09, 1.21]	<0.001
Workplace and school microaggressions	1.8 (1.9)	1.22	[1.08, 1.38]	0.001	2.4 (2.0)	1.41	[1.32, 1.51]	<0.001
Perceived social support								
Low	3.6% (12)	1.00			10.6% (107)	1.00		
Moderate	25.4% (86)	0.66	[0.13, 3.26]	0.610	35.8% (362)	0.38	[0.21, 0.69]	0.002
High	71.0% (240)	0.19	[0.04, 0.90]	0.036	53.7% (543)	0.11	[0.06, 0.21]	<0.001
Family								
Low	13.6% (46)	1.00			17.6% (178)	1.00		
Moderate	26.0% (88)	0.22	[0.08, 0.63]	0.004	32.1% (325)	0.54	[0.34, 0.85]	0.007
High	60.4% (204)	0.11	[0.04, 0.29]	<0.001	50.3% (509)	0.15	[0.10, 0.23]	<0.001
Friends								
Low	7.4% (25)	1.00			14.8% (150)	1.00		
Moderate	23.1% (78)	0.40	[0.13, 1.30]	0.129	36.7% (371)	0.37	[0.23, 0.59]	<0.001
High	69.5% (235)	0.20	[0.07, 0.60]	0.004	48.5% (491)	0.18	[0.11, 0.29]	<0.001
Significant other								
Low	3.8% (13)	1.00			9.0% (91)	1.00		
Moderate	13.6% (46)	0.65	[0.12, 3.45]	0.617	29.1% (294)	0.40	[0.21, 0.75]	0.005
High	82.5% (279)	0.20	[0.04, 0.93]	0.040	62.0% (627)	0.15	[0.08, 0.28]	<0.001
Ethnic identity scale								
Exploration	20.2 (5.4)	0.99	[0.95, 1.03]	0.647	20.9 (5.3)	1.00	[0.98, 1.02]	0.971
Affirmation	22.0 (3.0)	0.86	[0.79, 0.94]	0.001	21.8 (3.8)	0.85	[0.81, 0.89]	<0.001
Resolution	11.3 (3.4)	0.95	[0.89, 1.01]	0.097	13.2 (2.9)	0.92	[0.87, 0.96]	<0.001
Multiethnic identity integration scale								
Categorization	16.1 (8.2)	1.03	[1.00, 1.06]	0.025	16.1 (8.7)	1.03	[1.01, 1.04]	<0.001
Compartmentalization	26.3 (12.9)	1.04	[1.02, 1.06]	<0.001	26.2 (13.3)	1.03	[1.02, 1.04]	<0.001
Integration	30.6 (11.0)	0.99	[0.97, 1.01]	0.395	36.5 (11.1)	0.99	[0.98, 1.00]	0.089

TABLE 3 Adjusted odds of depression, anxiety, PTSD, or STB within a sample of multiracial/ethnic adults in the U.S.

	Depression, past 2 weeks			Anxiety, past 2 weeks			PTSD, past month			Suicidal thoughts and behaviors, past year			One or more mental health concern		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value	OR	95% CI	*p*-value	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Generation															
Gen Z—1997+	9.00	[4.62, 17.53]	<0.001	12.12	[5.97, 24.61]	<0.001	5.53	[2.83, 10.80]	<0.001	8.63	[3.58, 20.82]	<0.001	12.41	[6.18, 24.91]	<0.001
Millennials—1981–1996	3.56	[2.06, 6.16]	<0.001	5.53	[3.03, 10.07]	<0.001	2.67	[1.56, 4.58]	<0.001	4.15	[1.87, 9.24]	<0.001	4.04	[2.45, 6.66]	<0.001
Gen X—1965–1980	3.00	[1.70, 5.30]	<0.001	4.41	[2.37, 8.20]	<0.001	1.74	[0.99, 3.07]	0.056	2.78	[1.21, 6.37]	0.016	3.10	[1.85, 5.21]	<0.001
Baby Boomers-1946–1964	1.00			1.00			1.00			1.00			1.00		
Educational attainment															
High school graduate or less	2.12	[1.37, 3.29]	0.001	1.23	[0.80, 1.89]	0.356	2.13	[1.33, 3.39]	0.002	1.83	[1.11, 3.04]	0.019	1.83	[1.13, 2.95]	0.013
Some college	1.40	[0.99, 1.99]	0.058	1.06	[0.75, 1.51]	0.730	1.51	[1.04, 2.19]	0.031	1.40	[0.91, 2.15]	0.125	1.31	[0.92, 1.89]	0.138
College degree or higher	1.00			1.00			1.00			1.00			1.00		
Sexual orientation															
Straight	1.00			1.00			1.00			1.00			1.00		
Gay or Lesbian	1.05	[0.56, 1.99]	0.871	1.37	[0.73, 2.55]	0.328	0.84	[0.42, 1.68]	0.618	2.59	[1.32, 5.11]	0.006	1.29	[0.60, 2.75]	0.516
Bisexual or something else	1.87	[1.17, 2.99]	0.009	1.76	[1.12, 2.78]	0.015	1.55	[0.95, 2.50]	0.076	1.88	[1.17, 3.03]	0.009	1.91	[1.07, 3.40]	0.028
Gender identity															
Male	1.00			1.00			1.00			1.00			1.00		
Female	2.01	[1.41, 2.88]	<0.001	2.14	[1.50, 3.04]	<0.001	1.58	[1.09, 2.30]	0.016	1.26	[0.84, 1.89]	0.273	1.97	[1.36, 2.87]	<0.001
Transgender or gender expansive	4.95	[1.33, 18.43]	0.017	11.95	[2.33, 61.32]	0.003	46.08	[5.00,424.89]	0.001	2.88	[0.81, 10.24]	0.101	1.00		
Potentially traumatic experiences	1.08	[1.05, 1.12]	<0.001	1.09	[1.05, 1.12]	<0.001	1.16	[1.12, 1.21]	<0.001	1.07	[1.03, 1.12]	0.001	1.13	[1.09, 1.17]	<0.001
Lifetime discrimination	1.11	[1.04, 1.18]	0.002	1.14	[1.07, 1.21]	<0.001	1.13	[1.06, 1.21]	<0.001	1.08	[1.00, 1.16]	0.047	1.12	[1.04, 1.20]	0.003

(Continued)

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TABLE 3 (Continued)

	Depression, past 2 weeks			Anxiety, past 2 weeks			PTSD, past month			Suicidal thoughts and behaviors, past year			One or more mental health concern		
	OR	95% CI	*p*-value	OR	95% CI	*p*-value	OR	95% CI	*p*-value	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Microaggressions	1.01	[1.00, 1.03]	0.047	1.01	[1.00, 1.03]	0.133	1.02	[1.00, 1.04]	0.014	1.03	[1.01, 1.04]	0.005	1.02	[1.01, 1.04]	0.002
Perceived social support															
Low social support	1.00			1.00			1.00			1.00			1.00		
Moderate social support	0.41	[0.24, 0.71]	0.001	0.57	[0.33, 0.96]	0.033	0.51	[0.29, 0.89]	0.018	0.67	[0.38, 1.19]	0.171	0.31	[0.15, 0.64]	0.002
High social support	0.23	[0.13, 0.39]	<0.001	0.31	[0.18, 0.52]	<0.001	0.25	[0.15, 0.43]	<0.001	0.47	[0.27, 0.83]	0.009	0.14	[0.07, 0.28]	<0.001
Affirmation of ethnic identity	0.95	[0.91, 1.00]	0.032	*			0.95	[0.91, 0.99]	0.025	0.92	[0.88, 0.96]	<0.001	0.91	[0.86, 0.97]	0.001
Intercept	0.18	[0.05, 0.66]	0.010	0.04	[0.01, 0.09]	<0.001	0.12	[0.03, 0.46]	0.002	0.11	[0.02, 0.49]	0.004	0.98	[0.20, 4.87]	0.978

*Item excluded from model.

3.2.2 Experiences of mental health in more recent years

As adults, participants acknowledged the chasm that still exists between identifying the need for care and seeking help. Some participants came to the realization that experiences growing up may have been atypical or even harmful and contributed to internal turmoil. As adults who sought out mental wellness, participants reported concealing their mental health challenge from their family. For some, concealment aimed to avoid dialogue with family who still held stigmatizing beliefs. For others, concealment aimed to protect loved ones with untreated mental health issues.

> "There's no longer … it's not anything to be ashamed of, it's just this season if you're going through a mental health crisis, and there's plenty of services available. It's a really nice shift."

Participants reflected on the social changes in acceptance and normalization of mental health. Participants felt that people could now seek care and go to therapy, and that there are more processes and systems in place to support people going through a crisis. Participants reported working to overcome stigmatizing thoughts and beliefs they were raised with, while also recognizing their continued impacts. Participants reported seeking out communities of people with similar backgrounds and/or experiences to share resources and navigate the process of seeking wellness. However, there was a fear that new technology that allows police to access a person's medical history would result in increased police brutality, particularly for children of color.

3.2.3 Factors that impact mental health

Participants noted that fatigue, overworking, burden of responsibility, lack of support from one's family, criticism from loved ones, isolation, and dehumanizing experiences exacerbated mental health challenges. Participants reported experiences of rejection by their racial/ethnic groups, local community, and their own family resulting in a complicated, confusing, and often isolating experience. As participants reported difficulty finding a natural fit within any one group, they reported utilizing strategies such as masking and code-switching to fit in with other groups and cope with the absence of belonging. Participants identified these strategies as additional mental health stressors and, importantly, noted the resulting impact these strategies had on concealing symptoms of mental health concerns. For some, this resulted in missed and/or late-in-life diagnoses of mental health and developmental conditions. Participants with additional marginalized identities, including sexual minorities, gender expansive people, and women, reported additional layers of isolation, experiences of violence, and challenges seeking and receiving safe care. These aspects of their intersectional identities were elevated as a higher priority when seeking out care, with safety being a main concern.

> "An entire community can really be pushed to the brink by external stressors."

3.2.4 Experiences seeking out mental health support

Many participants experienced challenges trying to find support in recent years and reported having to go outside their local

community to find care. Financial barriers were unanimously cited by individuals who sought and received care. This was the case for those with public, private, and insufficient insurance coverage. Provider availability was another large barrier. For those who were limited by their geographic area, there were few providers and the waitlists for those providers were several years. Increases in coverage for virtual care from providers outside of the geographic area reduced this barrier, but people continued to encounter long wait lists. Individuals also reported the challenges of lapses in care or coverage, particularly while experiencing a mental health crisis and attempting to navigate the various systems to get healthy.

> "I am sometimes bound financially by the options afforded to me by my insurance provider.
>
> And, a lot of times those people are overbooked"

The difficult and frustrating care seeking process had negative impacts on participants' mental health and wellbeing. Participants also noted that finding a provider who could provide culturally appropriate care to be challenging, if not impossible, particularly for those living in less urban areas. Participants described a process that takes months or years to find an appropriate provider and having to begin the process again when they moved out of the city or state. Importantly, participants stressed the need to lower the barrier to entry for connecting to mental health care due to the absence of time, energy, or capacity to search for a provider that is available and affordable. Participants recommended that mental health providers provide additional information on their online profiles and sign up to appear on registries of providers serving diverse communities, and noted that they look specifically for providers whose profiles highlight the racial/ethnic background, gender identity, languages spoken, and sexuality of the provider; communities the provider has served and/or trained among; experiences with immigrants; explicit language highlighting that the provider is welcoming of LGBTQ+, neurodiverse, and disability community members.

> "I'm tired and I don't have the capacity all the time to just search and search forever."

3.2.5 Experiences with mental health providers

Many participants reported adverse experiences while receiving mental health care and identified the need to self-advocate. These adverse experiences included the application of inappropriate norms and standards, not feeling comfortable being open about harmful experiences perpetrated by the racial/ethnic group the provider is part of, being mishandled while experiencing a crisis, being completely excluded from the intake process, or being treated as "fascinating" by the provider. Participants also described experiences of the provider's own microaggressions and bias, describing experiences of the provider openly attempting to classify them, expressing anti-miscegenation, actively misinterpreting the person's words, and treating the person as less than human. For people with past traumatic experiences, experiences of being paired with a provider from a group that perpetrated the violence, or being put in a mixed group, was harmful. Participants with intersectional identities reported harmful experiences, with some comparing their past experiences to abusive relationships, experiencing fear of what the provider was writing down about them, having their experiences and realities dismissed, being given harmful advice, and even experiencing gaslighting by providers. As the social justice movement came back to the forefront over the past few years, participants noted experiences of providers performing social justice rather than providing culturally responsive care. For example, participants reported experiences where providers talked more about the J-DEI books they had read than apply knowledge from those books.

> "I'm thankful that I have a voice and I speak the things that are injustices."

Many participants had positive and beneficial experiences with mental health providers, while also noting that the negative experiences they encountered while finding the right provider. Experiences where a person was provided a care team that coordinated their services were seen as very positive, although infrequently experienced. For people who had been previously misdiagnosed or badly treated by mental health providers, a provider who included them in their assessment and care planning, while also acknowledging harm done to them, helped them to move forward. While many participants had positive sentiments about receiving care from a provider from their racial and/or ethnic community, few saw this as a possibility and fewer had worked with a provider sharing their racial or ethnic identity given the demographics of the provider population. Participants reported investing substantial time and effort in educating a provider on their cultural background, particularly the cumulative traumas experienced by Multiracial and multiethnic people. Participants reported sentiments of exhaustion and fatigue from having to bring providers up to speed and explain their existence in this world.

> "People who don't get what it means to have these
>
> accumulative traumas inflicted on us every day."

Participants expressed hope that finding a provider from their cultural community, or from any non-dominant community, would result in a more positive experience and less emotional labor. For those who had received care from a provider from a non-dominant community, the experience was typically recalled as quite positive. Providers who were from a similar community allowed a person to feel more at ease, not have to defend themselves, and not feel like the provider would automatically try to apply inappropriate norms and standards. Those with intersectional identities, particularly for participants who identified as queer, reported actively avoiding providers from their cultural community if that community was traditionally less accepting of queer identities. Others worried that the provider could have the same stigmatizing perspective they were raised. However, there was an overall desire to see more diversity among the provider population.

> "I feel a connection with this person, like, I feel like I don't have to spend the next 20 minutes explaining and articulating something that they probably wouldn't understand anyways."

3.2.6 Peer recommendations for multiracial and multiethnic people seeking wellness

Participants were asked to provide recommendations for members of the Multiracial/ethnic community who may be struggling with mental health. Participants' recommendations fell into three key categories: support, secure identity formation, and seeking care.

1. *"Know your support systems:"* Almost every participant recommended developing and leveraging chosen community and interpersonal supports. Participants reflected on the value of community support networks to access essential information, such as provider recommendations, online search criteria for providers, and registries of diverse providers. Participants described examples of these groups providing support for people with everyday experiences, experiences with mental health providers, unlearning stigmatizing beliefs, and general support navigating the world as a Multiracial and multiethnic person. Resources for and by people of color were cited as helpful. Participants also noted that there needs to be a crisis line by and for people of color to ensure the person is speaking to someone who can understand their experience. Participants also emphasized the need to differentiate between social support and social control, and to consider the validity of what is shared in online environments.
2. *"Be unwavering in who you are because society and the world at large will try to define you:"* Participants recognized the "tug of war" between cultural practices and beliefs and one's identity. Participants recommended a person work toward self-acceptance and secure identity formation. Participants also recommended identifying and retaining the helpful aspects of culture, such as forming community and being in nature, while working past the harmful aspects, such as stigma and criticism. Participants recommended exploring positive coping and emotional regulation practices, with examples including adequate rest, work-life balance, being in nature, finding a good hobby, breathing practices, physical activity, and finding online community.
3. *"Do not ignore it. Start working on it. Go to therapy. You're going to have different cultures that have told you different things, but it is not something that that you can ignore:"* Participants highlighted the need to reduce stigma of and normalize mental health. Therapy and finding someone to talk to was seen as beneficial. Participants noted that tools and strategies provided by therapists remain helpful during times they could not afford to see the provider. Participants advocated for trusting one's instincts on the fit of the provider, investing the time to find a provider that is a good fit, and increasing one's own knowledge of mental health. Participants noted the positive impact of educating themselves on their symptoms, diagnosis, and treatment options as well as known bias in the diagnostic classification systems. Given the challenges participants reported with the care-seeking process, participants recommended going back to support networks help curate and navigate the mental health landscape quickly. Participants also suggested the public health community increase the pool of culturally responsive providers for communities that experience greater stressors, such as poverty and food insecurity, and complementing this with school-based mental health education.

4 Discussion

This study provides crucial insights into the mental health status and experiences of Multiracial and multiethnic adults in the U.S., contributing to addressing significant gaps in our understanding of a population currently excluded and underrepresented in existing

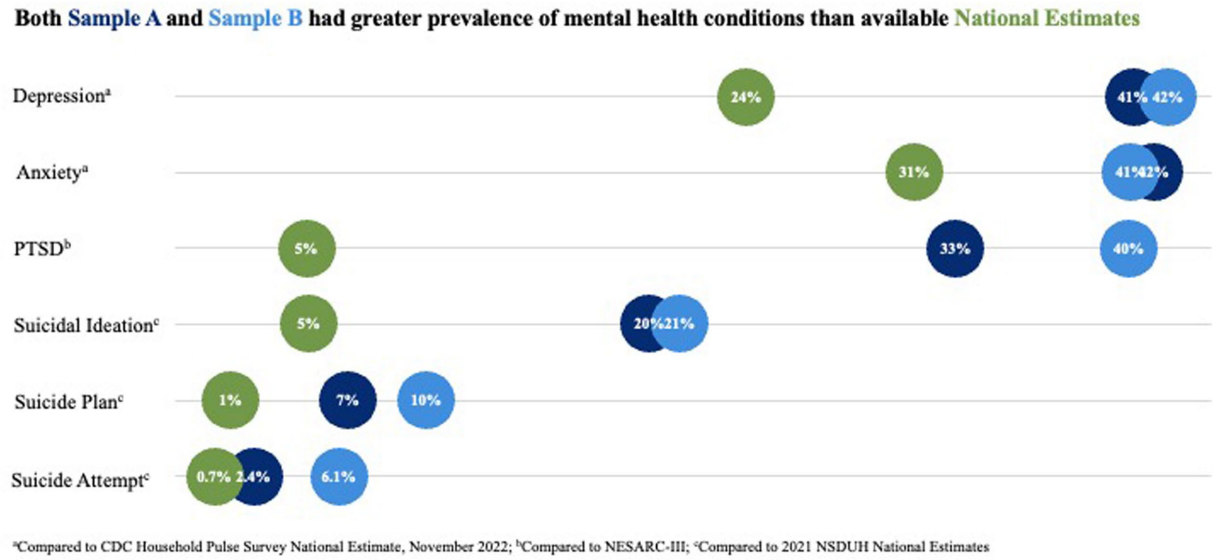

FIGURE 1
Both sample A and sample B had greater prevalence of mental health conditions than available national estimates. [a]Compared to CDC Household Pulse Survey National Estimates, November 2022. [b]Compared to NESARC-III. [c]Compared to 2021 NSDUH National Estimates.

public health data infrastructure. The results highlight an urgent need to re-consider the approach of the public health community to prioritize J-DEI, particularly concerning mental health and wellbeing of populations excluded and/or underrepresented in routine public health infrastructure and practice, by (1) acknowledging and addressing systemic exclusion/erasure/underrepresentation of populations in existing public health data and practice, (2) identifying and addressing community-specific barriers to accessing high quality behavioral health care, (3) ensuring behavioral health providers are capable of providing culturally-responsive care to Multiracial and multiethnic populations while diversifying the pool of available providers, and (4) investing in community-developed and-based supports and approaches to care.

4.1 Health inequities and systemic racism

The findings suggest a high burden of mental illness among Multiracial and multiethnic adults, made evident by higher rates of depression, anxiety, PTSD, and STB when compared to other racial or ethnic groups and national estimates.

Compared to data for the Multiracial population in the CDC Household Pulse Survey conducted online around a similar time frame (November 2–14, 2022), both samples had a higher prevalence of depressive symptoms (CDC: 31.9%) and similar prevalence of symptoms of anxiety (CDC: 42.5%) (29). The CDC Household Pulse Survey is a representative sample, uses an Adapted PHQ-2 and Adapted GAD-2, does not include ethnicity when assessing for Multiracial status, and combines "other" with "multiple races," which could explain some of these differences.

While PTSD is not a frequently collected population health metric in the U.S., the 2012–2013 National Epidemiologic Survey on Alcohol and Related Conditions III (NESARC-III) collected data for 12-month (4.7%) and lifetime (6.1%) PTSD (69). The proportion of Multiracial and multiethnic adults in our samples with clinically significant signs of PTSD in the prior 30-days is almost nine times greater and likely an underestimate of 12-month prevalence of PTSD in this sample. Studies assessing PTSD using NESARC-III data do not provide information for Multiracial or multiethnic adults; however, the highest prevalence found in the NESARC-III is among people identifying as American Indian or Alaska Native at 12.9%. The NESARC-III was conducted through face-to-face interviews more than 10 years ago, assessed PTSD using a narrow diagnostic definition tied to a specific potentially traumatic event, and assessed 12-month and lifetime PTSD; these methodological differences could explain some of the differences. Our larger study had a higher prevalence than the smaller study which could be partially explained by sampling processes, current events targeting Multiracial and multiethnic adults, multiple instances of racialized violence and violence against the LGBTQ+ community, and other potentially traumatic events happening in the U.S. during the study. As PTSD is not currently a routine health metric in the United States yet carries a high economic burden, we recommend public health practitioners consider including PTSD as a routine surveillance metric and that behavioral health clinicians incorporate trauma-responsive approaches, including PTSD screening tools, into their practice (70).

As with PTSD, the proportion of Multiracial and multiethnic adults from our two samples who had serious thoughts of suicide was more than four times greater and the proportion who had attempted suicide was almost nine times greater than national estimates from the 2021 NSDUH, which was predominantly Non-Hispanic White and found no significant racial or ethnic difference in STB (34). Our samples completed an anonymous online survey as compared to face-to-face household interviews which could partially explain the differences. As the U.S. is experiencing an increase in suicide rates among adolescents and some communities of color, these findings suggest behavioral health clinicians incorporate some element of screening for risk of suicide when working with Multiracial/ethnic clients (29).

The paucity of data on Multiracial and multiethnic populations within existing public health research, surveillance, and data infrastructure is indicative of systemic racism, perpetuating the exclusion, erasure, and marginalization of this growing population. The omission points to the dire need for comprehensive efforts to better understand and address the unique needs of Multiracial and multiethnic individuals, as well as other populations routinely excluded and/or underrepresented by existing structures, within the broader public health landscape. The increase in adjusted odds of depression, anxiety, PTSD, and STB with each subsequent generation following Baby Boomers is consistent with the existing literature describing worsening mental health among younger generations (71, 72). These findings, combined with the recent population estimates, highlight the urgency with which the public health community must adjust to include Multiracial and multiethnic populations.

4.2 Intersectionality and mental health

This study's findings highlight the value of an intersectional lens in public health research and practice, recognizing the way gender identity, sexuality, race, and ethnicity can intersect to create unique vulnerabilities and/or strengths. Consistent with prior literature (73), this study found people who identify as bisexual or another expansive sexuality to have the greatest adjusted odds of depression, anxiety, and STB when compared to straight respondents. This study also found female and gender expansive respondents to have greater adjusted odds of depression, anxiety, and PTSD when compared to males (see Table 3 for detailed statistics).

Younger generations are more fluid in terms of gender and sexuality than prior generations and are becoming progressively more Multiracial and multiethnic. Scientific research must apply a multidimensional intersectional lens and updated analytic approaches to routine surveillance and in-depth investigations to adequately capture the health status of intersectional Multiracial and multiethnic adults and inform public health programming. Notably, as sexuality and gender are understood to be more of a spectrum than a categorical construct, there is a need to re-consider the current methodological approaches to ensure inclusion of expansive identities. In order to promote mental health equity, we must commit to understanding the unique needs of our diverse populations, reduce structural factors that exacerbate weathering, and provide a culturally responsive and safe healthcare delivery system (74). As social conditions continue to exacerbate stressors for people with diverse intersectional identities, there is a clear role for the public health community to strengthen protective factors and mitigate stressors. As our society becomes more diverse and strives to promote health equity, it is paramount that our

research methodologies evolve to reflect this multifaceted reality. The results offer a call to action to not only recognize but also actively incorporate expansive identities in our research approaches.

Although not a focus of this study, we had a small number of transracial adoptees participate in this study, highlighting the complexity of identity for this population. We strongly recommend dedicated research into the health status of transracial adoptees given the increases in transracial adoption (75). We recommend that researchers be attentive racial disparities in the U.S.' child welfare system and ongoing discussions on the realities and impacts of international adoption (76–78). Additionally, given advances in fertility options resulting in differences between biological and birth parenting status, and differences between the racial and ethnic identities of birth parents and children, we recommend researchers consider capturing these data in future research.

4.3 Protective factors, coping, and community support

Ongoing, routine, updated public health data on the mental health status of Multiracial and multiethnic people with samples robust enough to identify inequities across crucial social factors is a fundamental step; understanding factors that exacerbate and protect the wellness of people identifying as Multiracial and multiethnic must follow. Despite facing regular prejudice events, often from their own families or racial/ethnic communities, Multiracial and multiethnic adults demonstrate a strong sense of community. This study illuminates the complex environment Multiracial and multiethnic people navigate while seeking optimal wellness, similar to other communities of color (21, 39–41). This study provides evidence to suggest the Multiracial and multiethnic community experiences impacts from weathering: respondents with higher levels of stress had increased odds of each mental health outcome and increases in categorization or compartmentalization of multiethnic identity, potentially traumatic events, lifetime discrimination, everyday discrimination, and microaggressions had a dose–response relationship with increased odds of having a depression, anxiety, PTSD, or STB. Due to regular experiences of rejection from social groups, Multiracial and multiethnic adults developed strategies such as masking and code-switching as a means of coping which serves to conceal symptoms of mental illness, delaying diagnosis and treatment. This suggests a need to adjust clinical approaches for this population, which requires further investigation.

This study also identified indications of a protective effect from integration of multiethnic identities on depression and anxiety, and perceived social support on depression, anxiety, PTSD, and STB. These findings are consistent with research conducted among monoracial communities of color, yet provide unique information of the challenges and value of Multiracial/ethnic populations embracing their multiple racial and ethnic identities (14–16). The importance of family and community in understanding and addressing mental health may be important cultural values for certain groups (40, 79, 80). Despite reporting experiences of rejection from predominantly monoracial groups, participants reported re-engagement as these groups have become more accepting. This study finds Multiracial and multiethnic adults to be welcoming and supportive of community members, ready to support people who have struggled or are currently struggling through similar experiences. Multiracial and multiethnic people also emphasized the importance and value of secure identity formation, which created opportunity for them to embrace and accept their racial, ethnic, and cultural identities. The support structures described by study participants emphasize the importance of identity, community, and belonging. As literature suggests belonging to social groups, strength in ethnic identity, and multicultural ethnic identity integration can serve to protect against mental health issues, investment of resources to support Multiracial and multiethnic communities develop and maintain these assets is recommended (14–16).

4.4 Access to behavioral healthcare

The challenges faced by Multiracial and multiethnic individuals in accessing adequate behavioral health care accentuate the pressing need to bolster our behavioral health workforce. This involves not just increasing numbers but ensuring providers are trained in delivering culturally responsive care. This includes ensuring screening tools and diagnostic approaches account for masking and code-switching commonly utilized by Multiracial and multiethnic individuals. The challenges expressed by participants in receiving needed care highlight the impact of the behavioral health shortage, and support efforts to urgently build the behavioral health provider pool (81). There is a clear unmet need for available affordable mental health care, and an opportunity to recruit the growing population of Multiracial and multiethnic youth into the field. The potential of online community forums and virtual care models holds promise for reaching this diverse population, offering avenues for culturally sensitive, accessible care.

4.5 Opportunities to include underrepresented/excluded populations in public health research and practice

This study's findings reveal the magnitude of the potential mental health burden and needs of Multiracial and multiethnic adults in the U.S. and demonstrate the importance of ensuring adequate representation of Multiracial and multiethnic populations in research and population surveys of mental health. As the U.S. reckons with the impact of racism as a public health crisis, the public health community must look inward at the systems and structures that serve to perpetuate inequities (82). As a complex arrangement or system of intentional and unintentional actions, structural racism is upheld by society through laws, social norms, and systems (83). This results in predictable patterns that allow public health workers to adjust for these patterns within surveillance, research, planning, and implementation.

4.5.1 Critically appraising standard tools and instruments for population-fit

This study demonstrates the importance of ensuring tools and instruments are adequate for measuring health status and key risk and protective factors and social constructs within populations of Multiracial and multiethnic people. As the field of psychiatric epidemiology conducts rigorous psychometric testing on standard screening and diagnostic instruments for major racial and ethnic

groups, this study highlights the importance of doing so for Multiracial and multiethnic populations. This must also be considered for tools designed to capture exposure to prejudice events and potentially traumatic experiences, as this study highlights the impact of exposure to these adverse experiences on the mental health of Multiracial and multiethnic adults. Furthermore, we strongly recommend the development of educational modules and clinical interventions specifically for Multiracial and multiethnic communities to both build the capacity of clinical, community and public health professionals to provide culturally responsive care for this growing population.

4.5.2 A need to advance standards, routine practices, and social constructs

As national standards result in quite broad categories, there have been increasing calls to disaggregate these larger racial and ethnic groups as within-group differences are often masked, limiting the ability of the public health community to adequately identify and respond to health inequities. Localities with larger populations of diverse communities have recently demonstrated the need for this disaggregation: New York City, a city of 8.8 million, released a series of reports documenting the health differences within groups of Latino, Black, and Asian populations (84–86). As another example, there are numerous data issues when it comes to American Indian/Alaska Native communities including poor data quality due to not disaggregating data, several definitions of who is American Indian or Alaska Native, being excluded from data collection altogether (termed "data genocide" or "asterisk nation"), and lack of understanding of the political status held by tribal citizens of tribal nations that is separate from race or ethnicity (7, 87). These reports highlight clear differences in health outcomes experienced within each racial and ethnic group; however, the health of individuals who identify with multiple racial and/or ethnic groups is often unknown or presented with unreliable estimates, if at all.

Analyzing race and ethnicity data within Multiracial and multiethnic populations is complex as there are no established standards and Multiracial and multiethnic individuals have complex racial and ethnic backgrounds that make classification a multi-step process (4). As with other larger racial groups, within group disaggregation is essential to better understand the mental health needs of Multiracial and multiethnic populations. While the larger study did detect a difference between White/Non-White and Non-White Multiracial and multiethnic respondents, with Non-White Multiracial and multiethnic respondents having greater odds of endorsing one or more mental health concern, it did not find any significant difference when stratifying by each individual health outcome. These findings do not support those of Miller et al. (31) that found White/Non-White to have more depression symptomatology than aggregated Multiracial and monoracial groups. However, our study populations vary substantially given Miller et al. used the National Longitudinal Adolescent to Adult study (18–25) from 2001 to 2003, over two decades ago, and compared each Multiracial group to all Multiracial people. Additionally, our study included any person who identified as Multiracial and/or multiethnic and did not exclude Hispanic/Latino people from the analysis. Our study's results by individual racial/ethnic group were inconclusive and warrant further investigation. For example, Sample A found significant differences for those identifying as American Indian or Alaska Native, which was not replicated in Sample B. While the two samples were collected in very different ways, and sample size for individual racial/ethnic groups limits our ability to adequately explore these findings, they do highlight the need for the field to go beyond exploratory research for this diverse and complex population and to ensure data can be disaggregated. Further research with current populations is needed to establish clinically and community meaningful classification procedures to standardize analyses, allow for comparability between studies, assess trends over time, and provide public health entities guidelines to implement routine public health surveillance within Multiracial and multiethnic populations.

4.5.3 Acknowledging and accounting for exclusion in public health

Limited data on "smaller" demographic groups is a common challenge in public health. Current national standards for demographic data collection are a limiting factor. Established in 1997 and last updated in 2000, the standards include five categories for race (American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White) and two categories for ethnicity (Hispanic or Latino, not Hispanic or Latino). Although current standards include the ability to select more than one race, actual practice does not ensure compliance with this standard and requires individuals and communities to self-classify themselves into existing groups that may be inadequate. These challenges have major implications, limiting the ability of the public health community to monitor and respond to unique health needs of Multiracial and multiethnic communities. Ensuring these standards evolve with changing populations to capture a sufficient spectrum of options can serve to affirm and respect the humanity and dignity of all people who have historically not been represented accurately and consistently in data.

As changing federal standards and public health data systems is a long process, there are ample opportunities for public health practitioners to assess, monitor, and address the health needs of their populations. This could include expanding the geographic reach of a study population, oversampling smaller populations, and working with organizations serving these excluded populations, to name a few. If population surveys are not able to oversample to have adequate coverage of Multiracial and multiethnic populations, there should be consideration given to the development of a representative survey on Multiracial and multiethnic mental health. As these recommendations require time and resources, this study leveraged PAR, convenience sampling, and mixed methods to explore the health status of a population in a way that could be easily and efficiently replicated by any public health team interested in better understanding the health status and needs of an underrepresented population to reduce delays and gaps in achieving health equity.

It is important to note that this study excluded people without high English reading levels or people unable to access an online survey. Language, literacy, and ability to access written text are critical structural barriers that limit inclusivity and have the potential to exacerbate health inequities. While this study relied on convenience samples and attempted to utilize a rapid PAR approach to highlight potential health inequities in an underrepresented/excluded population with minimal resources, it inherently excluded some of this population. As technology and virtual environments become more accessible and survey vendors adopt more inclusive recruitment strategies, there will be ample opportunities for researchers to conduct a similar study on a similar timeline with more inclusive approaches.

It is critical that the field advocate for and leverage these advancements as we work to reimagine our systems, practices, and approaches (88).

Data availability statement

The datasets presented in this article are not readily available because the participants of this study did not give written consent for their data to be shared publicly. With permission by the Johns Hopkins University IRB, an anonymized dataset from the quantitative study can be made available upon written request to the corresponding author. Due to the sensitive nature of the research, supporting data from the qualitative study are not available. Requests to access the datasets should be directed to JS, jshaff1@jhu.edu.

Ethics statement

The studies involving humans were approved by the Johns Hopkins University Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. Participants in the quantitative studies provided non-identifying written consent; participants in the qualitative study provided verbal consent.

Author contributions

JS: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Writing – original draft. XW: Data curation, Formal analysis, Writing – review & editing. JC: Formal analysis, Writing – review & editing. SB: Methodology, Writing – review & editing. HW: Conceptualization, Funding acquisition, Methodology, 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.2023.1286137/full#supplementary-material

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Racial and ethnic disparities in psychological care for individuals with FASD: a dis/ability studies and critical race theory perspective toward improving prevention, assessment/diagnosis, and intervention

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Fetal alcohol spectrum disorders (FASD) are among the most common neurodevelopmental disorders and substantially impact public health. FASD can affect people of all races and ethnicities; however, there are important racial and ethnic disparities in alcohol-exposed pregnancy prevention, assessment and diagnosis of FASD, and interventions to support individuals with FASD and their families. In this article we use the Dis/Ability Studies and Critical Race Theory (Dis/Crit) framework to structure the exploration of disparities and possible solutions within these three areas (prevention, diagnosis, intervention). Dis/Crit provides a guide to understanding the intersection of dis/ability and race, while framing both as social constructs. Following the Dis/Crit framework, the systemic, historical, and contemporary racism and ableism present in psychological care is further discussed. We aim to elucidate these racial and ethnic disparities within the fields of psychology and neuropsychology through the Dis/Crit framework and provide potential points of action to reduce these disparities.

KEYWORDS

fetal alcohol spectrum disorder, FASD, prenatal alcohol exposure, Dis/Crit, disparities, race, ethnicity

Introduction

Fetal alcohol spectrum disorders (FASD) are neurodevelopmental conditions associated with prenatal alcohol exposure (PAE). In the United States, FASD affect approximately 1.1–5% of school-aged children (1), making them among the most common neurodevelopmental disorders. Diagnostic criteria for FASD include neurobehavioral differences in the presence of PAE and may include subtle facial features and smaller growth in body and brain size in some

individuals (2, 3). Outcomes are variable in FASD; many risk and protective factors can influence functioning such as genetics, nutrition, receipt of services, and trauma/life stressors. Without adequate understanding and support, people with FASD are at higher risk for academic challenges (4), mental health conditions (5), housing and independent living issues, and trouble with the law (6, 7). FASD has a considerable public health impact (8) representing substantial societal and economic costs (9). Additionally, FASD are under-recognized and commonly misdiagnosed (10, 11).

Importantly, although FASD can affect people regardless of race, ethnicity, and socioeconomic status (SES), FASD is identified at higher rates in Native American, Black, and low-SES communities compared to White and middle/upper class communities (12). This pattern is the opposite in other neurodevelopmental disabilities such as attention-deficit/hyperactivity disorder (13, 14) and autism spectrum disorder (15, 16), with both diagnoses given to White individuals more frequently than Black, Indigenous, and People of Color (BIPOC) (13, 17). Greater attention to these disparities is needed within FASD and is relative to other neurodevelopmental disorders.

Dis/ability Studies and Critical Race Theory (Dis/Crit) provides a framework for understanding the intersections of race and dis/ability. We use the dis/ability notation instead of "disability" to disrupt the potentially harmful idea that some people cannot be successful within society's view of appropriate functioning due to not being "able" (18, 19). Dis/Crit frames racial and dis/ability identities as social constructs. This means there are no clear biological indicators distinguishing unique races or dis/abilities. Society defines the boundaries of what constitutes different race and dis/ability groups, which change over time and are shaped by current and historical power structures and values. Critical to Dis/Crit is an appreciation of the influence of intersecting identities and how societal responses to individual differences result in multiple marginalization (20). Further, Dis/Crit acknowledges how this double marginalization is maintained by systems of oppression in ways that exacerbate inequality and injustice for BIPOC communities (21). For example, Black and Native American children, while overrepresented in special education (22), experience significant delays in diagnosis (and underdiagnosis) of neurodevelopmental conditions (17, 23).

Neurodevelopmental conditions result from a complex interplay of biological risks, social-historical influences, and environmental factors (24, 25). Dis/Crit provides a framework for understanding how racial/ethnic disparities in prevention, assessment/diagnosis, and intervention for individuals with FASD stem from complex interactions between social determinants of health and structural racism disproportionately affecting BIPOC (26). These issues represent an urgent public health crisis. Here, we provide examples of such disparities, perspectives regarding their potential causes and conditions, and solutions to advance equitable, culturally-responsive, and evidence-based psychological and neuropsychological care of individuals with FASD (Figure 1).

Abbreviations: FASD, fetal alcohol spectrum disorder; PAE, prenatal alcohol exposure; Dis/Crit, Dis/ability Studies and Critical Race Theory; BIPOC, Black, Indigenous and People of Color; SES, Socio-economic Status; AEPs, alcohol-exposed pregnancies; AUD, alcohol use disorder; SUD, substance use disorder.

Our authorship team recognizes the importance of acknowledging our positionality. Our racial/ethnic backgrounds consist of individuals who are White, Black, Native American, and non-Hispanic. Multiple authors are also individuals with FASD. We acknowledge the power dynamics inherent in research, particularly within marginalized communities, and aim to approach this topic with cultural humility.

Racial and ethnic disparities in prenatal care, substance use disorder treatment, and evidence-based information

Mitigating racial/ethnic disparities in FASD necessitates an initial focus on the prevention of alcohol-exposed pregnancies (AEPs). Racial/ethnic differences in AEP are understudied and findings have been equivocal. Several studies suggest an increased risk of AEPs in racial/ethnic minorities (27–30) whereas others suggest White individuals are more likely to have an AEP (31, 32).

Aligning with the Dis/Crit framework, it is imperative to recognize and address historical and ongoing racially-biased practices contributing to a disproportionate incidence of AEPs among BIPOC communities on a global scale. Examples of this include intergenerational trauma in Indigenous communities (33–35) and practices such as the "dop system" in South Africa, originating during apartheid, whereby White farm owners used alcohol as a form of labor payment and social control of marginalized racial groups (36–38).

Significant racial/ethnic disparities are evident in prenatal care, receipt of evidence-based AEP information, and interventions for substance and alcohol use disorders (SUDs and AUDs). Importantly, historical and ongoing race-based and intergenerational trauma impacts multiple non-White and BIPOC communities including Black/African Americans, American Indians and Alaska Natives, and people of Jewish and Asian ancestry (39). This historical context contributes higher rates of stress and disproportionate access to resources for marginalized groups (40). The prenatal period is a pivotal juncture for preventing AEPs (41). BIPOC women are less likely than White women to receive prenatal care (42) and experience disparities in respect and autonomy within healthcare settings (43) potentially contributing to underutilization of services (44). Regarding receipt of evidence-based prenatal education, the literature is mixed. Some research has suggested Black women are less likely to receive evidence-based information regarding the negative impacts of AEPs compared to White women (45). However, recent data indicate BIPOC and low-SES women are *more* likely to receive comprehensive prenatal health education (including AEP information) than White and economically advantaged counterparts despite experiencing greater risks for adverse birth outcomes suggesting such prenatal health education is inadequately addressing these disparities (46). Moreover, significant gaps in receipt of mental health treatment exist for Black and Hispanic pregnant women with SUDs when compared to White women, even after controlling for education level, income, age, health insurance, and urbanicity (47). Pregnant BIPOC with AUDs are less likely to seek treatment, partially due to risk of victimization stemming from policies pertaining to AEPs (48–50). These policies may heighten the risk of criminalization among BIPOC women and reduce reporting for fear of losing their children or other punitive measures (50).

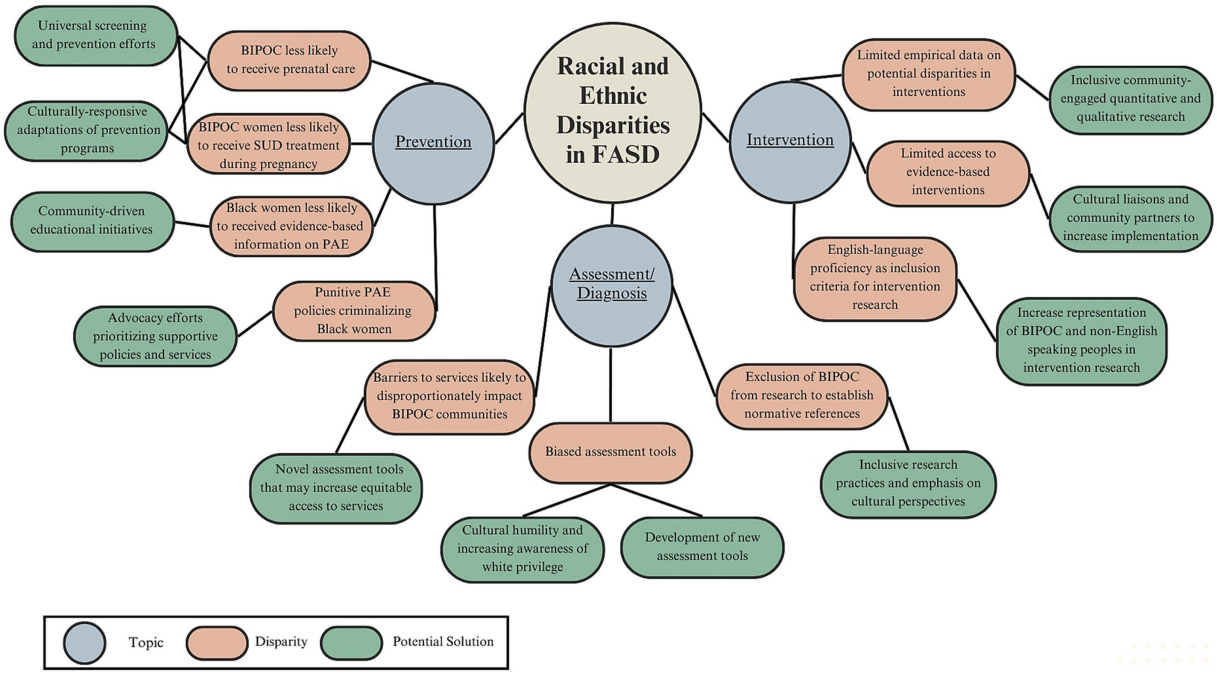

FIGURE 1
Graphical overview of racial and ethnic disparities in FASD within prevention, assessment/diagnosis, and interventions domains, and potential solutions.

Potential solutions

To reduce disparities in the receipt of evidence-based prenatal information and SUDs care, mental health providers can incorporate universal screening techniques, following the Screening, Brief Intervention, and Referral to Treatment (SBIRT) model (51). These efforts should include reflective and supervisory practice regarding racial/ethnic stereotyping potentially influencing disparities. Moreover, mental health practitioners can support open discussions about PAE by utilizing SAMHSA's guidelines to reduce stigmatizing language (52) while being mindful of their respective state's policies on AEPs and mandated child welfare reporting. Advocacy efforts should support policies prioritizing supportive over punitive actions for pregnant individuals who report an AEP. Efforts to reduce racial/ethnic disparities in AEPs should also involve tailored, culturally-responsive adaptations of prevention programs. Emphasis should be placed on collaboration with individuals with living experience (i.e., those with AEPs and BIPOC) as well as qualitative research methodology to understand experiences of intersectionality within systems of care. For example, Gonzales et al., emphasizes the importance of community-level healing practices (i.e., drumming, talking circles, and sharing practices related to pregnancy and parenting) to address racialized trauma as a key factor in contributing to AEPs in a Native American community (53). This underscores the need for culturally-informed, trauma-responsive training for mental health practitioners and those providing prenatal care. Finally, community-driven initiatives such as Proof Alliance's program "Our Children Are Sacred" (54), which disseminates information on AEPs while addressing the historical trauma and racism experienced by Indigenous communities, will be important.

Racial and ethnic disparities in assessment and diagnosis of FASD

The diagnostic process of FASD considers what is known about PAE; brain differences; smaller growth in height, weight, and head circumference; distinctive facial features (thin upper lip, smooth philtrum, short eye openings); and below average performance (i.e., 1.5–2 standard deviations below the mean depending on the diagnostic system) on norm-referenced neurocognitive and neurobehavioral measures (2, 55). Early diagnosis and intervention are crucial in supporting long-term functional outcomes (56, 57) and preventing adverse outcomes such as school disruption, mental health challenges, and trouble with the law, which have disproportionate consequences for BIPOC individuals. However, numerous barriers make early and accurate diagnosis a substantial hurdle for many individuals (58, 59). These barriers include a high cost of services, lack of healthcare access, lack of trained clinicians, the "hidden" nature of the condition for individuals who do not have facial and growth differences (25, 60), and stigma regarding AEPs (61–63). Such healthcare disparities disproportionately affect BIPOC, low-SES, and rural communities (64–66)—communities already at high risk for unequal access to prevention and early intervention. To our knowledge there are no empirical studies addressing potential ways in which race, dis/ability status, and other factors may contribute to healthcare inequalities for people with FASD and their families.

Psychologists and neuropsychologists play an important role in FASD diagnosis by collecting developmental histories, performing and interpreting neuropsychological assessments, and providing recommendations for services (67). The fields of psychology and neuropsychology have deep roots in structural racism. For example, many current cognitive performance assessments have been criticized

for contributing to racially-biased educational placement of BIPOC and low-SES students in special education (68, 69).

Importantly, BIPOC have been systematically excluded from research aimed at determining normative references of typical development, which likely contributes to inequality in rates of FASD diagnosis (12). Normative references for lip/philtrum ratings are available only for children of European, Black/African American, and South African mixed-race heritage (70, 71). Although the three cardinal facial features associated with PAE are present across racial/ethnic groups, threshold cutoffs for diagnosis vary by race/ethnicity (71–73). Clinicians often have to use their judgment to decide which racial guide to use for individuals whose race is not represented in existing guides. Similarly, available normative data for head circumference and palpebral fissure length (eye openings) is based on smaller samples predominantly composed of individuals of European heritage (74, 75). Moreover, factors such as stereotype threat can lead to underestimation of cognitive abilities in BIPOC (76, 77) suggesting they may be more likely to meet cutoffs used to quantify below average performance in FASD diagnostic systems.

Potential solutions

First, it is imperative that we strive to improve representation and normative data for the tools we use to inform assessment and diagnosis of individuals of diverse racial/ethnic backgrounds (25, 73). Moreover, factors such as cultural, linguistic, and SES background; quality of and access to educational opportunities; test familiarity; stereotype threat; and appropriateness of test norms should be thoughtfully considered as potential contributors to observed performance on neuropsychological assessment (78). Use of technologies such as digital and mobile health could also increase access to assessment and diagnosis for families in rural and under-resourced communities (79), although similar attention is needed to possible normative limitations and content biases. Efforts to reduce racial/ethnic disparities in assessment and diagnosis of FASD must also include a concerted effort to address the systemic racism and White privilege ingrained in medicine (80, 81). White psychologists/neuropsychologists must acknowledge the "invisible knapsack" of White privilege (82) and its potential role in engendering a rational mistrust of medical providers for BIPOC. Aligned with the Dis/Crit framework, researchers and clinicians should also consider how ableist language (e.g., "impairment," "deficit") as used in current FASD diagnostic systems may contribute to stigmatization as well as the intersectionality of receiving an FASD diagnosis and identifying as BIPOC (18). Additionally, centering research efforts on understanding cultural perspectives of FASD (83), perspectives of individuals with living experiences (84), and how the intersection of race and dis/ability may further affect access to systems of care will be crucial to ensuring research outcomes are valuable to and address the priorities of the FASD community.

Disparities in neurodevelopmental and behavioral interventions for people with FASD

Despite a considerably high prevalence, few interventions have been developed to support symptoms of FASD, and a majority of existing interventions have not yet progressed to active community implementation. A comprehensive review of the literature on interventions for FASD is beyond the scope of this paper (85, 86). To our knowledge, empirical studies on potential racial and ethnic disparities in interventions for FASD have not been published despite clear evidence for such disparities in neurodevelopmental disability literature more broadly (87–89). However, it is critical to acknowledge FASD intervention research and clinical services are rooted in the tradition of Western medicine, with limited access to services globally (85). Furthermore, numerous barriers impede evidence-based intervention for FASD across diverse cultures, including absence of local programs, housing of interventions in universities/medical centers who historically mistreated and oppressed BIPOC individuals, and failure of existing interventions to address individual differences at the intersection of dis/ability and culture (90).

A majority of interventions for FASD have been developed in North America (86) and many require English language proficiency as an inclusion criterion. While not specific to FASD intervention research, others have noted an increasing trend of English language requirements in behavioral clinical trials broadly (91). This constitutes a major limitation of current intervention research in the field of FASD likely to disproportionately affect BIPOC, non-English speaking, and bi/multilingual individuals and is likely to reduce the generalizability of intervention research. Many existing interventions are also caregiver-driven, which may hinder access for single-parent households or parents with multiple jobs.

Potential solutions

The inclusion of BIPOC and those with living experiences of FASD is crucial to community-engaged and inclusive intervention research (92). The use of qualitative methodologies to understand intersecting experiences of race and dis/ability in their entirety should be a first step in addressing disparities. Consistent with the Dis/Crit framework, it is imperative to include perspectives of individuals at the intersection of dis/ability and BIPOC identities as there are increased health disparities and unique experiences within systems for those holding such intersecting identities (93). Research advisory boards and community-based participatory research can be invaluable in ensuring the voices of community members are incorporated into ongoing research efforts (94–96). To highlight the need for community-engaged research, the annual meeting of the Fetal Alcohol Spectrum Disorder Study Group in 2022 featured a panel discussion including two adults with living experiences of FASD ("Nothing about us without us") (97). A detailed qualitative analysis of best practices for community-engaged research with adults with FASD is currently under development (98).

Researchers should consider ways in which new interventions can be developed and implemented in partnership with communities to be person-centered, culturally-appropriate, and accessible in a variety of languages (85). Diverse and representative research teams that include BIPOC, individuals with FASD, and BIPOC individuals with FASD may also bridge these partnerships and provide valuable perspectives. Beyond community partnership, researchers should focus intervention outcomes on community members' specific priorities and consider the complex ways race and cultural identities may intersect with such priorities. Cultural liaisons (e.g., trained interventionists/providers who are culturally-affiliated) may also be consulted to assist with implementing interventions and addressing

cultural differences (90). Additionally, mobile health initiatives such as the Families Moving Forward Connect app and the My Health Coach app for adults with FASD (99–101), which focus on supporting parents and adults in managing health needs for individuals with FASD, may increase access to evidence-based information and facilitate community support networks. Careful research is planned to determine whether cultural adaptations would be beneficial. Lastly, strategies to increase BIPOC representation in research such as building community trust, employing equitable recruiting methods, and offering information in multiple languages (102, 103) will help address racial/ethnic disparities in FASD intervention work. Implementation science guidelines addressing structural racism and health disparities can also guide scientifically sound intervention work (104, 105).

Discussion

A number of important factors have contributed to emerging evidence for racial/ethnic disparities in psychological care for individuals with FASD. While our understanding is far from complete, Dis/Crit provides a useful framework for conceptualizing the causes and conditions of such disparities and informing a path forward (21). In addition to the specific recommendations for potential solutions outlined above, several broad approaches will support systems-level changes coordinated across disciplines and settings.

It is of utmost importance to include individuals with living experiences of dis/ability (including FASD) and BIPOC at all levels of research aimed at understanding and supporting individuals with FASD. Community-engaged research practices are needed to foster collaborative dialogues with community members and highlight their cultural knowledge and living-experiences to better understand disparities within these communities. Moreover, community-engagement would support equitable research processes that empower individuals with FASD rather than further stigmatize/marginalize them. For example, adults with FASD who are authors on the current paper suggest a future aim of understanding how religion ties into cultural differences for people with FASD and how this may impact the diagnosis and intervention. Researchers and clinicians must strive for inclusivity, cultural humility, and equitable access to resources so individuals with FASD and their communities are supported in navigating each stage from prevention to intervention regardless of race/ethnicity. Equally important is diversification of the (predominantly White) psychology workforce in the United States (106, 107), which will allow for individuals seeking clinical services to feel represented and understood, help in reducing language barriers, and potentially lead to increased services globally. Importantly, communication and collaboration across systems of care (i.e., medical professionals and educators) is crucial in reducing disparities and promoting early and accurate identification of FASD. As primary care providers and other professionals (e.g., educators) are often at the forefront of care, psychologists and mental health professionals could offer support on early detection of AEP and FASD, provide referral resources, and intervention. Lastly, further research is needed to understand cultural perceptions and understanding of FASD (108), which could potentially increase stigmatization and create additional barriers to care for individuals with FASD (109–111). In addition to understanding cultural perceptions of the challenges of individuals with living experience of FASD and their families/caregivers, it will be important to focus on the strengths and resilience of the FASD community (112, 113).

Conclusion

In sum, racial/ethnic disparities in psychological care for individuals with FASD represent important challenges to the field and will require coordinated, collaborative, and inclusive efforts to overcome. We hope that increased awareness will foster discussion and stimulate creative solutions to improve equitable, culturally-responsive, and evidence-based psychological services and support for individuals with FASD and their families.

Data availability statement

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

Author contributions

MR: Conceptualization, Visualization, Writing – original draft, Writing – review & editing. BG: Visualization, Writing – original draft, Writing – review & editing. AR: Writing – original draft, Writing – review & editing. CK-T: Writing – original draft, Writing – review & editing. ES: Writing – original draft, Writing – review & editing. EW: Writing – original draft, Writing – review & editing. JM: Writing – original draft, Writing – review & editing. EH: Writing – original draft, Writing – review & editing. MM: Writing – original draft, Writing – review & editing. SA: Writing – original draft, Writing – review & editing. CP: Supervision, Writing – original draft, 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.

Publisher's note

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Suicide and mortality following self-harm in Culturally and Linguistically Diverse communities in Victoria, Australia: insights from a data linkage study

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Background: While cultural backgrounds are well-documented to be relevant to intentional self-harm, little is known about how cultural and linguistically diverse (CALD) backgrounds affect mortality outcomes following self-harm.

Aim: This study aimed to compare the risk of all-cause mortality and suicide after intentional hospital admissions for self-harm among people from CALD (vs. non-CALD) backgrounds.

Method: Linked hospital and mortality data in Victoria, Australia, was used to assess suicide and all-cause death after hospital admissions for self-harm among patients aged 15+ years. All-cause death was identified by following up on 42,122 self-harm patients (hospitalized between 01 July 2007 and 30 June 2019) until death or 15 February 2021. Suicide death was evaluated in 16,928 self-harm inpatients (01 January 2013 and 31 December 2017) until death or 28 March 2018. Cox regression models were fitted to compare mortality outcomes in self-harm patients from CALD vs. non-CALD backgrounds.

Outcomes: During the follow-up periods, 3,716 of 42,122 (8.8%) participants died by any cause (by 15 February 2021), and 304 of 16,928 (1.8%) people died by suicide (by 28 March 2018). Compared to the non-CALD group, CALD intentional self-harm inpatients had a 20% lower risk of all-cause mortality (HR: 0.8, 95% CI: 0.7–0.9) and a 30% lower risk of suicide (HR: 0.7, 95% CI: 049–0.97). Specifically, being from North Africa/Middle East and Asian backgrounds lowered the all-cause mortality risk; however, the suicide risk in Asians was as high as in non-CALD people.

Conclusion: Overall, people from CALD backgrounds exhibited lower risks of all-cause mortality and suicide following hospital admission for self-harm compared to the non-CALD group. However, when comparing risks based on regions of birth, significant variations were observed. These findings underscore the importance of implementing culturally tailored background-specific suicide preventive actions. The study focussed on outcomes following hospital admission for self-harm and did not capture outcomes for cases of self-harm that did not result in hospital admission. This limits generalisability, as some

CALD people might avoid accessing healthcare after self-harm due to cultural factors. Future research that not limited to hospital data is suggested to build on the results.

KEYWORDS

self-harm, suicide, mortality outcomes after self-harm, mental health, CALD, cultural backgrounds, multicultural, country of birth

Introduction

Intentional self-harm, such as self-poisoning or self-cutting with and without suicidal intent, is a serious public health problem in Australia (1). Intentional self-harm (hereinafter referred to as self-harm) is more common in female individuals, at younger ages, in Indigenous people, in separated and divorced people, and in people or communities with precarious employment situations (2). Mental health conditions, previous self-harm attempts, physical illness, substance abuse, social isolation, a lack of connectedness, racism, and discrimination are all risk factors for self-harm (2). However, religious affiliation and cultural norms are listed as possible protective factors for self-harm. These risks and protective factors for self-harm might be relevant to people from different cultural backgrounds.

Regarding adverse health outcomes after self-harm, research showed that people who engaged in self-harm might have an increased risk of premature death and self-harm reoccurrence (3–8). Research also showed a strong relationship between self-harm history and suicide (9): hospital-treated self-harm patients are at 30–200 times higher risk of suicide within 12 months of hospital discharge (10). In 2020, 3,139 Australians died from suicide, equivalent to nine suicide deaths every day (11). To help reduce the rate of suicide, effective prevention after self-harm is called for.

In the policy position statement of the Australian government on the CALD population (2021), Suicide Prevention Australia suggested to Parliament that it develop a suicide prevention plan that includes a section on preventing suicide in culturally and linguistically diverse (CALD) communities (12). However, little is known about potential suicide prevention strategies after hospital admission for self-harm among CALD people in Australia. There is evidence in England that the risk of suicide following self-harm among Black people was lower than that of white people, but when comparing South Asians to white people, the risk was not statistically different (at $p = 0.05$) (13). The variations in the risk of suicide following self-harm in different CALD groups suggest different targeted and tailored suicide prevention initiatives and allocations might be needed for different CALD groups based on cultural backgrounds.

Given that Australia is one of the most multicultural migrant countries, examining the mortality outcomes, including all-cause mortality and suicide following self-harm, among the CALD populations is necessary to inform suicide prevention strategies and priorities. This study used state-wide linked hospital data and mortality data for Victoria, Australia, which is a highly multicultural society. This allowed us to compare the outcomes in various CALD backgrounds by regions of birth and suggest specific culturally related suicide prevention messages and directions for future research in suicide prevention. More broadly, it provides key evidence supporting models for suicide prevention in other countries with rapidly increasing migration.

Methodology

This data linkage study consists of two retrospective analyses to evaluate (1) death from any causes and (2) suicide death following hospital admission for self-harm among self-harm hospital inpatients aged 15+ years in Victoria, Australia. We used linked hospital and mortality data to compare mortality risks among self-harm patients in CALD groups with the non-CALD group.

Data sources

Victorian admitted episodes dataset

Hospital admission cases were extracted from the VAED, which records all hospital admissions in public and private hospitals in the state of Victoria. Hospital inpatient data were used for sample selection and to determine pre-existing health conditions.

The VAED is a compilation of demographic, administrative, and clinical data on all admitted patient episodes of care provided by public and private hospitals, rehabilitation centers, extended care facilities, and day procedure centers in Victoria. The dataset is maintained by the Victorian Government Department of Health (DH) Health Data Standards and Systems (HDSS) unit for morbidity monitoring, case mix-based funding, and analysis purposes in accordance with several healthcare reporting agreements. Cases recorded on the VAED are coded to ICD-10-AM (Australian Modification of ICD-10): the WHO International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, and Australian Modification (14).

Victorian death index

All deaths in Victoria are registered with the Registry of Births, Deaths, and Marriages. Usually, death registration is done by the funeral director. The Registry of Births, Deaths, and Marriages provided the VDI data to the Center for Victorian Data Linkage (CVDL) under a Memorandum of Understanding. The data were then provided to researchers after ethics approval and the data linkage application process. The database contains the most up-to-date information on all deaths reported to coroners. However, the cause of death is not available in this database and is only available

in the *Cause of Death Unit Record Files*. The VDI was used as an indicator of death due to any cause.

Cause of death unit record files

The State and Territory Registrars of Births, Deaths, and Marriage and State Coroners provide data relating to deaths registered in Australia in a given reference year to the Australian Bureau of Statistics. The Australian Bureau of Statistics then codes the cause of death data using ICD-10. The COD dataset is administrative by nature and, as such, is useful for long-term monitoring of suicide deaths[1].

Data sources to identify pre-existing conditions that occurred 12 months before the index admission date

Victorian emergency minimum dataset

Emergency department (ED) presentation cases were extracted from the VEMD, which records ED presentations at *39 Victorian public hospitals* with 24-h emergency departments.

The VEMD comprises demographic, administrative, and clinical data detailing ED presentations at Victorian public hospitals with designated 24-h emergency departments. Data are coded according to the relevant VEMD User Manual published by the Department of Health (15).

The VEMD dataset was used to examine hospital-related outcomes (subsequent injury presentation; repeat ED presentation due to self-harm) and pre-existing hospital service use.

Clinical public mental health service contacts: Client Management Interface/Operational Data Store

The CMI/ODS data relates to clinical services that focus on the assessment and treatment of people with mental illness. These services are grouped by location into area-based mental health services and are managed by general health facilities, such as hospitals. There are reporting requirements for the Victorian Government's public mental health services using the CMI/ODS system. CMI/ODS comprises two systems. The Client Management Interface (CMI) is the local client information system used by each public mental health service. The Operational Data Store (ODS) manages a set of selected data items from each CMI. Data in the CMI includes demographic information, clinical status, including diagnosis, and service history for each person registered on the CMI/ODS system as receiving public clinical mental health services (16).

Linkage process

Data linkage is a technique for identifying records in and across 30 different Victorian health and human services datasets that belong to the same person, family, place, or event in a way that protects individual privacy and can be used for analysis. Data linkage was conducted by CVDL, the Victorian Department of Health. The CVDL uses linkage identifiers to anonymously identify content and case variables relating to an individual across datasets (17).

The CVDL team extracted the data based on an agreed-upon technical assessment and research proposal designed by the research team. They provided the linked data to the researchers in de-identified format; identifiers were removed and dates were replaced with encrypted dates. Therefore, informed consent from participants was not needed.

Sample selection

This study recruited participants using the same sample selection method as described in our previous work (18). Hospital admissions for self-harm included episodes where individuals engaged in self-harm with or without the intention to die. We extracted self-harm admissions from the VAED based on the International Classification of Diseases 10th Revision Australian Modification (ICD-10-AM). Admission records were selected if they contained a first external cause indicating self-harm (X60–X84) and a principal diagnosis that was either an injury (S00–T98) or a mental or behavioral disorder (F00–F99) (19).

Due to different data availabilities, two samples of participants were recruited to identify two outcomes. *Sample 1* included self-harm patients with their index hospital admissions for self-harm from 01 July 2007 to 30 June 2019 to identify all-cause deaths. *Sample 2* included those with index hospital admissions for self-harm from 01 January 2013 to 31 December 2017 to identify suicide deaths (Figure 1).

Grouping hospital admissions for self-harm episodes into periods of care was conducted to identify the incident episode, subsequent transfers, and statistical separations and statistical separations. This included instances where there was less than a 2-day gap between separation and readmission (18). Then, the index self-harm period of care was selected as the first (initial) self-harm period of care that occurred between the two timeframes mentioned above.

Participants were selected if they were 15 years and older and living in Victoria (regardless of their visa status). As participants with indeterminate or other sex were relatively rare within the samples (small cell counts), they were not included for confidentiality reasons. We excluded observations if patients had missing information on country of birth in VAED (<1% of total participants).

Outcomes

Death from any cause after hospital admissions for self-harm was identified by following Sample 1 until death or the data collection end date, which was 15 February 2021 (whichever came first). To flag the death outcome, Sample 1 data were linked with Victorian Death Index (VDI) data.

1 Participants from English-speaking backgrounds were excluded from the relevant CALD groups by ROB, and they were included in the non-CALD group.

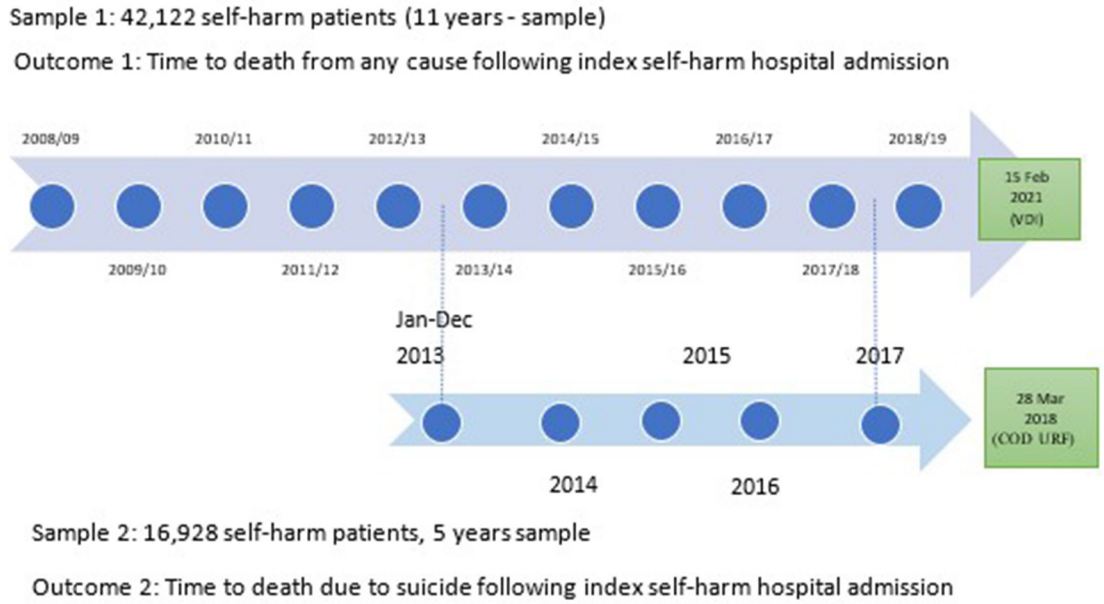

FIGURE 1
Schematic diagram of the data linkage periods to determine mortality outcomes.

Similarly, suicide death following hospital admissions for self-harm was identified by following Sample 2 until death due to suicide or 28 March 2018 (whichever came first) in the linked COD URF data (Figure 1).

Suicide deaths were identified as having an ICD-10 underlying cause of death coded intentional self-harm (X60–X84). Undetermined intent death was not defined as suicide in this study. Including undetermined intent death in suicide is a controversial topic (20, 21). It is considered best practice to separate the analyses of intentional and undetermined intent deaths (22). However, as there were only 18 undetermined intent cases in Sample 2 (<6 cases from the CALD group—Asia), we were not able to analyze these as a separate group due to low statistical power and data confidentiality. As a sensitivity analysis, we repeated the analysis, including undetermined intent deaths as suicide outcomes. The results show fairly similar findings (<10% differences). Therefore, in this study, suicide deaths included those who died by intentional self-harm (X60–X84) only.

CALD variables

The definition of CALD status of research participants and grouping CALD/non-CALD and sub-groups of CALD have been discussed elsewhere (18, 23).

CALD/non-CALD status of participants

The country of birth variable, as recorded in the VAED, was used to determine the CALD status of research participants. The CALD group included participants from non-English-speaking countries of birth (23). The CALD component "main language spoken at home" was not available in the data set and, therefore, was not used to define CALD status. Furthermore, although Indigenous people should be in a separate group (23) for data analysis due to their cultural diversity as well as having relatively high rates of self-harm compared to CALD and non-CALD groups (11), the small sample size of Indigenous peoples might affect the statistical power and data confidentiality of the research. For this reason, participants who self-identified as Indigenous peoples were grouped into CALD or non-CALD groups depending on their country of birth.

Research studies have shown that grouping all participants from CALD backgrounds into one group could make the group highly heterogeneous, and this could obscure important differences in self-harm (18, 24). We also divided the CALD group into nine subgroups based on region of birth (the Australian Bureau of Statistics (ABS)'s region classifications). Separate analyses comparing suicide/mortality risk in (1) the CALD group and (2) nine CALD subgroups with the non-CALD group were conducted to have more specific results.

CALD groups by nine regions of birth of participants (9 ROB/non-CALD)

- Oceania and Antarctica region, excluding Australia and New Zealand[1];
- North-West Europe, excluding the United Kingdom (England, Wales, Scotland, and Northern Ireland) and the Republic of Ireland (see footnote 2);
- Southern and Eastern Europe;
- North Africa and the Middle East;
- South-East Asia;
- North-East Asia;

- Southern and Central Asia;
- Americas, excluding Canada and the United States of America (see footnote 2);
- Sub-Saharan Africa, excluding South Africa (see footnote 2).

Demographic variables

Age group, sex, marital status, remoteness (Accessibility and Remoteness Index of Australia—ARIA+), and socioeconomic status (Socio-Economic Indexes for Areas—SEIFA) were extracted from VAED. The ARIA+ (25) and SEIFA were defined based on the residential addresses of patients as described elsewhere (18, 26). SEIFA was defined based on the Index of Relative Socio-Economic Advantage and Disadvantage, with state deciles based on statistical local areas. We regrouped participants into two groups of SEIFA, in which SEIFA Decile 1–5 indicated greater disadvantage, and Decile 6–10 indicated greater advantage.

Factors relevant to self-harm admission

Mechanisms of self-harm (self-poisoning by pharmaceuticals, self-poisoning by other substances, self-harm by sharp object, and other means); place of injury (self-harm occurred at home, healthcare center, and other settings); comorbidity (27), any psychiatric disorder admission at the time of the index hospital admissions for self-harm (F00-F99), and alcohol use mentioned during index hospital admission (28) were extracted from hospital admission records. These factors were coded based on ICD-10-AM codes.

Injury severity

Age-group stratified ICD-based injury severity scores (ICISS) based on the worst-injury method were used to calculate injury severity (29); serious injury was coded with an ICISS < 0.941, which means a survival probability of $\leq$94.1% (30, 31).

Pre-existing conditions within 12 months before the index admission date were identified based on ICD-10-AM codes in hospital datasets and by linking the samples with the Victorian Emergency Minimum Dataset (VEMD) and Clinical Public Mental Health Services (CMI/ODS) databases. These included *pre-existing hospital admissions due to self-harm* (VAED); *ED presentations due to self-harm*; *any admission due to mental illness* (ICD-10-AM coded as F00-F99 in VAED); and *mental health contacts before index admission* (any matched records found in linked clinical mental health service contact data, CMI/ODS).

Statistical analysis

Data were analyzed using SAS version 14.1 and prepared using SPSS version 25 and STATA version 12.1. To describe and compare the characteristics of self-harm patients in the CALD group [and CALD subgroups by region of birth (ROB)] vs. the non-CALD group, percentages and 95% CIs of participants by socio-demographic characteristics, injury types, injury outcomes, self-harm and mental health history, and comorbidity were presented in Table 1.

The occurrence of outcomes and (where relevant) 95% CI were calculated and presented in Tables 3, 5. For survival analyses, time-to-death was calculated as the number of days from the index episode of self-harm to the fixed end date of follow-up (censored cases, for those who survived until then), or until the date of death if this preceded the end of the follow-up interval.

Various Cox regression models were fitted to estimate the effects of CALD backgrounds on mortality outcomes. Model 1 is the univariable model, and the impacts of possible confounders (highlighted in Table 1) were tested in sequentially adjusted models: *model 2*—adjusted for gender and age; *model 3*—marital status and geography were added; *model 4*—mechanisms of self-harm, injury severity, comorbidity, and mental health illness during the index admissions were added; and *model 5—fully adjusted model*, pre-existing health service use due to self-harm and mental illnesses were added. Hazard ratios with 95% confidence intervals were calculated for all models.

Ethical consideration

The Monash University Human Research Ethics Committee provided the requested ethical approval for this research (Project ID 27360).

Results

There were 42,528 individuals hospitalized due to intentional self-harm in Victoria between 01 July 2007 and 30 June 2019 and selected for the study; among them, the country of birth was missing for 401 individuals; a further five people had death records in VDI where the death dates were earlier than the admission dates. They were excluded from the study, leaving the remaining Sample 1 of 42,122 people, and similarly, 16,928 people were included in Sample 2. Of these, 13.3% were from culturally diverse backgrounds: Southern and Eastern Europe (SEE) was the biggest CALD subgroup by ROB (accounted for 3.0% of Sample 1), followed by South-East Asia (2.2%). The characteristics of participants in Sample 1 are presented in Table 1.

Participants in both CALD and non-CALD groups were predominantly female individuals, living in major Victorian cities, and from higher SEIFA. CALD self-harm patients were older and more likely to be married/de facto than their non-CALD counterparts.

The most common self-harm method of choice in both CALD and non-CALD groups was self-poisoning by pharmaceuticals. Poisoning by other substances was more common among those from CALD backgrounds than non-CALD people.

During the index hospital admissions for self-harm, CALD people were less commonly admitted with mental health disorders than the non-CALD group, but more CALD patients were admitted with serious injuries or having at least one comorbidity than their non-CALD counterparts.

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TABLE 1 Characteristics of self-harm inpatients admitted to Victorian hospital 01 July 2007 and 30 June 2019 (Sample 1).

	Non-CALD				CALD			
	N	%	*CI (95%)*		*n*	%	*CI (95%)*	
No of patients	**36,503**	**86.7**	***86.3***	***87.0***	5,619	**13.3**	***13.0***	***13.7***
Gender								
Male	14,013	38.4	*37.9*	*38.9*	2,078	37.0	*35.7*	*38.2*
Female	22,490	61.6	*61.1*	*62.1*	3,541	63.0	*61.8*	*64.3*
Age group								
15–24	12,456	34.1	*33.6*	*34.6*	1,230	21.9	*20.8*	*23.0*
25–34	7,152	19.6	*19.2*	*20.0*	1,296	23.1	*22.0*	*24.2*
35–44	6,892	18.9	*18.5*	*19.3*	976	17.4	*16.4*	*18.4*
45–54	5,382	14.7	*14.4*	*15.1*	764	13.6	*12.7*	*14.5*
55–64	2,542	7.0	*6.7*	*7.2*	560	10.0	*9.2*	*10.7*
65+	1,846	5.1	*4.8*	*5.3*	785	14.0	*13.1*	*14.9*
Accessibility and Remoteness Index of Australia (ARIA+)								
Major Cities of Victoria, Australia	20,713	56.7	*56.2*	*57.3*	4,414	78.6	*77.5*	*79.6*
Inner Regional of Victoria, Australia	12,467	34.2	*33.7*	*34.6*	915	16.3	*15.3*	*17.2*
Outer Regional of Victoria, Australia	2,911	8.0	*7.7*	*8.3*	92	1.6	*1.3*	*2.0*
Socio-Economic Indexes for Areas (SEIFA)								
Decile 1–5 (greater disadvantage)	11,049	30.3	*29.8*	*30.7*	1,377	24.5	*23.4*	*25.6*
Decile 6–10 (greater advantage)	25,048	68.6	*68.1*	*69.1*	4,044	72.0	*70.8*	*73.1*
Marital status								
Never married	22,613	61.9	*61.5*	*62.4*	2,143	38.1	*36.9*	*39.4*
Widowed/divorced/separated	4,123	11.3	*11.0*	*11.6*	890	15.8	*14.9*	*16.8*
Currently married/defacto	8,896	24.4	*23.9*	*24.8*	2,483	44.2	*42.9*	*45.5*
Not stated/inadequately described	871	2.4	*2.2*	*2.5*	103	1.8	*1.5*	*2.2*
Mechanism of self-harm								
Poisoning- pharmaceuticals	28,679	78.6	*78.1*	*79.0*	4,260	75.8	*74.7*	*76.9*
Poisoning other substances	1,766	4.8	*4.6*	*5.1*	454	8.1	*7.4*	*8.8*
Sharp object	4,088	11.2	*10.9*	*11.5*	594	10.6	*9.8*	*11.4*
Other means	1,970	5.4	*5.2*	*5.6*	311	5.5	*4.9*	*6.1*
Place of injury occurred								
Home	17,478	47.9	*47.4*	*48.4*	2,958	52.6	*51.3*	*53.9*
Health care center	2,377	6.5	*6.3*	*6.8*	247	4.4	*3.9*	*4.9*
Other settings	2,403	6.6	*6.3*	*6.8*	344	6.1	*5.5*	*6.7*
Missing	14,245	39.0	*38.5*	*39.5*	2,070	36.8	*35.6*	*38.1*
Length of stay in hospital								
<2 days	22,043	60.4	*59.9*	*60.9*	3,231	57.5	*56.2*	*58.8*
2–7 days	8,739	23.9	*23.5*	*24.4*	1,331	23.7	*22.6*	*24.8*
8–30 days	4,355	11.9	*11.6*	*12.3*	787	14.0	*13.1*	*14.9*
31+ days	1,366	3.7	*3.5*	*3.9*	270	4.8	*4.2*	*5.4*
Serious injury	355	1.0	*0.9*	*1.1*	140	2.5	*2.1*	*2.9*

(Continued)

TABLE 1 (Continued)

	Non-CALD				CALD			
	N	%	*CI (95%)*		*n*	%	*CI (95%)*	
Comorbidity	2,159	5.9	*5.7*	*6.2*	522	9.3	*8.5*	*10.0*
Pre-existing conditions								
hospital admissions for self-harm history	587	1.6	*1.5*	*1.7*	43	0.8	*0.5*	*1.0*
Self-harm ED presentation history	2,905	8.0	*7.7*	*8.2*	208	3.7	*3.2*	*4.2*
Mental health disorder history	9,020	24.7	*24.3*	*25.2*	919	16.4	*15.4*	*17.3*
Clinical mental health contact history	11,435	31.3	*30.9*	*31.8*	1,050	18.7	*17.7*	*19.7*
Mental health disorder in index admission	19,571	53.6	*53.1*	*54.1*	2,889	51.4	*50.1*	*52.7*

Full data table by regions of birth in the Supplementary material.

Pre-existing conditions, including hospital-treated self-harm, hospital-treated mental health, and clinical mental health service contact 12 months prior to index hospital admissions for self-harm, were less common in CALD people than their non-CALD counterparts (Table 1).

These characteristics of participants in Sample 1 were consistent with those in Sample 2.

All-cause mortality risk following self-harm (Sample 1)

By the end of the follow-up on 15 February 2021, 3,716/42,122 people in Sample 1 (self-harm patients with their index hospital admissions for self-harm from 01 July 2007 to 30 June 2019) had died by any cause (8.8%), equivalent to an incidence rate of 13.2/1000 (CI: 12.8–13.6) person-years (Table 2).

Table 3 presents the results of Cox's proportional hazards regression models to examine the risk factors of all-cause mortality after hospital admissions for self-harm. The results showed that all-cause deaths were more likely to be male, of older age, and living in major cities in Victoria. Those who had a serious injury or comorbidity at the index hospital admissions for self-harm were at higher risk of all-cause mortality.

Regarding the relationship between health conditions and all-cause death after self-harm, Table 3 shows that the risk was higher among those with pre-existing health conditions of self-harm ED presentations or mental illnesses (than those without the conditions), but lower in patients currently diagnosed with mental illnesses during index hospital admissions for self-harm (than those without; Table 3).

Comparisons of all-cause mortality risks following index hospital admissions for self-harm among CALD vs. non-CALD

When grouping all CALD people together, CALD people had a higher incidence of suicide death than the non-CALD group [15.1 [CI: 13.8–16.3] vs. 12.9 [CI: 12.5–13.3] person-years]. The rate was highest in SEE [36.8 [CI: 32.7–40.9]] and lowest in Oceania and Antarctica (Table 2).

In Table 3, the univariable model (Model 1) showed that CALD people (as one group) were at higher risk of all-cause mortality than their non-CALD counterparts, especially those from SEE and North-West Europe (when broken down by regions of birth). However, in the multivariable models (fully adjusted for demographic, injury-related variables, and pre-existing health service use), we found opposite results: those from a CALD background were *20% less likely to die* within the follow-up time than the non-CALD group. Specifically, being from North Africa, the Middle East, and Asia lowered the risk of death from all causes compared with the non-CALD reference group; the risk of death in European backgrounds was similar to that observed in the non-CALD group. This might be because the European group was the oldest among all CALD groups. This suggests that age adjustment could have reversed the pattern observed.

Suicide risk following self-harm (Sample 2)

Sample 2 data showed that of the 16,928 people, 4.8% died by any cause by 28 March 2018 ($n = 814$), and nearly half (42.3%) of those who died by suicide ($n = 344$). The incidence rate was 3.9 (CI: 3.5–4.3)/1,000 person-years, and it was higher in the non-CALD group than in the CALD group (Tables 2, 4).

Table 4 presents the 15 leading causes of death among the 814 deaths over the follow-up period. Hanging was the first leading cause of death (X70; $n = 164$, 20.7%), followed by self-poisoning (X64, X61; $n = 87$, 10.7%), cancer (C349), and heart disease (I259; Table 4).

Table 5 presents the results of Cox's proportional hazards regression models to examine the risk factors for suicide death after hospital admissions for self-harm. Suicide after self-harm was more common in male individuals, older people, and those living in major cities in Victoria. Suicide was also more common among those who had been self-poisoned by other substances than pharmaceutical poisoning in the index hospital admissions for self-harm. Linkage data showed that suicide risk was increased among

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TABLE 2 Incidence rates of all-cause mortality and suicide by CALD and non-CALD groups.

	Deaths	Person-years at risk	IR (/1,000 person-years)	*95% CI*	
All-cause mortality (Sample 1)					
Non-CALD	3,162	245,070	12.9	*12.5*	*13.3*
CALD	554	36,779	15.1	*13.8*	*16.3*
Oceania and Antarctica*	(0–6)†	985	†	*0.6*	*9.5*
North-West Europe*	93	3,367	27.6	*22.1*	*33.2*
Southern and Eastern Europe	293	7,959	36.8	*32.7*	*40.9*
North Africa and the Middle East	38	5,572	6.8	*4.7*	*9.0*
South-East Asia	38	6,438	5.9	*4.0*	*7.8*
North-East Asia	21	2,987	7.0	*4.0*	*10.0*
Southern and Central Asia	41	6,567	6.2	*4.3*	*8.1*
Americas*	13	1,269	10.2	*4.7*	*15.8*
Sub-Saharan Africa*	(10–20)‡	1,635	‡	*3.2*	*11.5*
Total	**3,716**	**281,850**	**13.2**	***12.8***	***13.6***
Suicide mortality (Sample 2)					
Non-CALD	304	76,324	4.0	*3.5*	*4.4*
CALD	40	11,922	3.4	*2.3*	*4.4*
Europe*	24	3,383	7.1	*4.3*	*9.9*
Asia	(10–20)‡	5,435	‡	*0.8*	*3.2*
Others**	(0–6)†	3,104	†	*0.2*	*3.0*
Total	**344**	**88,245**	**3.9**	***3.5***	***4.3***

*Persons/POC of those who were born in English-speaking countries were excluded from the relevant CALD groups by ROB, and they were included in the non-CALD group.
**Others: Oceania and Antarctica; North Africa and the Middle East, Americas, Sub-Saharan Africa.
†Range was reported instead of the absolute number because cell values were <6.
‡Other cells in the same row and/or column may also be suppressed and reported with "Range ‡" to maintain confidentiality.

self-harm patients with pre-existing mental health conditions (before index self-harm admission) but lower among those who were diagnosed with mental health disorders at the time of the index episode. The risk was not different among patients who had previous self-harm hospital treatment.

Comparisons of suicide risks following hospital admissions for self-harm among CALD vs. non-CALD

Compared to the non-CALD group, the CALD group had a lower proportion of people who died by suicide following self-harm [1.7% [CI 1.2–2.3] vs. 2.1% [CI 1.8–2.3], respectively]. The risk of suicide after the first self-harm admission between CALD and non-CALD groups was not different in the univariable model, but it became different in the adjusted models (Model 2 to Model 5). CALD people had a 30% lower suicide mortality risk (Table 5).

Among those who died by suicide, 304 people (88.3%) were from the non-CALD group (of those, 91% were from Australia, 4% from England, and the remainder from New Zealand, Scotland, and South Africa). Among those who died by suicide in the CALD group ($n = 40$), above 50% were from SEE. Due to the low suicide incidence of ROB, we regrouped ROB into three major CALD groups: Europe, Asia, and Other regions. Those from Oceania and Antarctica, North Africa and the Middle East, the Americas, and sub-Saharan Africa had a significantly lower incidence of suicide overall and followed a similar pattern of suicide risk by age, sex, and other characteristics; therefore, they were grouped into "Other regions" (Tables 2, 5).

The univariable model showed that compared to the non-CALD group, suicide risk after self-harm was lower in CALD people; more specifically, by regions of birth, the risk was higher in European backgrounds but lower in Asians and other regions group (than the non-CALD group). However, the fully adjusted model showed that the risk of suicide among self-harm patients from Asian and European backgrounds was not different from that of non-CALD people (Table 5).

The fully adjusted models showed similar results to the age and sex-adjusted models, which means the differences in suicide and all-cause mortality risks in different cultural backgrounds were affected mostly by age and sex.

Discussions

The present study compared the risks of all-cause mortality and suicide following hospitalization for hospital admissions for self-harm between people from CALD and non-CALD backgrounds.

TABLE 3 Risk of death due to all causes among self-harm patients admitted to hospital from 01 July 2007 and 30 June 2019 (Sample 1), Cox's proportional hazards regression models: univariate, partly adjusted and fully adjusted models.

	Death by any causes					Model 1			Model 2			Model 3			Model 4			Model 5		
	Total	Death	%	CI 95%		HR	95% CI		HR	95% CI		HR	95% CI		HR	95% CI		HR	95% CI	
CALD by regions of birth																				
Non-CALD	**36,503**	**3,162**	***8.7***	***8.4***	***9.0***	**R**			**R**			***R***			***R***			***R***		
CALD	**5,619**	**554**	***9.9***	***9.5***	***10.2***	***1.2***[§]	***1.1***	***1.3***	***0.8***[§]	***0.7***	***0.9***	***0.8***[§]	***0.7***	***0.8***	***0.8***[§]	***0.7***	***0.8***	***0.8***[§]	***0.7***	***0.9***
Oceania and Antarctica*	146	(0–6)[†]	[†]	*0.5*	*6.4*	*0.4*[§]	*0.2*	*1.0*	*0.4*	*0.2*	*1.1*	*0.5*	*0.2*	*1.1*	*0.4*	*0.2*	*1.0*	*0.4*[§]	*0.2*	*1.0*
North-West Europe*	529	93	*17.6*	*14.3*	*20.8*	*2.2*[§]	*1.8*	*2.7*	*0.9*	*0.8*	*1.2*	*0.9*	*0.8*	*1.2*	*0.9*	*0.8*	*1.2*	*1.0*	*0.8*	*1.2*
Southern and Eastern Europe	1,249	293	*23.5*	*21.1*	*25.8*	*2.8*[§]	*2.5*	*3.2*	*1.1*	*0.9*	*1.2*	*1.1*	*1.0*	*1.2*	*1.0*	*0.9*	*1.1*	*1.0*	*0.9*	*1.2*
North Africa and the Middle East	821	38	*4.6*	*3.2*	*6.1*	*0.5*[§]	*0.4*	*0.7*	*0.5*[§]	*0.4*	*0.7*	*0.5*[§]	*0.4*	*0.7*	*0.5*[§]	*0.4*	*0.7*	*0.5*[§]	*0.4*	*0.7*
South-East Asia	935	38	*4.1*	*2.8*	*5.3*	*0.5*[§]	*0.3*	*0.6*	*0.5*[§]	*0.3*	*0.7*	*0.5*[§]	*0.3*	*0.7*	*0.4*[§]	*0.3*	*0.6*	*0.5*[§]	*0.3*	*0.7*
North-East Asia	472	21	*4.4*	*2.6*	*6.3*	*0.5*[§]	*0.4*	*0.9*	*0.6*[§]	*0.4*	*0.9*	*0.6*[§]	*0.4*	*0.9*	*0.5*[§]	*0.3*	*0.8*	*0.6*[§]	*0.4*	*0.9*
Southern and Central Asia	1,045	41	*3.9*	*2.7*	*5.1*	*0.5*[§]	*0.4*	*0.7*	*0.6*[§]	*0.4*	*0.8*	*0.6*[§]	*0.5*	*0.9*	*0.6*[§]	*0.4*	*0.8*	*0.6*[§]	*0.5*	*0.9*
Americas*	177	13	*7.3*	*3.5*	*11.2*	*0.8*	*0.5*	*1.4*	*0.7*	*0.4*	*1.1*	*0.7*	*0.4*	*1.1*	*0.7*	*0.4*	*1.2*	*0.7*	*0.4*	*1.3*
Sub-Saharan Africa*	245	(10–20)[‡]	[‡]	*2.2*	*7.6*	*0.6*	*0.3*	*1.1*	*0.5*[§]	*0.3*	*0.9*	*0.5*[§]	*0.3*	*0.9*	*0.6*[§]	*0.3*	*1.0*	*0.6*[§]	*0.3*	*1.0*
Sex																				
Male	16,091	2,016	*12.5*	*12.0*	*13.0*				*1.8*[§]	*1.6*	*1.9*	*1.8*[§]	*1.6*	*1.8*	*1.6*[§]	*1.5*	*1.7*	*1.6*[§]	*1.5*	*1.7*
Female	26,031	1,700	*6.5*	*6.2*	*6.8*				*R*			*R*			*R*			*R*		
Age groups																				
15–24	13,686	330	*2.4*	*2.2*	*2.7*				*R*			*R*			*R*			*R*		
25–34	8,448	496	*5.9*	*5.4*	*6.4*				*2.3*[§]	*2.0*	*2.6*	*2.4*[§]	*2.1*	*2.8*	*2.3*[§]	*2.0*	*2.7*	*2.2*[§]	*1.9*	*2.6*
35–44	7,868	663	*8.4*	*7.8*	*9.0*				*3.1*[§]	*2.7*	*3.5*	*3.4*[§]	*3.0*	*4.0*	*3.3*[§]	*2.8*	*3.7*	*3.1*[§]	*2.7*	*3.5*
45–54	6,146	688	*11.2*	*10.4*	*12.0*				*4.4*[§]	*3.9*	*5.0*	*5.0*[§]	*4.3*	*5.7*	*4.5*[§]	*3.9*	*5.2*	*4.2*[§]	*3.7*	*4.9*
55–64	3,102	495	*16.0*	*14.7*	*17.2*				*6.5*[§]	*5.6*	*7.5*	*7.5*[§]	*6.4*	*8.7*	*6.3*[§]	*5.4*	*7.4*	*6.1*[§]	*5.2*	*7.1*
65+	2,631	1,038	*39.5*	*37.6*	*41.3*				*19.8*[§]	*17.5*	*22.2*	*23.1*[§]	*20.0*	*27.0*	*16.8*[§]	*14.5*	*19.6*	*17.0*[§]	*14.7*	*20.0*
Accessibility and Remoteness Index of Australia (ARIA+)																				
Major Cities of Victoria, Australia	25,127	2,236	*8.9*	*8.5*	*9.3*							*R*			*R*			*R*		
Inner Regional of Victoria, Australia	13,382	1,227	*9.2*	*8.7*	*9.7*							*1.0*	*0.9*	*1.1*	*1.0*	*0.9*	*1.1*	*1.0*	*0.9*	*1.1*
Outer Regional of Victoria, Australia	3,003	232	*7.7*	*6.8*	*8.7*							*0.8*[§]	*0.9*	*0.7*	*0.8*[§]	*0.7*	*0.9*	*0.8*[§]	*0.7*	*0.9*

(Continued)

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	Death by any causes					Model 1		Model 2		Model 3			Model 4			Model 5		
	Total	Death	%	CI 95%		HR	95% CI	HR	95% CI	HR	95% CI		HR	95% CI		HR	95% CI	
Socio-Economic Indexes for Areas (SEIFA)																		
Decile 1–5 (greater disadvantage)	12,426	1,076	8.7	8.2	9.2					1.0	0.9	1.1	1.0	0.9	1.1	1.0	0.9	1.1
Decile 6–10 (greater advantage)	29,092	2,619	9.0	8.7	9.3					R			R			R		
Marital status																		
Never married	24,756	1,510	6.1	5.8	6.4					R			R			R		
Widowed/divorced/separated	5,013	905	18.1	17.0	19.1					1.0	0.9	1.1	1.0	0.9	1.1	1.0	0.9	1.1
Currently married/defacto	11,379	1,206	10.6	10.0	11.2					0.7§	0.6	0.8	0.7§	0.7	0.8	0.8§	0.7	0.8
Not stated/inadequately described	974	95	9.8	7.9	11.6					0.8§	0.6	1.0	0.7§	0.6	0.9	0.8§	0.6	1.0
Mechanisms of self-harm injury																		
Poisoning- pharmaceuticals	32,939	2,726	8.3	8.0	8.6								R			R		
Poisoning other substances	2,220	256	11.5	10.2	12.9								1.1	1.0	1.3	1.1	1.0	1.3
Sharp object	4,682	424	9.1	8.2	9.9								1.0	0.9	1.1	1.0	0.9	1.1
Other means	2,281	310	13.6	12.2	15.0								1.5§	1.3	1.7	1.5§	1.3	1.7
Place of self-harm																		
Home	20,436	1,996	9.8	9.4	10.2								R			R		
Health care center	2,624	218	8.3	7.3	9.4								0.9	0.8	1.0	0.8§	0.7	0.9
Other settings	2,747	342	12.4	11.2	13.7								1.1	1.0	1.2	1.1	1.0	1.2
Missing	16,315	1,160	7.1	6.7	7.5								0.9§	0.8	1.0	0.9§	0.8	1.0
Length of stay																		
<2 days	25,274	1,489	5.9	5.6	6.2								R			R		
2–7 days	10,070	1,132	11.2	10.6	11.9								1.5§	1.4	1.6	1.5§	1.4	1.6
8–30 days	5,142	780	15.2	14.2	16.1								1.6§	1.4	1.7	1.5§	1.3	1.6
31+ days	1,636	315	19.3	17.3	21.2								1.4§	1.2	1.6	1.2§	1.1	1.4
Serious injury																		
Yes	495	195	39.4	35.1	43.7								1.5§	1.3	1.8	1.6§	1.3	1.8
No	41,264	3,504	8.5	8.2	8.8								R			R		
Any comorbidity CHARLSON																		
Yes	2,681	663	24.7	23.1	26.4								2.0§	1.9	2.2	2.0§	1.8	2.2

(Continued)

TABLE 3 (Continued)

	Death by any causes					Model 1			Model 2			Model 3			Model 4			Model 5		
	Total	Death	%	CI 95%		HR	95% CI		HR	95% CI		HR	95% CI		HR	95% CI		HR	95% CI	
No	39,441	3,053	7.7	7.5	8.0										R			R		
Any mental health disorder																				
Yes	22,460	2,205	9.8	9.4	10.2										0.8§	0.8	0.9	0.8§	0.7	0.8
No	19,662	1,511	7.7	7.3	8.1										R			R		
Pre-existing (last 12 months before index self-harm admission)																				
Hospital admission due to self-harm																				
Yes	630	89	14.1	11.4	16.8													1.0	0.8	1.2
No	41,492	3,627	8.7	8.5	9.0													R		
ED presentation due to self-harm (last 12 months)																				
Yes	3,113	298	9.6	8.5	10.6													1.1§	1.0	1.3
No	39,009	3,418	8.8	8.5	9.0													R		
Hospital admission due to (all F codes)																				
Yes	9,939	1,394	14.0	13.3	14.7													1.7§	1.6	1.8
No	32,183	2,322	7.2	6.9	7.5													R		
Clinical mental health service contact (CMI-ODS)																				
Yes	12,485	1,359	10.9	10.3	11.4													1.2§	1.1	1.3
No	29,637	2,357	8.0	7.6	8.3													R		

Death from all causes was identified by following up the 42,122 self-harm patients (who were admitted to hospital from 01 July 2007 and 30 June 2019) until death or 15 Feb 2021 (whichever comes first).

*Persons/POC of those who were born in English-speaking countries were excluded from the relevant CALD groups by ROB, and they were included in the non-CALD group.

**Other regions included Oceania and Antarctica; North Africa and the Middle East; Americas; Sub-Saharan Africa.

†Range was reported instead of the absolute number because cell values were <6.

‡Other cells in the same row and/or column may also be suppressed and reported with "Range ‡" to maintain confidentiality.

§P-value < 0.05.

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TABLE 4 Fifteen leading causes of death among self-harm patients admitted to hospital from 01 Jan 2013 and 31 Dec 2017 (Sample 2).

Cause of death	Non-CALD		CALD		Total	
	n	%	*n*	%	*n*	%
Intentional self-harm by hanging, strangulation, and suffocation (X70)	146	*20.7*	18	*16.4*	164	*20.1*
Intentional self-poisoning by and exposure to other and unspecified drugs, medicaments and biological substances (X64)	53	*7.5*	8	*7.3*	61	*7.5*
Malignant neoplasm of bronchus and lung unspecified (C349)	‡	‡	†	†	26	*3.2*
Intentional self-poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified (X61)	‡	‡	†	†	26	*3.2*
Chronic ischaemic heart disease (I259)	‡	‡	†	†	20	*2.5*
Intentional self-harm by jumping or lying before moving object (X81)	‡	‡	†	†	16	*2.0*
J449 Chronic obstructive pulmonary disease, unspecified	‡	‡	†	†	15	*1.8*
Accidental poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified (X42)	‡	‡	†	†	15	*1.8*
Intentional self-harm by sharp object (X78)	‡	‡	†	†	15	*1.8*
Acute myocardial infarction, unspecified (I219)	‡	‡	†	†	12	*1.5*
Accidental poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified (X41)	‡	‡	†	†	11	*1.4*
Intentional self-poisoning by and exposure to carbon monoxide and other gases and vapors (X67)	‡	‡	†	†	11	*1.4*
Poisoning by and exposure to other and unspecified drugs, medicaments and biological substances, undetermined intent (Y14)	‡	‡	†	†	11	*1.4*
Other ill-defined and unspecified causes of mortality (R99)	‡	‡	†	†	10	*1.2*
Intentional self-harm by drowning and submersion (X71)	‡	‡	†	†	9	*1.1*
Total	**304**	***100.0***	**40**	***100.0***	814	*100.0*

† Range was reported instead of the absolute number because cell values were <6.
‡ Other cells in the same row and/or column may also be suppressed and reported with "Range ‡" to maintain confidentiality.

Overall, the study found that CALD people had a lower risk of all-cause mortality and suicide than the non-CALD group. By regions of birth (ROB), those from North Africa, the Middle East, and Asia had lower all-cause mortality risk compared with the non-CALD reference group, but suicide risk following self-harm was not different between Asian and non-CALD backgrounds. The results suggest that the risks of all-cause mortality and suicide vary among different cultural backgrounds grouped by region of birth.

One of the most important findings of this study was that, compared to non-CALD people, some CALD groups by ROB were at lower risk of death and suicide following self-harm; none of the CALD backgrounds (based on regions of birth) was associated with a higher risk than the non-CALD groups, after adjusting for age and sex. This is consistent with earlier research in England (13), revealing that Black people (suicide proportion: 0.78%) had a lower risk of suicide following self-harm Emergency Department presentation than white self-harm patients (2.1%; $p = 0.05$). We acknowledge that the lower risk of suicide after hospital admissions for self-harm in the CALD group overall (compared with the non-CALD group) is somewhat contrary to common public discourse and expectations around migrant difficulties (12). While the common knowledge was mostly based on the fact that migrants and refugees might be at higher risk of migration stress, language barriers, social isolation, service access barriers, transgenerational trauma, and other risk factors for suicide, self-harm, and mental illnesses, we argued that CALD-related potential protective factors might play an important role in preventing CALD people from suicide death (26). Potential protective factors include healthy migrant effects(32); being well-educated and from a wealthy background (this can be the case for some international students and skilled migrants entering Australia); and migration can act as a healthy (and in some cases, wealthy) selection process. Furthermore, some CALD people might be protected by specific cultural or spiritual beliefs about the body (e.g., the Confucian principle that their bodies belong to their parents and they should not harm the body). Participating in religious activities is also found to be a protective factor against suicide. These protective factors for suicide might explain some of the lower risk of suicide following hospital admissions for self-harm among CALD people. The healthy migrant effect specifically can explain the lower rates of death in the CALD (vs. non-CALD) group. We suggest future qualitative studies to explore protective and risk factors for self-harm and suicide among CALD people. The qualitative results might inform clinical decisions following a psychological assessment. If possible, some possible *protective factors* could be considered in developing suicide prevention strategies; potentially, these could inform prevention in the non-CALD group, which was at higher risk for fatal outcomes in our study and others (13).

TABLE 5 Risk of death due to suicide, Cox's proportional hazards regression models: univariate, partly adjusted and fully adjusted models.

	Death suicide					Model 1			Model 2			Model 3			Model 4			Model 5		
	Total	Death	%	CI 95%		HR	95% CI		HR	95% CI		HR	95% CI		HR	95% CI		HR	95% CI	
CALD by regions of birth																				
Non-CALD	**14,625**	**304**	***2.1***	***1.8***	***2.3***	**R**			**R**			**R**			**R**			**R**		
CALD	**2,303**	**40**	**1.7**	***1.2***	***2.3***	**0.9**	***0.6***	***1.2***	**0.7**[§]	***0.5***	***1.0***	**0.70**[§]	***0.5***	***0.1***	**0.7**[§]	***0.5***	***0.9***	**0.69**[§]	***0.5***	***1.0***
Europe*	691	24	*3.5*	*2.1*	*4.8*	1.7[§]	1.1	2.6	1.0	*0.7*	*1.6*	1.0	*0.6*	*1.6*	1.0	*0.6*	*1.5*	1.0	*0.6*	*1.5*
Asia	1,030	(10–20)[‡]	[‡]	*0.4*	*1.7*	0.5[§]	0.3	1.0	0.6	*0.3*	*1.0*	0.6	*0.3*	*1.0*	0.5[§]	*0.3*	*1.0*	0.6	*0.3*	*1.0*
Others**	582	(0–6)[†]	[†]	*0.1*	*1.6*	0.4	0.2	1.0	0.4[§]	*0.2*	*0.9*	0.4[§]	*0.2*	*0.9*	0.4[§]	*0.2*	*0.9*	0.4[§]	*0.2*	*0.9*
Sex																				
Male	**6,398**	**194**	***3.0***	***2.6***	***3.5***				**1.9**[§]	***1.5***	***2.3***	**1.9**[§]	***1.5***	***2.4***	**1.6**[§]	***1.3***	***2.0***	**1.6**[§]	***1.3***	***2.0***
Female	10,530	150	*1.4*						R			R			R			R		
Age groups																				
15–24	**5,713**	**43**	***0.8***	***0.5***	***1.0***				**R**			**R**			**R**			**R**		
25–34	3,177	60	*1.9*	*1.4*	*2.4*				2.3[§]	*1.6*	*3.5*	2.3[§]	*1.6*	*3.4*	2.2[§]	*1.5*	*3.3*	2.2[§]	*1.5*	*3.3*
35–44	2,968	73	*2.5*	*1.9*	*3.0*				2.8[§]	*1.9*	*4.1*	2.0[§]	*1.9*	*4.1*	2.7[§]	*1.8*	*4.0*	2.6[§]	*1.7*	*3.9*
45–54	2,456	81	*3.3*	*2.6*	*4.0*				3.9[§]	*2.7*	*5.7*	3.8[§]	*2.5*	*5.7*	3.5[§]	*2.3*	*5.2*	3.4[§]	*2.3*	*5.2*
55–64	1,290	32	*2.5*	*1.6*	*3.3*				2.9[§]	*1.8*	*4.6*	2.7[§]	*1.7*	*4.6*	2.6[§]	*1.6*	*4.3*	2.5[§]	*1.5*	*4.2*
65+	1,194	54	*4.5*	*3.3*	*5.7*				5.3[§]	*3.5*	*8.0*	5.1[§]	*3.2*	*8.1*	4.1[§]	*2.5*	*6.8*	4.3[§]	*2.6*	*7.1*
ARIA																				
Major cities of Victoria, Australia	**10,355**	**202**	***2.0***	***1.7***	***2.2***							**R**			**R**			**R**		
Inner Regional of Victoria, Australia	5,107	125	*2.4*	*2.0*	*2.9*							1.2	*1.0*	*1.6*	1.1	*0.9*	*1.4*	1.1	*0.9*	*1.5*
Outer Regional of Victoria, Australia	1,210	14	*1.2*	*0.6*	*1.8*							0.7	*0.4*	*1.2*	0.6	*0.9*	*0.3*	0.6	*0.3*	*1.0*
SEIFA																				
Decile 1–5 (greater disadvantage)	4,892	85	*1.7*	*1.4*	*2.1*							0.8	*0.6*	*1.0*	0.8	*0.6*	*1.0*	0.8	*0.6*	*1.0*
Decile 6–10 (greater advantage)	**11,783**	**256**	***2.2***	***1.9***	***2.4***							**R**			**R**			**R**		

(Continued)

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TABLE 5 (Continued)

	Death suicide					Model 1			Model 2			Model 3			Model 4			Model 5		
	Total	Death	%	CI 95%		HR	95% CI		HR	95% CI		HR	95% CI		HR	95% CI		HR	95% CI	
Marital status																				
Never married	**10,067**	**158**	***1.6***	***1.3***	***1.8***							**R**			**R**			**R**		
Widowed/divorced/separated	1,949	63	*3.2*	*2.4*	*4.0*							1.1	*0.8*	*1.6*	1.1	*0.8*	*1.6*	1.1	*0.8*	*1.6*
Currently married/defacto	4,556	121	*2.7*	*2.2*	*3.1*							1.0	*0.8*	*1.4*	1.0	*0.8*	*1.3*	1.1	*0.8*	*1.4*
Mechanisms of self-harm injury																				
Poisoning- pharmaceuticals	**13,253**	**210**	***1.6***	***1.4***	***1.8***										**R**			**R**		
Poisoning other substances	862	31	*3.6*	*2.4*	*4.8*										1.9§	*1.3*	*2.8*	2.0§	*1.3*	*2.9*
Sharp object	1,841	35	*1.9*	*1.3*	*2.5*										1.2	*0.8*	*1.8*	1.2	*0.9*	*1.8*
Other means	972	68	*7.0*	*5.4*	*8.6*										4.3§	*3.1*	*5.9*	4.5§	*3.2*	*6.2*
Place of self-harm																				
Home	**8,244**	**198**	***2.4***	***2.1***	***2.7***										**R**			**R**		
Health care center	1,032	19	*1.8*	*1.0*	*2.7*										0.7	*0.4*	*1.1*	0.6	*0.4*	*1.0*
Other settings	1,097	30	*2.7*	*1.8*	*3.7*										0.6§	*0.4*	*0.9*	0.6§	*0.4*	*0.9*
Missing	6,555	97	*1.5*	*1.2*	*1.8*										0.7§	*0.5*	*0.9*	0.7§	*0.5*	*0.8*
Length of stay																				
<2 days	**9,847**	**119**	***1.2***	***1.0***	***1.4***										**R**			**R**		
2–7 days	4,159	140	*3.4*	*2.8*	*3.9*										2.4§	*1.8*	*3.1*	2.3§	*1.8*	*3.0*
8–30 days	2,214	69	*3.1*	*2.4*	*3.8*										2.0§	*1.5*	*2.8*	1.8§	*1.3*	*2.5*
31+ days	708	16	*2.3*	*1.2*	*3.4*										0.9§	*0.5*	*1.6*	0.8	*0.4*	*1.4*
Serious injury																				
Yes	187	19	*10.2*	*5.8*	*14.5*										2.2§	*1.3*	*3.6*	2.2§	*1.3*	*3.7*
No	**16,555**	**321**	***1.9***	***1.7***	***2.1***										**R**			**R**		
Any comorbidity CHARLSON																				
Yes	1,576	56	*3.6*	*2.6*	*4.5*										1.2	*0.9*	*1.6*	1.1	*0.8*	*1.6*
No	**15,352**	**288**	***1.9***	***1.7***	***2.1***										**R**			**R**		
Any mental health disorder																				
Yes	9,365	174	*1.9*	*1.6*	*2.1*										0.5§	*0.4*	*0.6*	0.5§	*0.4*	*0.6*
No	**7,563**	**170**	***2.2***	***1.9***	***2.6***										**R**			**R**		

(Continued)

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TABLE 5 (Continued)

	Death suicide					Model 1		Model 2		Model 3		Model 4		Model 5	
	Total	Death	%	CI 95%		HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Pre-existing health conditions															
Hospital admission due to self-harm															
Yes	110	(0–6)†	†	*0.1*	*7.1*									1.4	*0.5* *3.7*
No	**16,818**	**(300–350)‡**	‡	***1.8***	***2.2***									**R**	
ED presentation due to self-harm (last 12 months)															
Yes	1,280	20	*1.6*	*0.9*	*2.2*									0.7	*0.4* *1.1*
No	**15,648**	**324**	***2.1***	***1.8***	***2.3***									**R**	
Hospital admission due to (all F codes)															
Yes	3,935	118	*3.0*	*2.5*	*3.5*									1.5§	*1.2* *2.0*
No	**12,993**	**226**	***1.7***	***1.5***	***2.0***									**R**	
Clinical mental health service contact (CMI-ODS)															
Yes	5,003	128	*2.6*	*2.1*	*3.0*									1.3	*1.0* *1.7*
No	**11,925**	**216**	***1.8***	***1.6***	***2.1***									**R**	

Death from suicide was identified by following up the 16,928 self-harm patients (who were admitted to hospital from 01 Jan 2013 and 31 Dec 2017) until death or 28 March 2018.

*Persons/POC of those who were born in English-speaking countries were excluded from the relevant CALD groups by ROB, and they were included in the non-CALD group.

**Others: Oceania and Antarctica; North Africa and the Middle East, Americas, Sub-Saharan Africa;

† Range was reported instead of the absolute number because cell values were <6.

‡ Other cells in the same row and/or column may also be suppressed and reported with "Range ‡" to maintain confidentiality.

§ P-vaue < 0.05.

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Self-harm in CALD people may be underestimated in the results presented here. This study focussed on examining the risk of suicide after hospital admissions for self-harm, noting that some CALD people might avoid accessing hospital services due to factors such as stigma and language barriers unless they had serious injuries requiring immediate care. Also, CALD people (in particular new migrants) might be less likely to have family or friends with them after self-harm to bring them to the hospital (compared with non-CALD). Fatal outcomes in CALD people may also be underestimated: suicide is considered to be a sin in some cultures, and therefore suicide might be masked as other injuries such as unintentionally falling from height (rather than intentionally) in some CALD populations. Those possibilities might have affected the result of the study; further research is needed to test these possibilities. An investigation of health outcomes following self-harm in the community (not limited to hospital-admitted participants) is recommended.

To the best of our knowledge, there are very little data on suicide and self-harm in CALD communities in Australia that could be used to compare the findings. This might be due to a lack of accurate, reliable data on suicide in CALD populations. According to Bowden et al. (33), data collection in these communities is inconsistent and unreliable, resulting in either limited data availability or none at all on suicide deaths and suicidality among these communities (33). We suggest more attention should be paid to strengthen self-harm and suicide data quality and coverage. This could include the development (or improvement) of self-harm databases to collect more detailed data on CALD people, capturing information on how people entered Australia and under what circumstances (as refugees or as planned migrants), the main language spoken at home, race, as well as other factors that might be relevant to self-harm, such as family violence and substance use.

Another important finding of this study is that when grouping CALD people by region of birth, there was considerable variation in risks, suggesting that suicide prevention efforts targeting specific cultural groups would be beneficial.

First, of all CALD groups, people from North Africa and the Middle East groups emerged to have lower risks of both all-cause mortality and suicide death. While there are potential cultural heritages that have been shown to play a protective role against suicide, such as religious activity, it might also be a bias because suicide can be intentionally masked or denied in this group if it conflicts with religious beliefs (34, 35). As we also found a lower risk of all-cause mortality in this group compared to the non-CALD group, this suggests underreporting of suicide deaths is less likely, which is the explanation for the lower suicide risk seen in North Africa and the Middle East groups. However, there is still a possibility that self-harm patients might be missed from this group due to underreporting hospital admissions for self-harm. Interventions to increase access to health services as well as data quality improvement should be prioritized, especially for this group.

Second, the risk of suicide following self-harm among those from Asian backgrounds was as high as in non-CALD people. This finding is consistent with the research in England (13), revealing that the risk of suicide following hospital admissions for self-harm in South Asian patients (suicide proportion: 0.93%) and white people (2.1%) was not statistically different ($p = 0.05$). However, provided that in a previous study, we found Asians had a lower rate of hospital-admitted self-harm than the non-CALD group (26), we believe that understanding the reasons why the risk of suicide after self-harm in the Asian group did not statistically differ from the non-CALD group could provide valuable insights into suicide prevention initiatives. Hospital presentation for self-harm is an opportunity for psychological management and other self-harm interventions (36), and self-harm patients who fail to access mental healthcare after self-harm might be placed at higher risk of suicide.

In another data linkage study investigating the likelihood of accessing mental health services after self-harm in CALD communities, we also found that Asian inpatients were less likely to contact mental health services after discharge (18). Thus, a plausible explanation for why the risk of suicide after self-harm in Asians did not differ from the non-CALD group (while other CALD groups by regions of birth had a lower risk) might be related to the lower uptake of mental health services after self-harm associated with some Asian backgrounds (18, 37). Secondary prevention should therefore be augmented for Asian as well as for non-CALD patients. The following section relates to the CALD group: further research specifically in the non-CALD group is highly recommended to inform primary and secondary prevention; this focus falls outside the scope of this study.

To find opportunities for suicide prevention in the group of Asian patients who have self-harmed, we need to understand cultural barriers that prevent the group from contacting mental health services after being discharged from the hospital due to self-harm. Possible barriers include low recognition of mental issues (mental health might be less likely to be discussed in Asian families) and stigma and shame around self-harm and mental health (37, 38). Also, for newly migrated people, poor awareness of mental health and available services could be a barrier, or some might choose to use alternative medicine (39, 40).

Therefore, clearly, there is still scope for suicide prevention in the CALD group by improving the uptake of mental health services following self-harm, especially by people from Asian backgrounds. Because mental health is not commonly discussed within Asian cultures, one of the possible interventions may be to improve awareness of mental health service provisions within their local communities (39, 40), especially for new migrants. Interventions to encourage self-harm patients to access mental health services after discharge from the hospital should also be emphasized (i.e., introducing available psychological services in local areas, referring patients to local mental health services, and informing patients' medical providers regarding their conditions and possible risks for follow-up and further assessment). This sort of information could be provided to patients and their families at the time of discharge (5, 41). Tailored assessments of mental illnesses among those with a history of self-harm should also be considered to better recognize self-harm patients at risk of suicide, especially at primary health service centers. More importantly, due to the possible challenges of discrimination and health inequalities experienced by some CALD people, it is important to consider interventions that are related to the appropriateness and cultural safety of the services themselves (42). Another intervention may be to offer language-specific information, in addition to an anonymous confidential telephone helpline for people to access that could also be language-specific. These suggestions could help inform suicide prevention strategies for CALD communities.

Limitations

There is potential selection bias in this study, which is limited to hospital-admitted self-harm. First, self-harm admissions do not capture all self-harm; some are not reported to health services, and some are reported to general practitioners. Second, self-harm could be presented as an unintentional injury due to socio-cultural factors such as shame, religious beliefs/mores, and stigma related to self-harm or mental health, especially among people from some CALD backgrounds (43, 44). Third, some self-harm could be left untreated due to shame and stigma and avoidance of healthcare for that reason. Therefore, the overall incidence of self-harm and health service use observed here may underestimate the extent of the problem, and the results should be interpreted with caution.

There are limitations to using only the country of birth to define CALD backgrounds. As presented in the research methodology, the inclusion of Indigenous people in the non-CALD group (because they were mostly born in English-speaking countries) may have increased the incidence of self-harm in the non-CALD group. This is likely to lower the sensitivity of the analysis in being able to distinguish CALD/non-CALD differences; therefore, the findings in this paper may present an underestimate of the underlying differences in outcomes between these groups. Next, comprehensive data on whether people in CALD groups arrived in Australia through refugee status was unavailable, and this factor should be examined when the data is available. Finally, the findings might also be influenced by the length of stay in Australia of migrants and acculturation: higher levels of acculturation appear to increase the risks of lifetime self-harm (45). In addition, some people in the non-CALD group were born overseas in English-speaking countries, but they might culturally be quite distinct from the remainder of the non-CALD group. The next stage of research should examine self-harm differences in comparison groups of CALD, Indigenous people, and non-CALD people with consideration of the impacts of length of stay in Australia and acculturation.

Moreover, as CALD individuals are migrants, there might be a possibility that some CALD individuals have migrated again, meaning a loss of follow-up in mortality databases. Future research is needed in which immigration linkage data would be involved.

Additionally, to compare the risk of suicide among people from various regions of birth, we grouped regions into bigger groups. Although they showed some similar patterns, we acknowledge that these groups are heterogeneous, and this might affect the results.

Implications

Further research is needed to build on this result, but tentatively, the findings suggest that following hospital-admitted self-harm, being from a CALD background was associated with a lower risk of death and suicide; the risk varied by region of birth. The risk of suicide after self-harm admission among those from Asian backgrounds was as high as that of those from non-CALD backgrounds, while it was lower among people from North Africa and the Middle East. The findings of this study demonstrate the need for suicide prevention following hospital admissions for self-harm for non-CALD people (who are at greatest risk overall) as well as for specific CALD groups (the focus of this study) to save lives and reduce the overall rate of suicide in Australia. To prevent suicide following hospital admissions for self-harm in CALD people, different strategies and resource allocation are likely to be needed for different CALD populations because of their different risk levels and possible risk/protective factors. Qualitative data to understand the risk and protective factors for suicide after self-harm in CALD communities could help inform clinical decisions following psychological assessment. Interventions should focus on raising awareness about the availability of health and mental health services as well as improving health equality in seeking healthcare, especially for new Asian migrants or refugees. More attention should be paid to improving the existing self-harm surveillance systems and on the reporting and publication of CALD-specific self-harm and suicide data.

Data availability statement

The linkage data might contain sensitive information about self-harm and suicide. The data will not be shared for confidentiality reasons. Requests to access these datasets should be directed to https://vahi.vic.gov.au/ourwork/data-linkage.

Ethics statement

The studies involving humans were approved by Monash University Human Research Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements.

Author contributions

TP: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. KO'B: Conceptualization, Supervision, Writing – review & editing. SL: Conceptualization, Supervision, Writing – review & editing. KG: Conceptualization, Supervision, Writing – review & editing. JB-G: Conceptualization, Supervision, Writing – review & editing, Data curation, Methodology.

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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.

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

Publisher's note

Supplementary material

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Breaking through the noise: how to unveil the cognitive impact of long COVID on pre-existing conditions with executive dysfunctions?

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long COVID, pre-existing cognitive impairment, cognitive sequelae, neurodevelopmental conditions, executive dysfunctions, Patient-oriented Research

I am a Canadian patient-oriented researcher working with patient partners with cognitive disorders [notably, autism, learning disorders, and attention deficit/hyperactivity disorders (ADHD)]. During work sessions together, I realized that their experience with the coronavirus disease 2019 (COVID-19) infection felt very different than mine. Those who had been infected explained to the group that the virus had magnified their daily struggles and sometimes still does 3 years later. Symptoms like insomnia, short-term memory issues, sensory overload, and concentration issues, with which they have been dealing for decades, became out of control and very distressing.

Knowing that the long-term sequelae of COVID-19 infection impact similar cognitive processes in a third of infected patients months after the acute phase (1), asking if patients with pre-existing cognitive disorders may be at increased risk of further cognitive impairment following COVID-19 is a fair question. For my fellow partners with neurodevelopmental disabilities, the question is even essential, as, if backed with evidence, it could enable access to long COVID care.

Systematic reviews and meta-analyses have become increasingly important in healthcare settings and are the main starting point for developing clinical practice guidelines. However, regarding the topic of the long-term interplay between neurodevelopmental disorders and the neurocognitive involvement of COVID-19, they might not be of great help. In two authoritative JAMA meta-analyses on long COVID prevalence and risk factors (1, 2), cognitive disorders are not once mentioned. This is not surprising since the individual studies they included were seldomly reporting on neurological or psychiatric disorders in the clinical characterization of their samples. The lack of reporting on those comorbidities is not the only barrier to better understand the potential association between cognitive disorders and long COVID cognitive sequelae. Most studies analyzed in those two meta-analyses excluded directly or indirectly the participation of people with cognitive impairments. Despite legal protections and policy directives for vulnerable groups, excluding patients with cognitive

impairments who are unable to provide consent is common practice in clinical research (3). Long COVID-related randomized clinical trials (RCTs) are no exception. Seven clinical trials published in 2022 and 2023 were testing interventions on patients with long COVID symptoms (retrieved from PubMed with the search terms "long-covid" AND "neuro"). All the seven RCTs excluded people with neurological and/or psychiatric conditions, people with moderate to severe cognitive impairment, or people with a disability, leaving an evidence gap regarding the potential benefits and risks of the interventions in these populations.

Was the extra burden and costs of enrolling people with cognitive impairment the hidden reason for their exclusion? Or was it because including them would have increased the sample heterogeneity generating noise that would have made the signal (treatment efficacy) more difficult to observe?

Whatever the reason, those meta-analyses and clinical trials cannot support policy or clinical decision-making on long COVID management for cognitively vulnerable patients (CVPs). The overlook or exclusion of CVPs from long COVID research not only reinforces the stigmatization of CVPs by disregarding cognitive disorders in research and health policy planning but also limits the generalization of findings on long COVID. Given the high prevalence of cognitive disorders in the population, the global prevalence of 6.2% of long COVID (1) may be an underestimation of the actual proportion of individuals suffering from long-term sequelae post-COVID-19 infection.

Witham and colleagues (4) provided a framework for addressing key issues when designing and delivering inclusive COVID-19 research, notably including strong community engagement, with exclusion criteria kept to a minimum. The literature on patient and public engagement is now abundant, and methodological tools and guidelines to include and account for a diversity of participants in research studies, even with cognitive disorders (3), can easily be found, leaving little excuse for their quasi-systematic exclusion.

However, there is another major issue in long COVID research that impedes the investigation of cognitive sequelae in people with cognitive disorders. The confounding nature of their symptomatology with the neurocognitive sequelae of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection is an added layer of complexity for their inclusion in long COVID research and long COVID care.

The World Health Organization defines clinical cases of the post-COVID-19 condition as individuals that have "*new-onset or persisting symptoms 3 months after onset of symptomatic SARS-CoV-2 infection that were not pre-existing*" (5).

Given this definition and given that most, if not all, of their cognitive symptoms were already present before the COVID-19 infection in my fellow partners, their complaints are considered an exacerbation of their primary diagnoses' symptoms, whatever the reasons for this exacerbation. That their symptoms worsened after the infection matters little in their access to long COVID care and cognitive rehabilitation.

In research, even if they could be included as participants, they might not meet the eligibility criteria of the test group depending on the long COVID case definition used and be misassigned in the control group, potentially leading to insignificant results regarding their risk of long COVID cognitive sequelae.

Obviously, to avoid confounded conclusions because of background noises, a careful analysis is required to identify whether post-acute COVID-19 sequelae are attributable and specific to SARS-CoV-2 infection, or whether they are driven by non-specific aspects of acute illness or the environment, or whether they are just similar in intensity or severity to symptoms pre-SAR-CoV-2 infection. However, as proposed by Shankar and colleagues for people with intellectual disabilities (6), any worsening of a cognitive symptom post-COVID-19 infection requiring a change in treatment or modifying daily functioning should be investigated as potential long COVID sequelae.

Indeed, including participants with neurologic and psychiatric disorders and broadening their case definition to any worsening symptoms post-infection, a few studies found that patients with neurocognitive involvement post-COVID-19 are more likely to have underlying cognitive or neurological disorders compared with those without (7–9), although no studies provided details on the pre-existing conditions.

In studies focused on the interplay of specific cognitive disorders with COVID-19, neurodegenerative dementia is the most actively studied, with parallels drawn from neuropathology to animal models (10, 11). Recently, a detailed cognitive and neuroimaging evaluation of patients with pre-existing dementia, 1 year following SARS-CoV-2 infection, showed a worsening of cognitive symptoms with a specific pattern of decreased attention, executive dysfunctions, delayed information processing speed, mood changes, and memory impairment, indicating an underlying disruption of frontal subcortical networks (12).

Conversely, the interplay between neurodevelopmental disorders and long-term COVID-19 has seldom received attention. Some studies reported an increased risk of long COVID in specific neurodevelopmental conditions or their associated traits, such as autism (13) and ADHD (14), but did not detail the types of long COVID symptoms associated with them. Although a report of a long COVID patient case with neurocognitive sequelae that had a pre-existing ADHD diagnosis suggested that fronto-executive network differences may form a selective vulnerability increasing the risk for cognitive symptoms (15), to my knowledge, no studies have specifically tested this hypothesis on this patient population nor on any neurodevelopmental disorder.

The main issues that prevent us from assessing the association between cognitive disorders and long COVID cognitive sequelae are combined in a recruiting RCT at McMaster University (Ontario, Canada), testing a cognitive rehabilitation intervention in patients with post-COVID neurocognitive sequelae (clinicaltrials.gov - NCT05676047). Although this represents a first-line treatment opportunity for my patient partners, they cannot benefit from it because of their "*previous history of a diagnosis of a neurological disorder affecting thinking*" (*Noise #1 (Background noise): Avoidance of confounding factors*). Some of them have no "*access to an electronic device with internet access and capability for Zoom videoconferencing*" (*Noise # 2 (Low sampling rate): Lack of inclusiveness*). Moreover, for those who would "pass" the two previous eligibility criteria, it is not said how their cognitive symptoms will be attributed "*to COVID and not to other intervening diagnoses associated with cognitive dysfunction*" (*Noise # 3 (Low signal quality): Lack of clarity on case definition*).

In 2024, and in light of the progress made to do inclusive research, can't we do better than this for this already highly vulnerable group? "*Noise is part of the real world*" (16), and so are people with cognitive disorders. Instead of considering them as noises, let's start hearing their voices and improve long COVID research for a better care for all.

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Risk of major depressive increases with increasing frequency of alcohol drinking: a bidirectional two-sample Mendelian randomization analysis

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Introduction: A growing body of evidence suggests that alcohol use disorders coexist with depression. However, the causal relationship between alcohol consumption and depression remains a topic of controversy.

Methods: We conducted a two-sample two-way Mendelian randomization analysis using genetic variants associated with alcohol use and major depressive disorder from a genome-wide association study.

Results: Our research indicates that drinking alcohol can reduce the risk of major depression (odds ratio: 0.71, 95% confidence interval: 0.54~0.93, p = 0.01), while increasing the frequency of drinking can increase the risk of major depression (odds ratio: 1.09, 95% confidence interval: 1.00~1.18, p = 0.04). Furthermore, our multivariate MR analysis demonstrated that even after accounting for different types of drinking, the promoting effect of drinking frequency on the likelihood of developing major depression still persists (odds ratio: 1.13, 95% confidence interval: 1.04~1.23, p = 0.005). Additionally, mediation analysis using a two-step MR approach revealed that this effect is partially mediated by the adiposity index, with a mediated proportion of 37.5% (95% confidence interval: 0.22 to 0.38).

Discussion: In this study, we found that alcohol consumption can alleviate major depression, while alcohol intake frequency can aggravate it.These findings have important implications for the development of prevention and intervention strategies targeting alcohol-related depression.

KEYWORDS

major depression (MDD), alcohol consumer, alcohol intake frequency, fat percentage, BMI

Introduction

Depression is a widespread mental disorder that impacts individuals globally and has emerged as the sixth primary burden of disease on a global scale (1, 2). The prevalence of depression has escalated over time, with a 50% surge in worldwide instances recorded between 1990 and 2017 (3). Consequently, comprehending the underlying causes of depression is imperative for its prevention. Extensive evidence has verified that several risk factors are associated with depression,

encompassing family history, stress, and specific social elements (4). Alcohol, renowned for fostering social interaction, sexual conduct, and stress alleviation across the globe (5), is also employed as a self-treatment remedy for patients enduring inherent or secondary mental disorders (6). Consequently, investigating the correspondence between alcohol consumption and depression remains a captivating subject (7).

Drinking and depression frequently coexist, and the connection between the two is intricate. The precise causal relationship between them remains uncertain (8). Some investigations have suggested that alcohol dependence is linked to an elevated risk of depression. For instance, a study of 3,967 adolescents in an ongoing cohort discovered that consuming alcohol was an autonomous factor contributing to depression (9). Another cohort study based on the US adult population also disclosed that alcohol use disorder substantially heightens the chance of subsequent depression (10). These investigations propose that alcohol use disorder can instigate depression. In contrast, there are also studies indicating that depression can result in increased alcohol consumption (11). Turner et al. (12) conducted a comprehensive review from 1997 to 2018 encompassing self-medication, mood disorders, and anxiety, and determined that mood disorders and anxiety elevate the risk of substance use disorders. Additionally, Jin-Seok Lee et al. (13) verified in mice that depression attributable to social isolation can be intensified by neuroinflammation caused by microglia, leading to augmented alcohol intake. Hence, it is evident that the emergence of alcohol use disorder and depression is a reciprocal and reinforcing relationship. On the contrary, certain investigations have displayed that moderate drinking might diminish the likelihood of depression (10, 14, 15). Alcohol has been found to normalize the sphingomyelin and monoamine functions of the nucleus accumbens in depressed mice, thereby alleviating depressive behavior (16). Furthermore, other studies have substantiated that drinking or excessive drinking does not amplify the risk of depression (17). Therefore, additional research is required to ascertain the causal association between drinking and depression, as well as comprehend the bidirectional nature of this connection.

To confirm the reliability of RCT study results in terms of causal inference, additional research methods are necessary due to the time-consuming nature of RCT studies (18). Mendelian randomization research is a particular approach that aims to infer potential causal associations between exposure factors and outcomes by utilizing genetic variation as an instrumental variable (19). This research method leverages the fact that genetic variation is randomly assigned during meiosis and fertilization, making it unaffected by self-selection and predetermined before the onset of diseases. Consequently, this minimizes the impact of confounding factors and issues related to reverse causation (20). To evaluate the possible causal relationship between depression and drinking (including frequency and type), a two-sample Mendelian randomization analysis was performed in this particular investigation. Furthermore, a two-step Mendelian randomization analysis was employed to explore the potential mediator between depression and drinking.

Methods

Two-sample study design

The study utilized two-sample Mendelian randomization (MR) to analyze the relationship between alcohol consumption (frequency and type) and major depression. The researchers conducted univariate and multivariate analyses using summary genetic data from GWAS and UK Biobank. Mendelian randomization is a method that leverages genetic variation to estimate the causal effects of risk factors on disease outcomes. To ensure the validity of MR studies, three assumptions must be met: (1) genetic variants are associated with risk factors (correlation assumption), (2) there are no confounding factors influencing the associations between genetic variants and outcomes (independence assumption), and (3) the restrictive assumption is excluded (21).

Date sources

Severe depression data were obtained from the depression meta-analysis conducted by Howard et al. (22), which examined various depression phenotypes in participants from 23andMe, PGC, and UK Biobank, including 170,756 patients with depression and 329,443 controls. However, participant data from 23andMe were not included in the publicly available data. The alcohol consumption data were sourced from the GWAS study conducted by Clarke et al. (23), which analyzed the weekly and monthly drinking volume as well as drinking type of 112,117 participants from UK Biobank. Other data, such as drinking frequency and drinking type, were extracted from published GWAS studies from UK Biobank. Additionally, there are several risk factors associated with alcohol consumption and depression, including inflammation levels [inflammatory biomarkers IL-6 (24) and C-reactive protein (25)], acid sphingomyelinase (16), body mass index (26), body fat percentage (BFP) (27), and diet-related metabolites (28). These data were obtained from the IEU Open GWAS database summary website.[1] The study aimed to assess whether these factors mediate the causal relationship between alcohol use and major depression. The relevant data are organized in Supplementary Table 1.

Selection of the genetic instrumental variables

To investigate the causal relationship between alcohol consumption and major depression, we conducted a study using genome-wide association studies (GWAS). We identified a total of 450 SNPs for alcohol consumption, 8,460 SNPs for alcohol intake frequency, and 4,606 SNPs for major depression that reached genome-wide significance ($p < 5 \times 10^{-8}$; Supplementary Data Sheet 1). To ensure accuracy, we used linkage disequilibrium statistics (LD) to screen for significant SNPs and excluded any overlap between genetic sites ($r^2 < 0.001$, kb = 10,000). Additionally, we accounted for potential confounding factors by examining each SNP in the PhenoScanner GWAS database (29, 30) and eliminating SNPs that were influenced by factors such as smoking, anxiety, mental stress, and pain.

1 https://gwas.mrcieu.ac.uk/

Testing instrument strength and statistical power

Instrument strength is determined by the magnitude and precision of the association of genetic instruments with risk factors, which is represented by the *F* value. The F value is calculated based on the proportion of variance in the phenotype (R^2), sample size (N), and number of instruments (k), using the formula $F = R^2\ (N-k-1)/k\ (1-R^2)$ (31). R_i^2 for instrument i can be calculated using the approximation $R_i^2 = 2 \times EAF_i \times (1-EAF_i) \times \beta_i^2$, where EAF_i represents the effect allele frequency and β_i is the estimated genetic effect of exposure (32). An F statistic ≥10 indicates that the risk of incorporating weak correlation instrument bias in the MR analysis is relatively low (33).

Statistical analyses

Univariate Mendelian randomization analysis

Univariate Mendelian randomization analysis was conducted using the inverse-variance weighted (IVW) method under a multiplicative random effects model (31). This method combines Wald ratio estimates for each SNP into a single causal estimate for each risk factor, where each estimate is obtained by dividing the SNP-outcome association by the SNP-exposure association (33). To address potential bias introduced by pleiotropic instrumental variables, sensitivity analysis was performed to resolve heterogeneity in causal estimates. In fixed effects variance weighted analysis, Cochran's Q value was calculated to quantify the heterogeneity produced by different genetic variants, with $p \leq 0.05$ indicating the presence of heterogeneity (34, 35). If heterogeneity was detected, a random-effects IVW MR analysis was employed. MR-Egger regression, based on the intercept term, was used to evaluate the presence of horizontal pleiotropy, with pleiotropy bias considered to exist when the deviation $p < 0.05$ (36). Additionally, sensitivity analyses were conducted using the Weighted median (37), Weighted mode (38), MR-Egger regression (39), and Simple mode methods. Briefly, the weighted median method estimates the causal effect based on the median of the weighted empirical density function of individual SNP effect estimates. This method remains applicable even in cases of horizontal pleiotropy and partial violation of the Mendelian randomization assumption (37). The weighted mode method clusters SNPs based on the similarity of causal effects and estimates causal effects based on the cluster with the largest number of SNPs, thereby providing unbiased estimates (38). Additionally, we used MR-PRESSO to assess the presence of outlier SNPs. MR-PRESSO compares the distance of all genetic instruments to the regression line (sum of squared residuals) to the distance expected under the null hypothesis of no horizontal pleiotropy (40). Furthermore, we performed a leave-one-out SNP analysis to evaluate the impact of individual variants on the observed causal effects (41).

Multivariate Mendelian randomization analysis

In order to investigate the relationship between drinking and severe depression, we conducted a multivariate Mendelian randomization analysis (42) that considered the frequency and type of drinking. This analysis allowed us to simultaneously estimate the effects of drinking frequency and the coexistence of different types of alcohol (beer/cider, fortified wine, red wine, white wine/champagne, spirits, other alcohol) on depression severity. To ensure the accuracy of our results, we used genetic tools from relevant GWAS and employed linkage disequilibrium detection ($r^2 = 0.001$, kb = 10,000) to prevent SNP overlap. Additionally, we utilized LASSO analysis to eliminate exposure factors with collinearity.

Mediation analysis

Mediation analysis was conducted to evaluate the causal effects of potential mediator exposures on major depression. Firstly, genetic tools were used to estimate the effects of alcohol use and alcohol frequency on the mediators. Secondly, genetic tools for the identified mediators were used to assess their causal effects on major depression. The "coefficient product" method (43) was employed to determine the indirect effect of drinking and drinking frequency on the risk of major depression through each potential mediator, if evidence supported the influence of these factors. Standard errors for indirect effects were obtained using the delta method (44).

Results

Univariate Mendelian randomization analysis

To investigate the correlation between alcohol intake and major depressive disorder, we performed a two-sample Mendelian randomization analysis. The analysis included all SNPs listed in Supplementary Data Sheet 2. Our univariate MR analysis revealed a causal relationship, indicating that alcohol consumption is a protective factor for major depression. The IVW odds ratio (OR) was 0.71 with a 95% confidence interval (CI) of 0.54 to 0.93, and a *p*-value of 0.01 (Table 1). The absence of weak correlation bias was supported by the *F* value (Table 1), and heterogeneity was not detected according to Cochran's Q value (Q = 3.63, $p = 0.16$; Supplementary Data Sheet 3). No potential outliers were identified by MR-PRESSO. Additionally,

TABLE 1 MR results for the relationship between alcohol and depression.

Method	Number of SNPs	F	OR (95%CI)	*P*
Alcohol consumption on major depression				
IVW	3	96	0.71 (0.54–0.93)	0.01
Weighted median			0.71 (0.56–0.91)	0.01
Weighted mode			0.75 (0.52–1.08)	0.26
Simple mode			0.59 (0.38–0.91)	0.14
MR-Egger			1.77 (0.34–9.22)	0.62
Alcohol intake frequency on major depression				
IVW	66	6,140	1.09 (1.00–1.18)	0.04
Weighted median			1.06 (0.96–1.16)	0.24
Weighted mode			1.00 (0.80–1.27)	0.95
Simple mode			1.09 (0.85–1.40)	0.50
MR-Egger			0.97 (0.72–1.32)	0.86

MR-Egger intercept analysis provided no evidence of directional pleiotropy ($p = 0.47$; Supplementary Data Sheet 3). The weighted median analysis yielded consistent results with the IVW method (OR = 0.71; 95% CI 0.56 to 0.91; $p = 0.01$), further supporting the protective effect of alcohol consumption on the risk of major depression. The forest plot in Figure 1A displays the estimates of the effect of SNPs associated with alcohol consumption on the risk of major depression. Additionally, displayed in Figure 1B is a scatterplot which showcases the correlation amid the consumption of alcohol and the likelihood of encountering significant depression. The slopes of various regression studies are denoted by distinctively colored lines. A negative causal relationship exists between the frequency of alcohol intake and major depression. As the frequency of drinking increases, the probability of suffering from major depression also increases. The IVW OR value is 1.09 with a 95% CI of 1.00 to 1.18, and a p value of 0.04 (Table 1). The F value indicates no presence of weak correlation bias (Table 1). The inclusion of SNPs shows heterogeneity, as indicated by Cochran's Q value of 160 and a p value of 4.41×10^{-10} (Supplementary Data Sheet 4). However, the IVW method is not affected by heterogeneity, ensuring the credibility of the results. MR-PRESSO analysis did not detect any outliers. Additionally, MR-Egger intercept analysis found no evidence of directional pleiotropy with a p value of 0.47 (Supplementary Data Sheet 4). The forest plot in Figure 1C presents the estimates of the effect of SNPs associated with alcohol intake frequency on the risk of major depression. Furthermore, Figure 1D shows a scatter plot illustrating the association between alcohol intake frequency and the risk of major depression.

Regarding the protective effect of alcohol consumption on major depression, we investigated the relationship between different types of

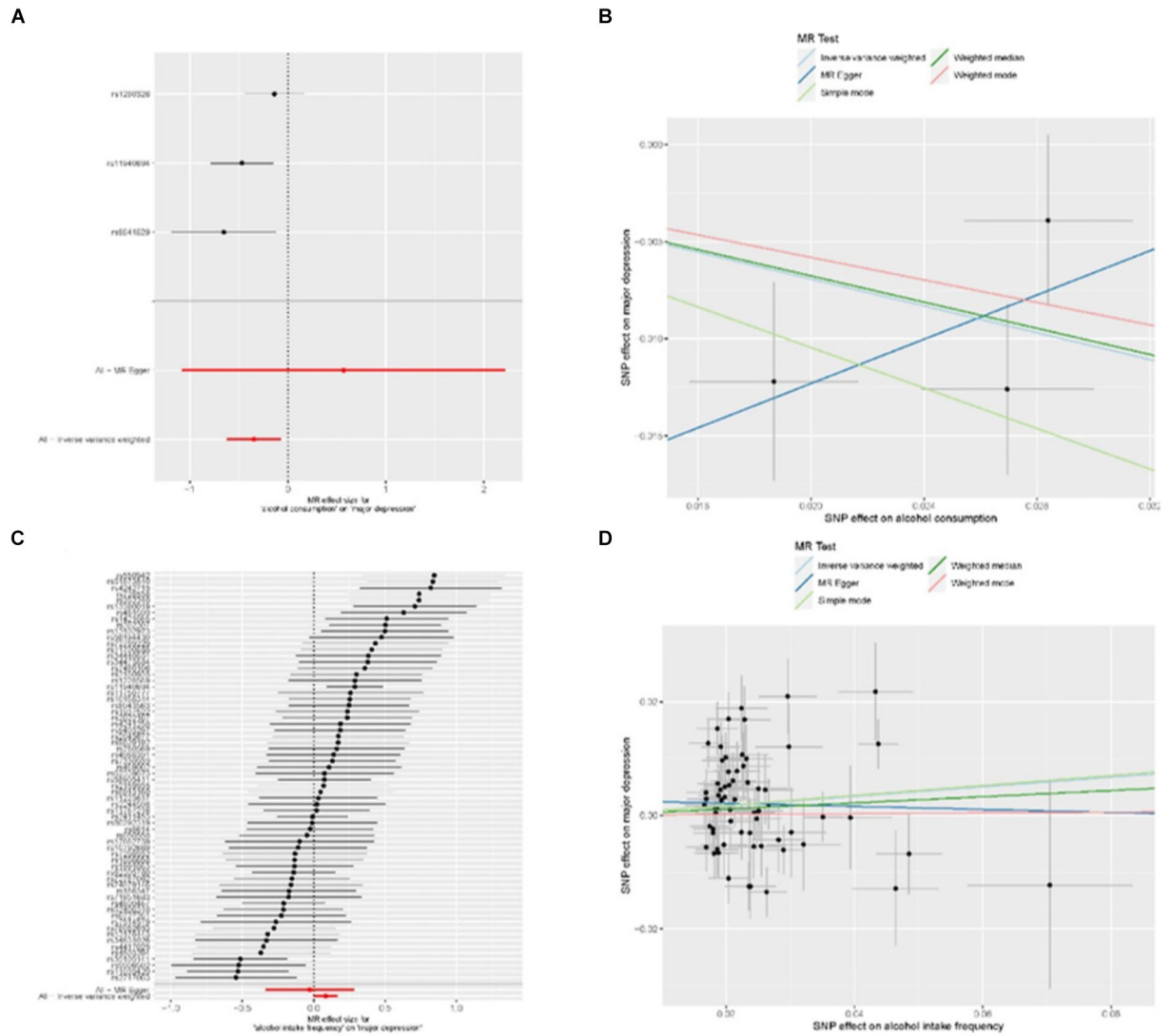

FIGURE 1
MR results for the relationship between alcohol and major depression. **(A)** forest plot of individual and combined SNP MR-estimated effect sizes. The effect estimates represent the log odds for major depression increase in alcohol consumption, and the error bars represent 95% CIs. **(B)** Scatter plot of SNP effects on relative alcohol consumption vs. major depression, with the slope of each line corresponding to the estimated MR effect per method. The data are expressed as raw β values with 95% CIs. **(C)** Forest plot of individual and combined SNP MR-estimated effect sizes, that is alcohol intake frequency and major depression. **(D)** Scatter plot of SNP effects on relative alcohol intake frequency vs. major depression.

drinking and this effect. We conducted separate single-factor Mendelian analyses to examine the effects of intake of beer/cider, fortified wine, red wine, white wine/champagne, spirits, and other alcohol on major depression. However, we found that there were too few strongly correlated SNPs when extracting SNPs, so we adjusted the p-value to 5×10^{-6} (Supplementary Data Sheet 5). The included SNPs can be found in Supplementary Data Sheet 6. The results obtained using the IVW method indicated that there was no significant causal relationship between the type of drinking and the occurrence of major depression. OR values and corresponding 95% CI for each type of alcohol were as follows: beer/cider (OR value 1.00, 95% CI 0.91~1.09, $p = 0.95$), fortified wine (OR value 0.99, 95% CI 0.76~1.28, $p = 0.93$), red wine (OR value 0.97, 95% CI 0.88~1.11, $p = 0.81$), white wine/champagne (OR value 0.98, 95% CI 0.86~1.11, $p = 0.73$), spirits (OR value 1.13, 95% CI 1.00~1.29, $p = 0.06$), and other alcohol (OR value 1.02, 95% CI 0.82~1.28, $p = 0.84$; Supplementary Table 2).

Multivariate Mendelian randomization analysis

To investigate the effects of alcohol consumption and alcohol intake frequency on major depression, we conducted a multivariate Mendelian randomization analysis. We specifically examined the affect of different types of alcohol on major depression. The findings from our analysis revealed that when considering multiple types of drinking, alcohol consumption no longer showed a causal effect on major depression (OR value 1.05, 95% CI 0.79~1.39, $p = 0.76$). However, alcohol intake frequency remained a significant contributing factor for major depression (OR value 1.13, 95% CI 1.04~1.23, $p = 0.005$), as presented in Table 2.

Causal inference of major depression on alcohol consumption and alcohol intake frequency

In order to examine the potential causal effect of major depression on alcohol consumption and alcohol intake frequency, we used major depression as an exposure factor and performed a univariate Mendelian randomization analysis. The SNPs used in the analysis are shown in Supplementary Data Sheet 7. The results of the analysis are presented in Table 3. Our findings indicate that major depression does not have a causal effect on alcohol consumption (OR value 1.00, 95% CI 0.96 ~ 1.03, $p = 0.82$). Regarding the causal analysis of major depression on alcohol intake frequency, the weighted median method suggests that major depression is involved with an increase in alcohol intake frequency (OR value 1.09, 95% CI 1.02~1.17, $p = 0.007$). However, according to the IVW method, major depression does not have an effect on alcohol intake frequency (OR value 1.08, 95% CI 1.00~1.16, $p = 0.07$). It is important to consider that the data analyzed in this study exhibits strong heterogeneity (Cochran's Q value is 38, $p = 6.93 \times 10^{-21}$; Supplementary Data Sheet 8). Therefore, it is concluded that major depression does not have a causal relationship with alcohol intake frequency.

TABLE 2 Multivariable MR analysis estimating the effect of relative alcohol on MDD, conditioning on different alcohol.

Method	Number of SNPs	OR (95%CI)	*P*
Alcohol consumption			
IVW	4	1.05 (0.79–1.39)	0.76
Alcohol intake frequency			
IVW	79	1.13 (1.04–1.23)	0.51×10^{-2}

Mediation analysis

Considering the potential impact of alcohol consumption on depression-related metabolites (45), we performed a two-step Mendelian randomization study, incorporating inflammation levels [including IL-6 (24) and CRP (25)], diet-related metabolites (28) (such as vitamin A, mannitol, and hippuric acid), acid sphingomyelinase (16), body mass index (26), and BFP (27) as mediating factors. Figure 2 (see Supplementary Data Sheet 9 for included SNPs) illustrates the study design. In the first step, we conducted univariate MR analyses to assess the causal effects of alcohol consumption and alcohol intake frequency on the aforementioned mediating factors. Our findings indicated a causal relationship between alcohol consumption and alcohol intake frequency with BMI, showing that alcohol consumption increases BMI (IVW method $\beta = 0.33$, 95% CI 0.08 to 0.59, $p = 0.97 \times 10^{-2}$), and alcohol intake frequency also leads to an increase in BMI (IVW method $\beta = 0.21$, 95% CI 0.09 to 0.32, $p = 3.5 \times 10^{-4}$). (Please refer to Table 4 for details.) Moreover, we observed a causal relationship only between alcohol intake frequency and the BFP. Alcohol intake frequency was found to be a contributing factor to the increase in the BFP (IVW method $\beta = 0.14$, 95% CI 0.07 to 0.32, $p = 6.94 \times 10^{-5}$), while alcohol consumption did not exhibit this effect (IVW method $\beta = 0.09$, 95% CI −0.10 to 0.28, $p = 0.33$), as shown in Table 4. The remaining factors showed no causal effect on alcohol consumption and alcohol intake frequency (Supplementary Tables 3, 4). Subsequently, we conducted a multivariate MR analysis involving BMI, BFP, and major depression. The results revealed that only the BFP had a causal effect on major depression when combined with BMI. An increase in the BFP was associated with an elevated risk of major depression ($\beta = 0.21$, 95% CI 0.03 to 0.38, $p = 0.02$), as shown in Table 4. Therefore, we examined the impact of alcohol consumption frequency on major depression by considering the BFP as a mediator. Our findings revealed that the BFP had a mediation effect value of 0.03 (95% CI: 0.01–0.03, $p = 2.30 \times 10^{-4}$), with a mediation ratio of 37.5% (95% CI, 0.22–0.38), as presented in Table 5.

Discussion

In this study, we conducted an analysis on the causal effects of alcohol consumption and alcohol intake frequency on major depression. We found that alcohol consumption can alleviate major depression without considering different types of drinking, while alcohol intake frequency can aggravate it. However, when we comprehensively considered different types of drinking and possible mediating factors, we concluded that alcohol intake frequency

is the main cause of aggravating major depression. One of the reasons for this is that alcohol intake frequency worsens the BFP, which in turn aggravates major depression.

In analyzing the causal effects of alcohol consumption and alcohol intake frequency on major depression, our study emphasizes the importance of the amount of alcohol consumed. The data for alcohol consumption was obtained from the GWAS study conducted by Clarke et al. (23). The average age of the participants in this study was 59.6 years old, with an average weekly alcohol consumption of 121.04 g, which is below the theoretical minimum risk drinking amount of 130.90 g/week (46). Therefore, the participants in this study can be classified as moderate drinkers. Our research findings suggest that moderate drinking can alleviate major depression. However, as alcohol intake frequency increases and the amount of drinking exceeds the theoretical minimum drinking amount, alcohol consumption becomes a factor that increasing the risk of major depression. This viewpoint is partially supported by the study conducted by Hammerton et al. (47). In their investigation, encompassing a sample of 3,902 adolescents, they discovered a direct correlation between alcohol dependency during the age of 18 and the onset of depression at the age of 24. However, no substantiating proof was identified to support the notion of a connection between alcohol usage and depression. Another study by Li et al. (48) examined the correlation between alcohol intake, alcohol use disorder, and the risk of depression. Their findings revealed that moderate drinking (0 g~84 g/week) reduces the risk of depression, while alcohol use disorder significantly increases the risk of subsequent depression (relative risk 1.57, 95% CI 1.41~1.76). This indicates that excessive drinking to the extent of alcohol use disorder can indeed contribute to depression.

TABLE 3 Bidirectional MR results for the relationship between major depression and alcohol.

Method	Number of SNPs	F	OR (95%CI)	P
Major depression on alcohol consumption				
IVW	42	7,401	1.00 (0.96–1.03)	0.81
Weighted median			0.99 (0.94–1.03)	0.56
Weighted mode			0.95 (0.88–1.03)	0.25
Simple mode			0.93 (0.83–1.03)	0.17
MR-Egger			1.02 (0.89–1.18)	0.74
Major depression on alcohol intake frequency				
IVW	39	6,860	1.08 (1.00–1.16)	0.07
Weighted median			1.09 (1.02–1.17)	0.007
Weighted mode			1.11 (0.97–1.28)	0.14
Simple mode			1.12 (0.96–1.31)	0.15
MR-Egger			0.96 (0.65–1.44)	0.86

A variety of biological mechanisms can provide evidence for the causal relationship between alcohol consumption and depression, such as the serotonin hypothesis. Serotonin (5-hydroxytryptamine), a neurotransmitter, is known to be related to the pathophysiology and treatment of depression (49). The synthesis of serotonin in the brain depends on the level of its precursor, tryptophan, in the plasma (50). During short-term or long-term alcohol abuse, the activity of hepatic tryptophan pyrrolase that responsible for tryptophan degradation increases, resulting in a decrease in plasma tryptophan levels. This reduction in tryptophan levels leads to a decrease in serotonin synthesis in the brain (51). The mediating effect of obesity is also related to tryptophan metabolism. Obesity is considered a chronic inflammatory state, with adipocytes secreting inflammatory cytokines such as IFN-γ, TNFα, and IL-1β (52). Alcohol exacerbates this inflammatory state, which in turn stimulates indoleamine 2,3-dioxygenase (IDO) and leads to the catabolism of tryptophan. This further reduces plasma tryptophan levels and hampers the synthesis of serotonin in the brain (53). In addition to reducing

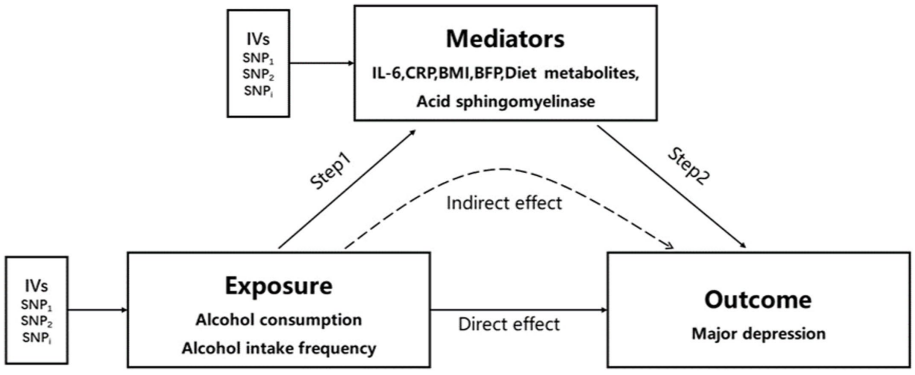

FIGURE 2
Two-step MR analysis framework. Step 1 estimated the causal effect of the exposure on the potential mediators, and step 2 assessed the causal effect of the mediators on major depression. "Direct effect" indicates the effect of exposure on major depression. "Indirect effect" indicates the effect of exposure on major depression through the mediator. IVs, instrumental variables.

plasma tryptophan content, alcohol can directly decrease the number of serotonin neurons in the dorsal raphe nucleus through inflammatory reactions (54), contributing to the development of depression. The presence of obesity can intensify these inflammatory reactions (53). Another theory on the pathogenesis of depression involves the hyperfunction of the hypothalamic–pituitary–adrenal (HPA) axis, characterized by increased activity of corticotropin-releasing factor, reduced negative feedback function, and elevated cortisol levels (55). Alcohol not only affects the HPA axis of the fetus through maternal intake during early life, increasing the risk of subsequent depression (56), but it can also directly stimulate the HPA axis in adults, promoting the onset of depression (57). Cortisol has been found to facilitate the conversion of preadipocytes into mature adipocytes, and an elevation in cortisol levels is associated with an increase in fat accumulation (58). However, the precise mechanism through which alcohol consumption exacerbates depression by affecting adiposity requires further investigation through rigorous and high-quality studies.

For the reduction of depression risk through moderate alcohol consumption, it appears to be associated with the enhancement of dopaminergic and GABAergic signaling (59). *In vivo* microdialysis studies conducted on awake and freely moving rodents have demonstrated that alcohol increases dopamine levels in the nAc, thereby suggesting a decrease in depressive symptoms (60, 61). Additionally, alcohol can enhance the function of GABAergic transmission in the amygdala, which is also linked to resistance against depressive symptoms (62, 63). It is important to note that enhanced dopaminergic and GABAergic signaling is also associated with addictive behaviors (64). Therefore, moderate alcohol consumption can reduce the risk of depression, while excessive alcohol consumption can lead to addictive behaviors, which may also be indicative of depression. The influence of social factors may contribute to the diminished visibility of the causal connection between major depression and alcohol consumption when taking into account the collective impact of various alcoholic beverages. Research indicates that individuals who prefer red wine or white wine/champagne tend to have higher education levels and greater economic income compared with those who prefer beer/cider. This may explain why the consumption of red wine and white wine/champagne is linked to a lower risk of depression (65–68). As the population's income and education levels continue to rise, it will be necessary to reevaluate the impact of different drinking preferences on major depression in the future.

In this research, a comprehensive two-sample Mendelian randomization study was conducted, utilizing a substantial number of stable and persistent genetic variants extracted from the GWAS summary. The primary objective of this investigation was to delve into the potential causal relationship between alcohol consumption, alcohol intake frequency and major depression, specifically focusing on major depression and normal drinking. Notably, the study exclusively focused on individuals of European descent to ensure the absence of ethnic bias. The decision to employ MR analysis instead of retrospective studies was made due to its ability to eliminate confounding variables and its immunity to reverse causation. Furthermore, MR studies offer larger sample sizes and a closer approximation to random assignment in comparison to randomized controlled trials. Moreover, our study utilized instrumental variables that were considerably more detailed, comprehensive, and reliable when compared to previous research endeavors. However, it is crucial to acknowledge certain limitations within this study. Firstly, the biological significance of the genetic tools employed in this research remains unknown, thus we cannot completely dismiss the possibility of violations of the independence and exclusion restriction assumptions, particularly regarding pleiotropy. Nonetheless, we incorporated various methods, such as sensitivity analysis employing the Cochran Q statistic, MR-PRESSO, weighted median, weighted mode, and MR-Egger, to determine trustworthy causal estimates. Secondly, the SNPs associated with alcohol consumption predominantly originated from the UK Biobank study, which predominantly consisted of individuals with a mean age of 59.6 years. Conversely, the sample used in the major depressive disorder GWAS encompassed a broader age range. Consequently, it is plausible that alcohol usage among younger individuals could be influenced by other variants with distinct associations with major depression,

TABLE 4 Two-step MR results for the relationship between major depression and alcohol.

Method	Number of SNPs	OR (95%CI)	β (95%CI)	*P*
Step1. Alcohol consumption on BMI				
IVW	3	1.40 (1.08–1.80)	0.33 (0.08–0.59)	0.97×10^{-2}
Step1. Alcohol consumption on BFP				
IVW	3	1.10 (0.91–1.33)	0.09 (−0.10–1.28)	0.33
Step1. Alcohol intake frequency on BMI				
IVW	81	1.23 (1.10–1.38)	0.21 (0.09–0.32)	0.35×10^{-3}
Step1. Alcohol intake frequency on BFP				
IVW	81	1.15 (1.07–1.24)	0.14 (0.07–0.21)	0.69×10^{-6}
Step2. BMI on major depression, conditioning on BFP				
IVW	353	0.99 (0.88–1.12)	−0.008 (−0.13–0.11)	0.90
Step2. BFP on major depression, conditioning on BMI				
IVW	286	1.23 (1.03–1.47)	0.21 (0.03–0.38)	0.02

TABLE 5 The mediation effect of alcohol intake frequency on major depression via BFP.

Mediator	Total effect	Direct effect A	Direct effect B	Mediator effect	*P*	Mediated proportion
	β (95%CI)	β (95%CI)	β (95%CI)	β (95%CI)		β (95%CI)
BFP	0.08 (0.002–0.17)	0.14 (0.07–0.21)	0.21 (0.03–0.38)	0.03 (0.01–0.03)	2.30×10^{-4}	37.5% (0.22–0.38)

However, it should be duly noted that relevant GWAS data pertaining to this phenomenon is not yet accessible. Thirdly, it is important to note that we cannot confirm whether the individuals in the study received psychotherapy as part of their treatment. The inclusion of psychotherapy may have some influence on the study's results. This is because, if the participants had received psychotherapy, it is likely that it would have helped them reduce their alcohol usage and alleviate their significant depression. Therefore, these factors must be considered when interpreting the study's conclusions. Lastly, while MR can effectively serve as an alternative to randomized controlled trials when assessing causality, it is crucial to acknowledge that genetic variation is inherently influenced by innate factors and may not entirely reflect the impact of a particular intervention on the outcomes. To obtain definitive confirmation of causal relationships, it may be necessary to conduct randomized controlled trials (RCTs) on preventive interventions. Additionally, it should be noted that the depression genome-wide association studies (GWAS) utilized in our analysis did not account for the diversity of major depressive disorder (MDD), specifically atypical depression and melancholic depression.

To explore the potential correlation between depression and alcohol consumption, a bidirectional two-sample MR analysis was executed in this research. The results show strong genetic evidence supporting a causal connection between increased frequency of drinking and heightened susceptibility to major depression. Furthermore, it was observed that the impact of augmented alcohol intake on depression risk is partially influenced by the BFP. These findings have important therapeutic implications for people with alcohol use disorder and MDD. Individuals with comorbid drinking disorders and MDD may benefit from a progressive reduction in alcohol use and weight management during treatment rather than abrupt alcohol abstinence. This approach can help align patients' psychological and physiological elements with treatment goals, potentially reducing psychological stress associated with alcohol withdrawal and alleviating depression symptoms. A less rigorous treatment strategy may also increase patient compliance and overall therapy efficacy. It is advisable to carry out a robust randomized clinical trial in the future to substantiate the significance of these discoveries.

Data availability statement

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

Ethics statement

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

Author contributions

WF: Writing – original draft, Writing – review & editing, Data curation, Investigation. BZ: Writing – review & editing, Funding acquisition, Project administration, Supervision, Validation. PD: Data curation, Writing – review & editing. Y-hB: Methodology, Writing – review & editing. ZJ: Validation, Writing – review & editing. XL: Investigation, Writing – review & editing. XZ: Software, Writing – review & editing. KZ: Data curation, 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.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2024.1372758/full#supplementary-material

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Provider perspectives on the impact of COVID-19 on treatment of substance use and opioid use disorders among American Indian and Alaska Native adults

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Introduction: American Indian/Alaska Native (AI/AN) communities are more likely to suffer negative consequences related to substance misuse. The COVID-19 pandemic exacerbated the opioid poisoning crisis, in combination with ongoing treatment barriers resulting from settler-colonialism, systemic oppression and racial discrimination. AI/AN adults are at greatest risk of COVID-19 related serious illness and death. In collaboration with an Indigenous community advisory board and Tribal leadership, this study explored AI/AN treatment provider perceptions of client-relatives' (i.e., SUD treatment recipients) experiences during the pandemic from 2020 to 2022.

Methods: Providers who underwent screening and were eligible to participate ($N = 25$) represented 6 programs and organizations serving rural and urban areas in Washington, Utah, and Minnesota. Participants engaged in audio-recorded 60–90 min semi-structured individual interviews conducted virtually via Zoom. The interview guide included 15 questions covering regulatory changes, guidance for telemedicine, policy and procedures, staff communication, and client-relatives' reactions to implemented changes, service utilization, changes in treatment modality, and perceptions of impact on their roles and practice. Interview recordings were transcribed and de-identified. Members of the research team independently reviewed transcripts before reaching consensus. Coding was completed in Dedoose, followed by analyses informed by a qualitative descriptive approach.

Results: Five main domains were identified related to client-relative experiences during the COVID-19 pandemic, as observed by providers: (1) accessibility, (2) co-occurring mental health, (3) social determinants of health, (4) substance use,

coping, and harm reduction strategies, and (5) community strengths. Providers reported the distinctive experiences of AI/AN communities, highlighting the impact on client-relatives, who faced challenges such as reduced income, heightened grief and loss, and elevated rates of substance use and opioid-related poisonings. Community and culturally informed programming promoting resilience and healing are outlined.

Conclusion: Findings underscore the impact on SUD among AI/AN communities during the COVID-19 pandemic. Identifying treatment barriers and mental health impacts on client-relatives during a global pandemic can inform ongoing and future culturally responsive SUD prevention and treatment strategies. Elevating collective voice to strengthen Indigenous informed systems of care to address the gap in culturally-and community-based services, can bolster holistic approaches and long-term service needs to promote SUD prevention efforts beyond emergency response efforts.

KEYWORDS

American Indian and Alaska Native, COVID-19, medications for opioid use disorders, opioid use disorder, substance use disorders, harm reduction, access, health equity

Introduction

Harmful outcomes related to substance use disproportionally impact many American Indian/Alaska Native (AI/AN) communities compared to other racial and ethnic groups. This inequity exists even as there are higher rates of abstinence from certain substances (i.e., alcohol) among AI/AN adults compared with non-Hispanic Whites (1, 2). Higher rates of alcohol and drug use disorders are associated with historical trauma and political factors including colonization, forced removals, and efforts to eradicate culture and language, much of which impacts current social and economic challenges experienced by some Tribal communities (1, 3–10).

Structural factors contribute to elevated substance use risks which result in psychological distress and barriers to care that were further compounded during the COVID-19 pandemic (11–14). Among the general population in the US, the pandemic resulted in significant decreases in life expectancy, increased unemployment, economic instability, social isolation, depression, fear, and anxiety (15–18). From 2019 to 2020, rates of fatal drug poisonings among AI/AN adults surpassed other racial/ethnic groups, increasing 39% between 2019 to 2020 (19). These combined public health emergencies further strained AI/AN populations.

AI/AN communities led health care innovation during the pandemic, utilizing community driven strategies to attain high rates of COVID-19 vaccinations. They similarly innovated to continue to provide opioid treatment during the pandemic. To address the treatment needs of people experiencing substance use disorders (SUD), especially opioid use disorder (OUD), during the COVID-19 emergency, changes were made to meet service delivery demands (20). One study by Wendt et al. (21) assessing the impact of COVID-19 among Indigenous communities in the US and Canada, noted that the pandemic increased the flexibility in prescribing medications for OUD, dosing schedules, and access through the expansion of telemedicine. At the same time, providers also described reduced access to traditional Indigenous healing and medicine practices for addiction recovery, linking this to increases in substance use and mental health symptoms and decreases in overall well-being (21). Although regulatory flexibility was meant to promote greater availability and accessibility, little is known about the effectiveness of these changes among programs serving AI/AN communities.

To better understand the impact of these regulatory changes and the ways AI/AN communities navigated the service delivery landscape during the COVID-19 pandemic, we conducted semi-structured qualitative interviews with SUD treatment providers in AI/AN-serving programs. We assessed provider perspectives of the pandemic on the health, well-being, substance use and treatment access of client-relatives (throughout this paper we refer to service recipients as client-relatives). This term, 'client relative' was among the research team and chosen to highlight the relational and cultural connectedness rooted within kinship values. Hence, we uplift Indigenous worldviews to view clients as relatives. Our research question was: *From providers' perspectives, what were the strengths and challenges client-relatives faced with respect to access and utilization of SUD treatment services, daily life and substance use during the first 2 years of the pandemic (2020–2022)?* Provider perspectives can help to inform future community-and culturally-specific public health responses and strategies across prevention, treatment, recovery, and harm reduction services.

Materials and methods

Community engagement and theoretical framework

Community Based Participatory Research (CBPR) strategies were employed throughout the study. CBPR is a bi-directional process that centers community knowledge and power-sharing between community and university partners (22). CBPR has led to improved health and social equity outcomes among Indigenous communities through the lens of Indigenous worldviews and systems of care (23–25). Interventions that seek to embody CBPR principles must also centralize cultural perspectives and community engagement (26). A

national Collaborative Board (CB) was formed in 2019 as part of a parent project, consisting of more than 25 members with a range of backgrounds from across the country (27). To inform the present research, a sub-set of the CB provided consultation on the study design, research questions, and development of the interview guide. Further, we also connected with additional partners and developed relationships with Tribal leadership and behavioral health providers and practitioners at AI/AN-serving organizations and treatment centers across the Pacific Northwest.

Positionality

Consistent with decolonizing methodologies and self-reflexive praxis, we acknowledge and highlight the identities and backgrounds of the researchers as they relate to the present study (28, 29). MR is a citizen of the Haliwa-Saponi Tribe and Asian Indian of Indo-Fijian descent, residing in the Pacific Northwest. She has walked alongside both rural and urban Indian communities for 8 years, providing health and human services, culturally informed programming, CBPR strategies, and Indigenous methodological approaches to prevention programming. KH is a descendant of the Eastern Shoshone Tribe/White, mixed European ancestry and has partnered with AI/AN communities in health justice research for more than 15 years. KB is a descendant of Filipino ancestry and immigrants, born in the Pacific Southwest. MB is a member of the Spokane Tribe of Indians. RS is a Cowlitz Tribal member descending from Chief Scenewa with mixed ancestry and has worked in the substance use disorder and medically assisted treatment fields for the last 5 years. KAO is White of mixed European ancestry and has partnered on research projects with Tribal communities and AI/AN researchers for 5 years. FK is White of mixed European ancestry and has collaborated on research projects with Tribal communities and AI/AN researchers for 15 years. MGM is Scotch-Irish and German American and has partnered with AI/AN communities on substance use treatment research and training for over 10 years. ANCC is White of mixed European ancestry and has partnered on research projects with Tribal communities and AI/AN researchers for 13 years.

Participants

This study was approved by the Washington State University and Northwest Portland Area Indian Health Board Institutional Review Boards. Providers were recruited through advertisements (e.g., flyers) placed in partnering organizations, referral by partnering organizations or other agencies (e.g., social services, Tribal health, or others), word-of-mouth, and social media sites (e.g., Facebook). Six programs and organizations serving multiple Tribal and sovereign nations and urban areas in Washington, Utah, and Minnesota served as recruitment sites, a majority of which were from Washington state. Eligible participants were: (1) willing and able to provide informed consent (2) employed at an AI/AN-serving addiction program; (3) had direct client-relative contact (administrative or clinical); (4) aged 18 or older; and (5) fluent in English. Study data and individual participant profiles were collected and managed using REDCap (Research Electronic Data Capture) electronic data capture tools hosted at Washington State University (30, 31).

Procedure

Interviews were conducted by the first and third author. Each participant completed one semi-structured interview. The interview guide included 15 base questions covering regulatory changes, guidance for telemedicine and HIPAA compliance, policy, procedures, staff communication, and perspectives on COVID-19 impact to their professional roles, as well as client-relatives' reactions to changes implemented, service utilization, and changes in treatment modality. Examples include: "*What have you noticed about client-relative substance use since COVID-19 disruptions in March 2020* (e.g., *increases, decreases in substance use and poisoning*)?" For a complete list of interview questions, see Supplementary material. The interviews ranged in duration from 60 to 90 minutes. Upon interview completion, participants were given a $100 gift card sent directly to their email. All interviews were audio recorded using secure Zoom video conferencing.

Data analysis

The second and third authors independently coded 25% of the transcripts, applied thematic analysis to these data, and then came together to discuss preliminary codes and iteratively generate a codebook (32). Thus, the codebook was created per categorization and thematic analysis, from an in-depth review of the transcripts, and not *a priori* (33). The first and third author then coded all 25 transcripts. Thirty-six codes were finalized for review to address the current research question. The transcripts underwent an additional analysis informed by a qualitative descriptive approach (34–36). The coding procedure included four members of the research team. Two of which were the primary coders, a third for secondary review and the fourth for consensus. The inclusion of four coders ensured reliability, and the sample size, indicative of saturation (37, 38). Dedoose 9.0.85, a qualitative data analysis software, was used for all qualitative data management and analytic procedures.

Results

Overview

Thirty-six individuals were screened for participant eligibility. Of those screened, 8 were ineligible, with common reasons due to not being employed at an AI/AN-serving addiction program or not having direct client-relative contact; 3 did not respond to requests for scheduling; and 25 individuals consented to participate and completed interviews. Nineteen (76%) identified as female with ages between 30 and 60 years. Per recommendations of the CB, questions about race/ethnicity and other basic demographics were not asked due to privacy concerns. Participants held positions as clinical behavioral health practitioners, substance use disorder professionals (SUDPs), licensed mental health counselors (LMHCs), licensed clinical social workers (LICSWs), nurse practitioners (ARNPs), administrators, and other programmatic positions (Table 1).

Five coded domains were identified from the data related to client-relative experiences during the COVID-19 pandemic, as observed by providers. These are detailed below and include: (1) accessibility, (2) co-occurring mental health, (3) social determinants

TABLE 1 Brief overview of provider characteristics.

Provider characteristics		
Sample size	N = 25	
Age	M = 43.24	S = 8.12
Biological sex	Male 24%	Female 76%
Region type	Urban 84%	Rural 16%
Provider type	Clinical (e.g., ARNP, SUDP, LMHC) 64%	

of health, (4) substance use, coping, and harm reduction strategies, and (5) community strengths.

Accessibility

Providers highlighted several challenges related to client-relatives access to SUD treatment services during the pandemic, including general lack of access to care due to program closures, navigating changes in service flow leading to limited availability and capacity of providers to meet growing need for treatment services. In addition, providers described that the limited number of pharmacies available to client-relatives were inundated during the pandemic and accessing prescription medications was severely delayed. Providers shared client-relatives' collective expressions of stress and frustration due to these regulatory challenges impacting their capacity to provide services, but flexible in response to the public health emergency. Despite understanding the need for changes to protect public health, providers described limitations on continuity of care which carried well into the pandemic. A provider expanded by stating:

> …some people were very receptive [to the changes in care, while from] some people there was a lot of pushback and completely disengaged. I think that was a challenge [and] for some people that change in the way we delivered services, and just trying to get it all together was really disruptive in their recovery. There were people that had been maintaining abstinence that relapsed and may have not engaged in services the same way…some people really liked doing telemedicine… I can't say it's one way or the other. I mean, it was a disruption the way that it was for everybody.

Moreover, providers overwhelmingly stated how the pandemic placed an additional burden on top of an already under-resourced system which further strained SUD service delivery. Providers described that integrated group sessions were a large component of treatment services and in some cases an accompaniment to individualized therapy sessions or talk-therapy. Although due to the pandemic, the transition to alternative treatment delivery formats (e.g., telemedicine) was generally experienced as positive, there were difficulties in facilitating group sessions and engaging client-relatives, especially when a client-relative was also experiencing complex traumatic issues. The following quote described challenges to virtual group work, including mutual support groups:

> …groups became very restricted and the services were obviously crippled as a result …. Things were shut down [and] it was quite a while before … community support groups like [Alcoholics Anonymous] and [Narcotics Anonymous] and [Cocaine Anonymous] opened back up. They did move to online, but I don't know that that carries the same … [the] connectedness that going to an in-person 12-step meeting has versus via Zoom. I think that's really impersonable, and if you don't know anybody, if you're just now trying to enter into recovery and stop using, walking through the door is already tough but not having that human connection, I think it makes it extremely tough … to wanna stick around.

Co-occurring mental health

A majority of the sample reported an exacerbation of co-occurring mental health concerns among client-relatives. Mental health challenges arose due to increased stress related to school closures and parenting with limited resources. Reductions in social and structural supports (e.g., school) and subsequent impact on mental health left some providers feeling ill-equipped to support client-relatives. Providers described the exacerbation of trauma-related mental health symptoms among client-relatives and the overall impact of the pandemic on Indigenous communities, such as the compounding nature of post-traumatic stress disorder (PTSD), increased anxiousness and intergenerational trauma colliding with service closures due to the COVID-19 pandemic. Providers addressed these needs and how they attempted to keep up with and in some cases expand care, while also navigating the broader healthcare system:

> We've seen a big uprise in the need for… mental health services, and so our department just recently started a co-occurring program where now we can ... start assessing for ... mental health. Prior to that, we were having just to refer out to our mental health department here at the Tribe. So there's definitely been a higher need, for sure ... and that's something ... that our mental health department has grown, and our co-occurring services we're starting to do are definitely taking off … [as the] need has grown….

Delivering services during the pandemic were also considered within the context of historical and intergenerational trauma. Providers specifically addressed this and the way they navigated client-relative care:

> I think that … working with Native communities … there is inter-intergenerational trauma that is always in the room and not often recognized by the client. It's like… maybe at first you recognize that it's something outside of you creating [hardships], and then eventually you think it's just something wrong with you. … And folks don't understand that … they're carrying this mass trauma, and that that is actually what has made their lives difficult.

Providers reported the cultural impact of grief and loss for many Indigenous communities throughout the pandemic as significant, making direct connections to historical loss and trauma perpetuated into the present day and heightened further during the pandemic. It was shared that many client-relatives lost loved ones during this time and the AI/AN population at large are experiencing collective trauma

as a result of the COVID-19 pandemic, amplified by both historical and contemporary traumas. The inability to conduct ceremonies and engage in cultural, spiritual, and cleansing practices affected the ways in which client-relatives were able to regulate emotions and engage in their own treatments:

> … [there is] disconnect [ion] … a lot of my elder clients, they were very safe and stayed home. But you could tell it was takin' a toll on their mental health as far as not being able to participate. And especially with… the culture and [individuals] not being able to participate in community dinners for, [and] I'm speaking for several Tribes… not being able to, powwows and, smokehouse… canoe journey or, blessing of the fleet, or clam bakes. Like, these are events that, clients look forward to. And not only clients but, you know [also us as providers] … it's a privilege. I've worked for the Tribe for seven years and I've been honored to be able to participate in these events… that's where I meet a lotta family and … they struggled with not having that spiritual [connection] ….

Social determinants of health

Providers spoke about the impacts of COVID-19 on the community through the lens of social structural drivers of health. Many noted that the negative impacts were detrimental to their client-relatives' recovery. Specifically, providers discussed barriers related to employment, housing, and transportation. Providers addressed these issues with client-relatives concurrently with navigating the pandemic and their recovery. Providers also spoke to the prolonged stress linked to the pandemic, including long-term stressors associated with transportation:

> So, transportation was such a big mess [throughout] COVID [and] continues to be a mess. I hope that that was really highlighted for people, and maybe, could be a focus for Tribal government in terms of funding moving forward 'cause we can anticipate that there will be another epidemic or crisis where transportation's gonna be crucial.

One provider noted that their organization provided transportation, although they were unable to bill for this service outside of medical appointments or to pick up prescription medications. Client-relative challenges regarding transportation included lack of personal vehicles, limited public transportation, distance, and financial constraints in purchasing gas or public transportation passes. Some client-relatives noted that because they did not have a personal vehicle, they became reliant on a family member or friend for transportation, which caused some difficulty in coordinating scheduling.

Providers spoke to the housing crisis and the inequitable access to stable housing for client-relatives, noting that experiences of houselesness were also exacerbated due to the pandemic. Providers described the necessity of stable housing for treatment effectiveness and overall health. The following quote describes the relationship between housing instability and limited availability of higher levels of care for substance use:

> … just that incongruence within themselves where they want help, but then their addiction is very strong in them… [causing] difficulty in getting into inpatient programs, which seems like it was worse because there was more people … going back to their using and then wanting help and not being able to get in… we've had a client here, sleeping in their car on our parking lot for months… I think it took two and a half months to get him [housing and other support services] … and that's just one in particular that I can think of, long waits to get in, exceptionally long.

Additionally, providers address the interwoven nature of in-person cultural activities integrated into SUD services such as drumming circles, traditional medicine services, beading and art groups, sweat lodges, and other healing ceremonies, which are imperative to client-relatives' well-being and treatment progress. These services, either could not be offered or were limited in offerings during the pandemic. Providers expressed that the lack of cultural connection and integrative components of traditional health severely impacted continuity of care.

Substance use, coping, and harm reduction strategies

Most providers reported seeing an increase in the use of fentanyl, methamphetamine, cannabis, and alcohol directly related to the pandemic. One participant provided the following statement in response to increases in substance use:

> I think that [substance use has] increased. I think that people that were stable, that when the groups [and] society shut down … there was really nothin' to do, nowhere to go for people and I think that boredom set in, and stress set in, and fear set in, and I think that a lotta people relapsed as a result. I think that people that were coming through the doors trying to enter into recovery and had virtually no services available for them, [they] struggled. I really think [the pandemic] set our field back quite a bit as a result.

In addition, there were individuals that shifted the type of substances used but providers did not necessarily identify that shift as an increase:

> …within the last year, we've seen the drug of choice change a lot. Like right now, we're experiencing a lot more fentanyl use … [among] youth and adults, especially … Alcohol as well as well, where prior to COVID … it seemed to be more marijuana [and] DUIs. That's something, we can track, too, where it seems like alcohol definitely was on the uprise, and then right now, like within the last six months, at least in our area, we've seen fentanyl use just spike where [it] was not a thing pre-COVID, at least not to where we were seeing it on a consistent basis.

The changes in services due to the pandemic was a concern for providers and seen as impacting how client-relatives might utilize less healthy ways to cope to manage emotion dysregulation and limited social connection. A provider outlined this association between service availability and choice of coping strategies:

> [Some clients] have this mentality of, like, I, [as the provider] can fix all your problems for you. Like, that's not real, right? People

> know how to regulate their own bodies. People know how to self-medicate, and that's a coping skill, whether people wanna admit it or not. Using drugs is a coping skill. My goal in my career is just to give you something that maybe isn't gonna poison you, just as an option, and you can choose it or not …. But, you know, you are doing a coping skill. You do know how to regulate your body. You are smart, and you're resourceful and resilient …so we need fully integrated treatment, that is so essential and vital because—it's about showing somebody that there is a different way, and they can choose something different. And, at the end of the day, they gotta make that choice.

Harm reduction strategies were seen as a way to mitigate risks associated with increased substance use. Although Naloxone training and education was provided for healthcare providers and peer support workers at their respective organization, the impact of COVID-19 on policies, procedures, and social distancing, as well as staff fidelity to uphold such processes, influenced the successful implementation of these strategies for client-relatives. Several providers alluded to the availability of Naloxone as beneficial and in alignment with their support of harm reduction strategies, but with noted challenges. One participant noted that: "There's not very much access to Naloxone training, unfortunately. So I try to educate people, as they come in … lots of fentanyl." Providers specifically discussed the inconsistency in implementing Naloxone distribution protocols:

> I know that the procedure is the person comes to the back door, rings the bell, asks for one, and, you know, a nurse or whoever's on will give them one. And, I'm just like, "Is anyone havin' a conversation with these people, or are they just handin' the bags out and-and shuttin' the door?" … there needs to be a conversation. I know that [with] the needle exchange programs, it's not like I'm [just] going around [handing them out]. They [are available] in a specific location, [and we provide outreach] you know, interact with people and get to know them and counsel them a little bit to try and initiate some kind of change.

Identifying access and use of Naloxone is just one harm reduction strategy. Providers emphasized that strategies ultimately need to be client-relative centered, coordinated, and holistic to ensure that communities are as safe and healthy as possible.

Community strengths

It was vital to providers to share community strengths and the specific ways in which their respective organizations came together with the goal of relationality and healing while navigating the challenges of the pandemic. Providers detailed that culturally specific programming (e.g., drumming, beading, feasts) that had previously been integrated into treatment services were halted or transitioned to an online format. Overall, providers spoke to the continuation of virtual cultural services as important to social connection. Through the grief in loss, substance use, and impact on communities, the shared focus on community and cultural connectedness was described as pivotal in promoting resilience, recovery, and prevention. Providers described how their organizations and communities were able to access hope and lean on cultural beliefs, values, and practices. A provider summarized this sentiment in the following way:

> What I love ... about the clinic is that, even though we were all stuck in this, like, fear of COVID and not knowing and a medical emergency pandemic, we were still reminding the community, let's go back to our basics. Let's go back to what we know and what comforts us. So it was really awesome to be part of that, to see it. So and even now, we're still offering our traditional medicine, so I really just wanted to also mention that too cause that's something I also saw outta the pandemic that was just really inspirational, and I feel like it really lifted the spirits of the community here, since, you know, we're such a small little area … it's just like the one lifting of one person's heart and it spreads around, you know. So it was really cool …. I'm just really happy to be still here, still part of it, and working through it. So hopefully things will get better. I know that they probably could never go back to the way they were, but, I think that it's gonna make us all into more resilient people, I hope.

Discussion

In this qualitative community-based participatory research study, we examined SUD providers' perspectives on the challenges experienced by client-relatives receiving substance use treatment services for opioid use disorder during the COVID-19 public health emergency. Overall, providers observed exacerbation of mental health symptoms and other comorbidities among client-relatives due to social structural challenges and reduced access to both AI/AN traditional healing practices and substance use services. Findings add to the little representative research on AI/AN serving organizations' response to, and perceptions of, client-relative experiences and needs for SUD treatment services during a national public health emergency. Findings help inform preparation and planning for the advancement of public health strategies and service delivery.

Accessibility of services for client-relatives was a huge concern for providers. Although providers noted the benefit of the programmatic and regulatory changes in SUD services related to telemedicine for client-relatives, barriers remained. Similarly, Nesoff et al. (39) conducted a cross-sectional analysis among non-AI/AN adults accessing or in need of treatment, to quantify the extent of policy uptake and the number of people with SUD impacted by policy changes at the state level across the U.S. Nearly half a million people who were accessing treatment before the pandemic had limited or no access to treatment at the onset of the pandemic. Providers in our study noted that there were minimal services prior to the pandemic, and that this limited access was intensified during the pandemic and led to increases in substance use and poorer mental health. A combination of strategies to increase availability, access, and engagement into care are necessary. In May of 2023, the Drug Enforcement Administration (DEA) announced an extension to the flexibilities adopted during the COVID-19 public health emergency including those related to telemedicine, protocols for controlled prescription medications

(e.g., length of prescriptions), consultation and examinations (40) which is promising news for AI/AN communities who continue to manage high rates of poisonings and social structural barriers (e.g., transportation). Although regulatory flexibility could not alleviate all challenges, it was seen as generally positive, with hopes of seeing such flexibility as common practice, rather than a temporary emergency response effort.

There was also consensus among participants in our study that, among many AI/AN communities, health inequities were directly tied to historical, intergenerational, and ongoing traumas. Ramos et al. (41) address this link among AI/AN populations in California, investigating experiences of substance use, homelessness and treatment seeking. They found that services needed to be culturally grounded and responsive to the needs of AI/AN people experiencing homelessness to reduce substance use. The COVID-19 pandemic brought about collective trauma among AI/AN communities, resulting in an amplification of health and social disparities. Moreover, SUD services should better integrate the role of historical and social contexts to understand and serve AI/AN communities more effectively. Intervention strategies that centralize the integration of traditional approaches and cultural activities that consider both the historical and contemporary traumas and challenges that AI/AN communities' face with respect to SDOH, behavioral health, and SUD outcomes are therefore needed (42). This is especially relevant in the context of national and global public health crises like drug poisonings and COVID-19. Providers emphasized the integral component of cultural services in treatment and community connectedness that are unique to the AI/AN population. The inclusion of traditional medicine, songs, drumming, language teachings, beading, and arts are imperative to the recovery and healing of client-relatives and support health relationships. Moreover, the minimal resources and funding allocated for traditional health and cultural healing practices as part of SUD services with regards to Medicaid, Medicare, and private insurance reimbursement impact the extent to which culturally relevant and traditional care can be provided. There is a need for culturally responsive providers, and building capacity for service providers who identify as AI/AN and those with lived experience (43, 44).

Some common limitations should be considered within the current work. Although the sample was not restricted to a specific geographic area of the U.S., most providers were employed by, or served, client-relatives from Tribal communities in the Pacific Northwest. While the challenges reported regarding accessibility and substance use are represented in multiple populations, findings are not necessarily generalizable to all Tribal communities. Further, these challenges are from the perspective of providers and not client-relatives themselves. In addition, although appropriate due to the safety protocol and regulations throughout the COVID-19 pandemic, conducting interviews virtually rather than in-person may have altered interpersonal and social dynamics impacting engagement and responses. The inclusion of providers was dependent upon the availability of providers and respective approvals in participation per respective treatment services or agencies, and participant inclusion was not specific to provider type (e.g., ARNP, LMHC). Per the guidance of the CB, community voice was prioritized in the decision to not collect racial, ethnic, or biological sex demographics of participants. Strengths of the research include the comparatively large sample size and interview content domains that considered treatment providers' efforts to deliver services that centered history, culture, healing, resilience, and social connection for client-relatives during the pandemic.

The implications of these findings suggest expanding capacity and workforce initiatives within AI/AN populations to equip AI/AN community health workers and mental health practitioners to provide substance use treatment and recovery services that are grounded in local cultural and traditional practices and that can support social drivers of recovery success such as connectedness, economic instability, houselessness, transportation, and integrated behavioral health services (45). Investigating and expanding culturally informed harm reduction strategies inclusive of Naloxone and Narcan through AI/AN community-led programming and Indigenous research methodologies that center stories and cultural strengths is important (46). Such efforts should not just be limited to the pandemic period but used to build the capacity of AI/AN-serving treatment and prevention programs.

Conclusion

Findings highlight SUD treatment provider perspectives on the impact of the COVID-19 pandemic on client-relatives' experiences in accessing treatment, managing stressors, and fluctuations in substance use and mental health. Findings also illuminate experiences of resiliency and hope and the ways in which culturally specific community and public health related response strategies, preventative approaches, and long-term service needs can be leveraged to promote well-being among AI/AN adults experiencing SUD or who are in recovery. These strategies may include Tribal best practices, expanding harm reduction strategies, building community and systems capacity, and providing adequate funding directly to AI/AN-led and serving programming addressing SUD.

Data availability statement

The datasets presented in this article are not readily available because data sharing agreements restrict data access to only authorized researchers. Requests to access the datasets should be directed to meena.richardson@wsu.edu.

Ethics statement

The studies involving humans were approved by the Washington State University (#18604) and Northwest Portland Area Indian Health Board Institutional Review Boards (#1743728-3). Tribal Council approvals and/or data sharing agreements were received from several Tribal Nations, however we do not disclose the names of the sovereign nations due to established data sharing agreements. The views expressed in this paper do not necessarily reflect that of NIDA CTN and partnering communities. 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

MR: Conceptualization, Data curation, Formal analysis, Methodology, Software, Validation, Writing – original draft, Writing – review & editing. KH: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Writing – original draft, Writing – review & editing. KB: Data curation, Formal analysis, Methodology, Software, Writing – review & editing. MB: Data curation, Methodology, Writing – review & editing. RS: Conceptualization, Writing – review & editing. BK: Conceptualization, Writing – review & editing. KO: Conceptualization, Writing – review & editing. FK: Conceptualization, Writing – original draft, Writing – review & editing. MM: Conceptualization, Writing – review & editing. KV: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Writing – review & editing. AC: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Writing – review & editing.

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Conflict of interest

KO was employed by the company KEAO Consulting LLC. KV has a conflict-of-interest management plan at the University of New Mexico due to providing training and consultation in evidence-based treatments of addiction.

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

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2024.1356033/full#supplementary-material

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Mobile addiction treatment and harm reduction services as tools to address health inequities: a community case study of the Brockton Neighborhood Health Center mobile unit

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Opioid overdose deaths continue to increase in the US. Recent data show disproportionately high and increasing overdose death rates among Black, Latine, and Indigenous individuals, and people experiencing homelessness. Medications for opioid use disorder (MOUD) can be lifesaving; however, only a fraction of eligible individuals receive them. Our goal was to describe our experience promoting equitable MOUD access using a mobile delivery model. We implemented a mobile MOUD unit aiming to improve equitable access in Brockton, a racially diverse, medium-sized city in Massachusetts. Brockton has a relatively high opioid overdose death rate with increasingly disproportionate death rates among Black residents. Brockton Neighborhood Health Center (BNHC), a community health center, provides brick-and-mortar MOUD access. Through the *Communities That* HEAL intervention as part of the *HEALing Communities Study* (HCS), Brockton convened a community coalition with the aim of selecting evidence-based practices to decrease overdose deaths. BNHC leadership and coalition members recognized that traditional brick-and-mortar treatment locations were inaccessible to marginalized populations, and that a mobile program could increase MOUD access. In September 2021, with support from the HCS coalition, BNHC launched its mobile initiative – Community Care-in-Reach® – to bring low-threshold buprenorphine, harm reduction, and preventive care to high-risk populations. During implementation, the team encountered several challenges including: securing local buy-in; navigating a complex licensure process; maintaining operations throughout the COVID-19 pandemic; and finally, planning for sustainability. In two years of operation, the mobile team cared for 297 unique patients during 1,286 total visits. More than one-third (36%) of patients received buprenorphine prescriptions. In contrast to BNHC's brick-and-mortar clinics, patients with OUD seen on the mobile unit were more representative of historically marginalized racial and ethnic groups, and people experiencing homelessness, evidencing improved, equitable addiction care access for these historically disadvantaged populations. Offering varied services on the mobile unit, such as wound care, syringe and safer smoking supplies, naloxone, and other basic medical care, was a key engagement strategy. This on-demand mobile model helped redress systemic disadvantages in access to addiction treatment and harm reduction services,

reaching diverse individuals to offer lifesaving MOUD at a time of inequitable increases in overdose deaths.

KEYWORDS

overdose, harm reduction, substance use, mobile health, health equity, opioid use disorder, addiction treatment, outreach

1 Introduction

Overdose deaths have disproportionately affected racial and ethnic minoritized groups in recent years. A study examining overdose death rates in the U.S. by age, sex, race, and ethnicity during the COVID-19 pandemic demonstrated that in 2021, non-Latine Black (hereafter referred to as Black) men accounted for the highest rate of overall overdose deaths and overdoses, involving fentanyl at rates of 61.2 deaths per 100,000 population and 43.3 per 100,000, respectively (1). Comparable trends took place in Massachusetts the same year. Overdoses among Black individuals increased 70% between 2019 and 2020, and again by 42% between 2021 and 2022. At 143.8 per 1,000,000 in 2022, overdose rates for American Indian/Alaska Native individuals (hereafter referred to as Indigenous) are 433% of the rate for the general population (2). Similarly, opioid-related overdoses increased among Latine individuals (hereafter referred to as Latine) from 35.4 per 100,000 in 2020 to 39.1 and 45.5 per 100,000 in 2021 and 2022, respectively (2). Meanwhile, a decrease in opioid-related overdose death rates was observed among White individuals (36.5 per 100,000 in 2021 versus 33.3 per 100,000 in 2022) (2). Of note, the authors acknowledge that bodies of literature employ widely varied descriptors of racial and ethnic groups. Hereafter, formatting of descriptors will align with preferred terminology from the American Medical Association's *Inclusive Language for Reporting Demographic and Clinical Characteristics* (3). When referring collectively to individuals with Black, Latine, and/or Indigenous racial and ethnic identities, the terms marginalized, historically marginalized or oppressed, or underrepresented racial or ethnic groups may be used (3).

Through a social justice and Right to Health lens, it is evident that structural racism, racialized discriminatory drug policy, and subsequent systemic disadvantages result in disparities in accessibility, availability, acceptability, and quality (AAAQ) of addiction treatment and its outcomes for minoritized racial and ethnic groups (4, 5). Buprenorphine is an evidence-based medication for opioid use disorder (MOUD) that is widely considered to be a first line form of treatment (6). Inequities in AAAQ to this treatment modality for Black, Indigenous and Latine groups are well-documented. In recent years, availability of buprenorphine has increased overall in the United States, however the greatest increases in numbers of buprenorphine providers have occurred in zip codes with highest percentages of White residents (7). A study at the neighborhood level has shown that predominantly Black and Latine communities have less physical availability of buprenorphine (8).

Patients from minoritized racial backgrounds experience delays in accessing addiction treatment (9). When patients from minoritized backgrounds are enrolled in treatment, treatment programs are unsuccessful at retaining them (10–12). Similarly, patients from minoritized backgrounds are at a greater risk for discontinuation of treatment once enrolled than their White counterparts (13). Delays in accessing medical care, and early termination from treatment are attributed to racial discrimination in healthcare settings (14, 15). These factors cumulatively contribute to unequal access to addiction treatment and differential treatment outcomes for racial and ethnic minority communities.

1.1 Disparities in MOUD treatment among Black, Latine, and Indigenous peoples

It is well documented that individuals who identify as Black are less likely to receive MOUD treatment, especially buprenorphine (16). A study using data of the *National Ambulatory Medical Care Survey* and *National Hospital Ambulatory Medical Care Survey* from 2004 to 2015 found that Black patients have a statistically significantly lower odds of receiving buprenorphine treatment from ambulatory care facilities than White patients of the same facilities (17). A review of a national commercial insurance database exposed that Black adolescents and young adults are less likely than their White counterparts to receive buprenorphine treatment for opioid use disorder (14). An assessment of Medicaid recipients found that Black individuals were 42% less likely to receive buprenorphine than White patients (18).

Disparities in MOUD access also exist among people with Latine identities. Mirroring results found among their Black counterparts, Latine adolescents and young adults are less likely to receive treatment with buprenorphine than White patients (14). A 2022 analyses of sociodemographic differences in buprenorphine treatment among Medicaid recipients were less likely to receive effective dosing and treatment duration with buprenorphine (19). A similar study found that Latine individuals were 22% less likely to receive buprenorphine than their White counterparts (18).

Like observations among Black and Latine individuals, unequal receipt of MOUD treatment occurs among Indigenous peoples. Medicaid recipients of Indigenous identities had 12% lower odds of receiving buprenorphine treatment than those identified as White (18). A 2021 study found slightly lower retention in buprenorphine care 90 days after initiation among Indigenous patients and identified a dearth of literature focused on MOUD access for this patient population (12). Geospatial analyses of access to buprenorphine treatment has also revealed that census block groups with majority Indigenous populations experience the longest median road distance to a buprenorphine provider among any racial or ethnic group majority census block population (16.5 miles versus 2.1 miles general population) (20).

Root causes of these disparities in receipt of buprenorphine treatment among marginalized individuals can be proximally traced to interpersonal and organizational discrimination, stigma, disproportionately unaddressed social driver of health (SDOH) needs, culturally inappropriate services, and a shortage of providers and locations for buprenorphine treatment, especially those that accept Medicaid plans (16, 21). More distally, discriminatory health care and criminalized drug policies contribute to unequal access in MOUD and addiction treatment in the United States (16, 22, 23).

2 Background and rationale

Brockton, Massachusetts is an urban community 20 miles south of Boston. According to the 2020 U.S. Census, 41% of Brockton's population identifies as Black, 12% are Latine, 0.47% are Indigenous peoples, 32% of residents are foreign-born, and 47% of the population speaks a language other than English in their home (24). Mirroring trends taking place on the state and national levels, Brockton's historically marginalized populations have been disproportionately impacted by overdose deaths in recent years. Community-level data made available via the National Institutes of Health HEALing Communities study found a 40% increase in overdose deaths among non-Latine Black individuals in Brockton between 2017 and 2021, while overdose deaths for non-Latine White individuals decreased by 8% (25).

The HEALing Communities Study (HCS) is a multi-site study in 67 communities in four states (Kentucky, Massachusetts, New York and Ohio) which uses the Communities that HEAL (CTH) intervention to reduce opioid overdose deaths (26). As part of the Communities That HEAL intervention, (27) developed within the HCS trial, a community coalition was formed in Brockton, comprised of individuals and organizations in Brockton working on the overdose crisis. Health center leadership and coalition members recognized that traditional brick-and-mortar treatment locations were not accessible or acceptable to the entire population, and that a mobile program could increase access to addiction treatment.

In 2020, the HCS coalition in Brockton funded a mobile medical services program operated by Brockton Neighborhood Health Center (BNHC), a Federally Qualified Health Center (FQHC) in Brockton, MA. In September 2021, with support from the HCS coalition, and alongside a partnership with The Kraft Center for Community Health at Massachusetts General Hospital, Brockton Neighborhood Health Center (BNHC) launched its mobile services initiative – Community Care-in-Reach – to bring low-threshold substance use treatment, safer use supplies, and preventive medical care to a patient population at high risk for overdose at sites where overdoses frequently occur.

Equity for marginalized patients, particularly those from oppressed racial and ethnic groups and people experiencing homelessness was a driving force behind program design. BNHC's mobile services program deconstructed obstacles that contribute to disparities in health outcomes among patients from historically marginalized and oppressed racial and ethnic backgrounds. These challenges included poor accessibility and limited availability of buprenorphine treatment, failure of service providers to engagement patients in treatment, (10) and early discharge from programming for failure to adhere to strict clinic attendance, urine testing, and other requirements (13).

This Community Case Study assesses the equity impact of the Brockton mobile program strategy to increase buprenorphine access. Programs with similar models have demonstrated ability to promote buprenorphine access (28, 29). We hypothesized that a mobile services model that entails accessible MOUD and non-judgmental harm reduction interventions, delivered by a diverse team trained in concepts related to health equity, could effectively promote access for individuals from marginalized racial and ethnic groups to buprenorphine as a first-line treatment and improve engagement in health services for historically oppressed groups, including those experiencing homelessness.

3 Essential elements of the intervention

3.1 Physical space and logistics

BNHC leaders, architects, and clinical team devised a floor plan for a mobile medical trailer that included features necessary for basic medical care. In addition to developing the internal layout, team members scouted ideal venues for mobile services. Overdose data provided by local law enforcement, feedback from outreach staff and key informants, and proximity to local community partners and pharmacies were considered to determine locations with the greatest demand and feasibility for mobile substance use and medical treatment.

3.2 Staffing

The mobile unit is staffed by four team members during each session. A Family Nurse Practitioner serves on the mobile unit to prescribe buprenorphine, pre-exposure prophylaxis for HIV (PrEP), post-exposure prophylaxis (PEP), and provide other basic medical care. An LPN/Phlebotomist is available to draw lab specimens, perform wound care, and assist in administrative tasks such as patient check-in and registration. Peer recovery coaches and community health workers conduct foot outreach near the mobile unit to connect patients to care or inpatient treatment, methadone programs, and other case management services that support general wellness. A program manager oversees the daily operations, including supplies, scheduling, and staffing. For safety reasons, the mobile services unit requires at least three team members to operate and space limitations set the maximum number of staff at five.

BNHC sought to have mobile unit staff composition reflect the diversity of patients being served with the goal of diminishing the possibility of bias. Mobile services staff consisted of nurses, nurse practitioners, community health workers, recovery coaches, and administrators from diverse backgrounds. Leadership recruited staff who spoke Spanish, Cape Verdean Creole, Arabic, Tagalog, and Khmer. BNHC also retains live medical interpreters in Spanish, Portuguese, Cape Verdean Creole, and Haitian Creole. Interpreters at BNHC undergo training related to substance use treatment and harm reduction to ensure comfortable, inclusive care for patients who are best served in languages other than English. Team members have lived experience with addiction, recovery, homelessness, psychiatric conditions, criminal-legal involvement, and military service. Mobile services staff regularly attend training related to health equity, antiracism, and

trauma-informed care. The provision of services by a diverse and culturally representative team works to reduce biases, center cultural and linguistic knowledge, and earn trust in the treatment team among patients who have experienced systemic, organizational, and interpersonal discrimination when accessing medical care.

3.3 Engaging patients

Accessibility, nonjudgmental communication, and cultural appropriateness are fundamental elements of the mobile services program that promote health equity. The accessible nature of the mobile services program expedites treatment for patients. All appointments are conducted on a walk-in basis, enabling individuals who find it difficult to attend formally scheduled appointments to receive care. The mobile unit parks in locations where patients are known to frequently visit, empowering individuals to access treatment in a comfortable setting. Clinic-based treatment may be postponed by long waitlists, extensive documentation, and biases on behalf of treatment staff. Since the conditions for initiating treatment on the mobile unit are nominal, marginalized patients of the mobile program can receive buprenorphine prescriptions and other medical services without delay.

The immediate availability of a provider improves consistent medication/treatment access by patients, many of whom are members of marginalized racial or ethnic groups, experiencing homelessness, and/or formerly incarcerated. In the brick-and-mortar clinic, patients must call to schedule an appointment, experience wait times, and interact with several staff members before meeting with a medical provider directly. Clinic patients who are tentative to engage in treatment may abandon their efforts entirely because of these obstacles. In the mobile program, a provider is promptly available to prescribe buprenorphine, deliver patient education, and initiate follow up in a setting where patients are known to reside, eradicating these prohibitive factors.

Criteria for participation in mobile services are exceedingly flexible. Patients follow up with the mobile team once a week at a time and place of their preference. Missed appointments, refusal of laboratory testing or urine toxicology testing, or active use typically lead to termination in formal clinic settings. However, none of these factors disqualify patients from accessing care from the mobile program. Since discharge from treatment on the mobile unit is rare, mobile programming promotes accessible care for patients of marginalized backgrounds who are disproportionately affected by early termination from treatment (6).

Patient care in the mobile program centers on non-judgment, enabling providers to earn trust among patients who often/usually experience discrimination within the health care system and have been ostracized and excluded from accessible addiction treatment. The mobile unit team is committed to treating patients in all stages of change, including pre-contemplation and contemplation.

3.4 Harm reduction as an engagement tool

In addition to medical care, the mobile unit operates as a Syringe Services Program (SSP), providing safer injection equipment, safer smoking supplies, and naloxone to the community. Anonymous drug checking with fentanyl test strips and Fourier transform infrared spectrometry (FTIR) is also available (30–32). These interventions can reduce the risk of unintentional overdose and infectious diseases and serve to earn trust with the patient population. Patients in active use recognize the mobile program's provision of services, free of judgment or coercion. When patients eventually require medical care, the rapport necessary to facilitate patient engagement has already been established.

4 Methods

To evaluate buprenorphine access, a quantitative assessment of electronic health record (EHR) data from BNHC's Nextgen and later Epic EHRs was conducted. Encounters resulting in a sublingual buprenorphine prescription were extracted from September 1, 2021 through August 31, 2023 for both the Community Care-in-Reach mobile program and BNHC's brick-and-mortar office-based addiction treatment program. Prescriptions for extended-release injectable buprenorphine prescribed from the stationary clinic were excluded in this analysis ($n = 100$), which is unavailable in the mobile setting given DEA restrictions on storage and transport of the medication. The resulting report contained all prescription fills in the 2-year timeframe for each patient (e.g., a patient receiving seven refills would appear seven times), which was then deduplicated to obtain a list of unique patients who had received buprenorphine by site. Patients receiving buprenorphine from both locations were represented on both mobile and brick-and-mortar reports. Demographic information for the distinct lists of participants were used to determine aggregate tallies of buprenorphine-receiving patients by race and ethnicity for each clinical site. This allowed for a comparison of percentage of patients receiving buprenorphine by demographic characteristics between the mobile services and brick-and-mortar programs.

5 Results

Following 24 months of operation, the mobile services unit has expanded accessibility of MOUD within the Brockton community. From the conception of the program in August 2021 through September 2023, 1,283 medical appointments were conducted for 297 unique individuals. Of these patients, 41% were female, 57% male, 74% were Brockton residents, 7% reported speaking a language other than English, and 29% were experiencing homelessness, of whom half reported staying in a shelter. Two-thirds (66%) identified as White, 25% as Black, 10% as having Latine ethnicity, and 1.0% of Indigenous background. More than half of these visits (59%, $n = 790$) were for the purpose of prescribing buprenorphine (Table 1).

In the two-year operating period, providers on the mobile unit prescribed buprenorphine to 107 unique patients and wrote a total of 695 buprenorphine prescriptions. The average dose per prescription was 17.8 mg per day. Thirty-seven percent of MOUD patients were female and 63% male; approximately 70% were Brockton residents. Those receiving buprenorphine from the mobile unit were as racially diverse (24% Black, 14% Latine, 1.9% Indigenous) as the overall mobile unit patient population and had a similarly high prevalence of homelessness (35%). In contrast, those receiving buprenorphine at the brick-and-mortar clinic were more likely to be White (74%, with 19% Black, 13% Latine, 1.0% Indigenous) than mobile unit buprenorphine patients.

One-third of initial visits to the mobile unit were for wound care. Seventy-four percent of buprenorphine patients presented requesting MOUD access; however, 26% initially presented seeking other services and later returned for buprenorphine treatment (Table 2).

TABLE 1 Demographics of unique patients receiving buprenorphine seen by the Brockton Neighborhood Health Center mobile unit ($n = 107$) and stationary site ($n = 420$), September 1, 2021 through August 31, 2023.

	Mobile unit	Stationary clinic
self-reported racial identity of buprenorphine patients		
Indigenous peoples (American Indian/Alaskan Native)	2 (1.9%)	4 (1.0%)
Asian	0 (0%)	1 (0.2%)
Black	26 (24.3%)	78 (18.6%)
More than one race	2 (1.9%)	13 (3.1%)
Pacific Islander	1 (1.9%)	1 (0.2%)
White	69 (64.5%)	309 (73.6%)
Unknown/refused to report	7 (6.5%)	14 (3.3%)
Total	107 (100%)	420 (100%)
Self-reported Latine racial identity of buprenorphine patients		
Latine	15 (14.0%)	56 (13.3%)
Not Latine	86 (80.4%)	346 (82.4%)
Unknown/refused to report	6 (5.6%)	18 (4.3%)
Total	107 (100%)	420 (100%)

TABLE 2 Reason for encounter at Brockton Neighborhood Health Center mobile unit, August 2021 through September 2023 ($n = 1,283$).

Reason for encounter	Number of encounters (%)
Buprenorphine/MOUD	790 (59%)
Wound care	178 (13%)
HIV/STI testing and/or treatment	96 (7%)
Preventive care/sick visits/misc. follow ups	276 (21%)

The mobile services program has also proven to be an effective tool in reaching individuals experiencing homelessness and individuals reentering the community from incarceration, two groups that are known to be at an elevated risk for overdose (33, 34). Eighty-six (29.0%) of the 297 individual patients the mobile unit served in this period were identified as homeless in the electronic medical record, and 46.1% of homeless patients received buprenorphine prescriptions from the mobile services team. Forty-one patients had been incarcerated in the past 5 years, 65.9% of whom were treated with buprenorphine from the mobile team. It is likely that these data under-represent the prevalence of incarceration and homelessness in the patient population due to limitations of the Electronic Health Record (EHR) in capturing these metrics.

6 Discussion

A mobile treatment model for people with OUD that brick-and-mortar treatment fail to engage is feasible. Indeed, similar mobile care models have been implemented successfully to increase access to preventive health and addictions care in diverse settings in the US (28, 35–37). Such models, through geographic and philosophic flexibility, can work to promote health equity and, in part, begin to redress discriminatory practices in the medical system that lead to disparities in MOUD and substance use-related AAAQ measures. At a time when overdose deaths are disproportionately increasing among those identifying as Black, Latine, and Indigenous peoples, it is key that strategies to address the overdose crisis are centered in social justice and a Right to Health framework. The Brockton Community Care-in-Reach® program reached many patients who identified their race or ethnicity from an underrepresented group or reported homelessness, who might otherwise not have MOUD or other forms of medical care accessible to them.

In our experience, harm reduction programs and addiction treatment providers in both mobile and clinic settings should cultivate an atmosphere of acceptance to promote equitable care for patients from marginalized communities. This can be accomplished through thoughtful program design that intentionally eliminates barriers that are reticent of discriminatory policies and practices in the medical system to help promote available, accessible, acceptable, and quality services (23). Nonjudgmental treatment works to foster mutual trust between patients who have experienced current and historical oppression and healthcare providers. Developing culturally appropriate services should be an organizational priority for addiction treatment providers to facilitate patients from historically marginalized racial and ethnic groups to access care. Substance use services should be offered in languages used in the catchment area and delivered in a culturally relevant manner by a multidisciplinary team whose experiences reflect those of the patient population. Staff should participate in regular training relating to antiracism and health equity and be encouraged to use their lived experience to raise up strategies that promote AAAQ. Regularly seeking and incorporating participant feedback into program design is essential.

Establishing a mobile unit involves overcoming many obstacles. Onerous licensing requirements developed with brick-and-mortar sites in mind require reform to encourage mobile programs such as the one highlighted here. Local politics and relationships with other community organizations also determine successful program implementation. To establish a mobile unit, an organization must have strong relationships with existing institutions in the community, which in this case the HCS coalition helped foster.

Clinical takeaways include the importance of wound care and other services because many patients who ultimately received buprenorphine accessed other services first. Providing comprehensive harm reduction supplies including safer injection, sniffing, and smoking kits, is critical to building trust and promoting engagement with services. Additionally, some patients attended appointments at both mobile and brick-and-mortar sites. Mobile services added access for patients already engaged at other BNHC sites who might need occasional geographic flexibility. Finally, buprenorphine served a harm reduction purpose. Even patients who might intermittently missed prescription visits would report that having at least some buprenorphine in their system seemed to prevent overdose. Lastly, while patient feedback helped shape clinical offerings, future opportunities include ongoing engagement of patient and community to shape mobile unit operations.

Finances and sustainability are persistent issues for mobile units (28). Seeking out all relevant grant opportunities is vital. Secondly, maximizing billable encounters – and offering a wide variety of billable clinical services, such as wound care – is crucial. Finally, supportive state-level policies are key to sustainability of such interventions. While Medicaid reimbursement policies are a strength in Massachusetts, they may still under-support mobile MOUD and harm reduction programs that offer low-threshold models of care. Finally, telehealth policies that support remote visits are also important since many mobile unit patients require engagement via telehealth at some point in their care. With many patients lacking smartphone access or data plans, reimbursement for audio-only telehealth visits must remain a point of advocacy as COVID-19 policies are repealed across the country. Medicaid expansion, sufficient coverage of OUD-related treatment and services, and telehealth service coverage are vital policies that must be expanded to further support mobile access to lifesaving MOUD at a time of ever-increasing overdose deaths.

In our experience, a mobile unit offering MOUD is feasible and can help promote availability, accessibility, acceptability, and quality of MOUD services to populations that have been disproportionately impacted by oppression, discrimination, and under-resourcing of medical services.

Data availability statement

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

Author contributions

AP: Conceptualization, Data curation, Formal analysis, Investigation, Project administration, Writing – original draft, Writing – review & editing, Methodology. KC: Conceptualization, Data curation, Formal analysis, Investigation, Project administration, Writing – original draft, Writing – review & editing. TB: Methodology, Writing – review & editing. AC: Conceptualization, Investigation, Methodology, Supervision, Writing – original draft, Writing – review & editing. KL: Investigation, Methodology, 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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Intersectional inequalities in health anxiety: multilevel analysis of individual heterogeneity and discriminatory accuracy in the SOMA.SOC study

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Background: Intersectional approaches are needed to disaggregate the complex interaction of social identities contributing to (mental) health disparities. Health anxiety represents an overlooked public mental health issue. Therefore, intersectional inequalities in health anxiety were examined using multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA).

Methods: Analyses are based on cross-sectional data of the adult population living in Germany ($N = 2{,}413$). Health anxiety was assessed with the Whiteley Index-7. Applying intersectional MAIHDA, health anxiety in the intersectional strata of gender, history of migration, and income was predicted. Discriminatory accuracy was assessed via the intra-class correlation and the proportional change in variance.

Results: Analyses revealed additive social inequalities in health anxiety with greatest impact of low income but no clear intersectional gradient. Most affected by health anxiety were females who immigrated themselves with low income, males whose parent(s) immigrated with low income, and males who immigrated themselves with medium income.

Conclusion: Intersectional approaches contribute to a more comprehensive understanding of (mental) health disparities. In addition to general efforts to counteract health inequalities, combining universal screening and targeted psychotherapeutic treatment seems promising to specifically reduce inequalities in health anxiety.

KEYWORDS

health anxiety, intersectionality, MAIHDA, mental health disparities, social determinants of health, SOMA.SOC

Introduction

Health anxiety is understood as the excessive worry over health and fear of having or getting a serious illness which can range from mild symptoms to a pathological extent (1, 2). With prevalence rates between 2.1 and 13.1% in the general population and even up to 34.6% in the psychiatric setting, health anxiety is a widespread but much overlooked challenge (1, 3). Due to its stress relation, health anxiety often coexists with other mental disorders, such as generalized anxiety disorder, depression or somatoform disorders and is also relevant in the

context of (chronic) physical illnesses (4, 5). Adverse life events, e.g., experiencing a (former) serious illness, high levels of stress, or ongoing challenges in life can contribute to the development or exacerbation of health anxiety symptoms (4, 5). Health anxiety is associated with reduced health-related quality of life and high economic burden due to inappropriate health care use, sick-leave, and disability (1, 4, 6). Cognitive behavioral therapy has proven to be an effective treatment to reduce health anxiety (7). The challenge, however, remains to sensitize those affected to their excessive fears and enable access to appropriate psychotherapeutic treatment (7). In medical settings, brief screening instruments like the Whiteley Index (WI) or the Short Health Anxiety Inventory (SHAI) seem promising to identify individuals critically affected by health anxiety (1). This combination of universal screening and targeted treatment follows the approach of proportionate universal interventions (8).

It is important to acknowledge that social inequalities can play a role in shaping the experiences and outcomes of individuals with health anxiety. Systematic evidence revealed individuals with low socio-economic status, education, or income to be more affected by health anxiety (1, 9). However, regarding gender, age, and ethnic minority status/history of migration as further important social determinants of mental health (10), systematic evidence is inconclusive (1, 11). As former studies are limited to single indicators, an intersectional approach is needed to shed further light on the social context of health anxiety as an important and overlooked mental health outcome (3).

Intersectionality is rooted in Black feminist theory and can be understood as a framework to understand interactions of multiple social categories leading to disadvantage, discrimination, and inequality (12, 13). Stress exposure due to, e.g., sexism or racism and subsequent coping mechanisms can result in higher morbidity and mortality (14). Besides experiences of discrimination on the individual level, multiple discrimination can occur on a structural level diminishing peoples' social power and opportunity for political participation (15). Additionally, protective factors to resist against one's social categories might moderate the effect of intersections on health outcomes (16). Thereby, social mechanisms can occur either additive or multiplicative or some combination of both. Additive effects represent the sum of privileges and/or disadvantages, whereas multiplicative effects imply that the effects of the social characteristics enhance each other (16, 17). Quantitative research on intersectional inequalities in different health outcomes received increased attention in recent years and new statistical approaches have been developed (18–20). Research mainly focused on self-rated physical and/or mental health status as outcome and on the intersectional strata of gender, race/ethnicity (history of migration) and/or socio-economic status (indicated by income, education, and/or occupation). Due to the diverse assessment of the intersectional strata as well as methodological aspects, comparability is limited and results are inconclusive (18, 20). For the European or German context, so far only few studies were conducted indicating intersectional inequalities in mental health status according to female gender, low income, and history of migration (20, 21).

By applying the novel approach of intersectional multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA) to health anxiety as an important mental health outcome, we explored the broader social context of mental health disparities with the focus on the social dimensions gender, history of migration, and income as three key social determinants of health. The following research questions were investigated: Are there social inequalities in health anxiety in the adult population living in Germany? If so, are these social inequalities of additive or multiplicative effect and which of the three social dimensions contributes most to inequalities in health anxiety? Are the more disadvantaged intersectional strata significantly greater affected by health anxiety than the more privileged ones?

Materials and methods

Study design and sample

Analyses were based on cross-sectional data collected via a telephone survey (computer assisted telephone interview) of the adult population (age ≥ 18 years) living in Germany. The survey was conducted from March until May 2022 by a company specialized on social research. To ensure a probability sample, randomization followed the dual-frame approach with random-digit-dialing (22) including registered and computer-generated telephone (70%) as well as mobile phone numbers (30%). Furthermore, within households, respondents were randomly chosen via the Kish selection-grid (23). Sample size calculation was based on a vignette design applied in the study. For details, please see the published study protocol (24). In the present analyses, the vignettes were not used. Interviews were conducted in German language. Accordingly, people with insufficient German language skills were excluded. Oral informed consent was given at the beginning of the interview. In total, $N = 2{,}413$ people participated in the study, resulting in a response rate of 45%. To correct for selection bias regarding overrepresentation or underrepresentation of certain groups of people, data was weighted following a standardized three steps approach (22, 25). First, the distribution of household sizes in the sample was weighted according to the official distribution in the population. Second, design weights were calculated to correct for differing probabilities of selection rooted in the sampling design, including the household size, number of households and mobile phone numbers. Third, continuing bias in the distribution of socio-demographic characteristics was adjusted by applying the iterative proportional fitting including age, gender, education, and place of residence. After the three-steps weighting approach the weighted study sample corresponded to the socio-demographic distribution of the official 2022 German statistics.

Measures

Social dimensions

Gender, history of migration, and net household income per month were assessed by a standardized questionnaire. Since only two participants reported their gender as diverse, they were excluded from the analyses and the variable gender was dichotomized into male and female. According to the definition of migration background by the Federal Statistical Office, history of migration was assessed based on the nationality (German nationality and/or another) and country of birth of participants as well as the country of birth of both parents (born in Germany yes/no) (26). Hence, participants were allocated to the following three categories: no history of migration, parent(s)

immigrated, or immigrated themselves. Due to the historical context of so called guest workers, late emigrants, and refugees, German research mostly assesses history of migration instead of race/ethnicity (14, 26). To take differences in household size and composition into account, the net monthly household income was adjusted for household size (27). The resulting equivalent income was divided into the following terciles: low (≤ 1,250 Euro), medium (1,251 – < 2,250 Euro), and high (≥ 2,250 Euro) income.

Covariates

Age was assessed as another item by the standardized questionnaire and divided into the following terciles: 18–40 years, 41–60 years, 60+ years. Since health anxiety can be associated with worse health conditions, it is important to account for individual health status. As an indicator of the current health status, somatic symptom severity was assessed with the German version of the Somatic Symptom Scale-8 (SSS-8) (28). The scale consists of eight items asking about gastrointestinal, cardiopulmonary, pain-related, and fatigue-related somatic symptoms, using a time interval of the last seven days. Each item can be scored on a 5-point Likert scale (0 = not bothered at all to 4 = bothered very much). The total score of the added items ranges from 0 to 32 with higher scores indicating higher somatic symptom severity (28).

Outcome

Health anxiety was assessed with the validated German version of the Whiteley Index-7 (WI-7), a short form of the validated Whiteley Index-14 (2). The WI-7 consists of seven items regarding illness convictions and illness worries. Each item can be answered with no (= 0) or yes (= 1). The total score ranges from 0 to 7 with higher scores indicating more health anxiety (29). In the present study, Cronbach's α was 0.67.

Missing data

In total, about 1% of individual items across all variables were missing (at random). This was mostly due to missing values on the income variable (about 18%). For the other variables, the amount of missing values was <1%. The missing data pattern was analyzed, and missing data was imputed using the multivariate imputation by chained equations method (30). The method for imputing missing values depends on the variable's nature. For continuous variables, predictive mean matching was applied, while logistic regressions were used for binary variables.

Statistical analyses

For an overview of the study sample in terms of health anxiety, we first calculated arithmetic mean with standard deviation (SD) of the WI-7 score. With analyses of variance, unidimensional social inequalities in health anxiety were examined. Additionally, Pearson correlation (r) between health anxiety and somatic symptom severity was measured.

For the intersectional analysis, MAIHDA was carried out (19, 31). This novel approach in quantitative intercategorical intersectionality research includes multilevel models nesting individuals at level 1 (between-strata level) within intersectional strata at level 2 (within-strata level). By this, social identities correspond to contextual-level variables with equal relevance for the outcome, consistent with intersectionality theory (19). In accordance with existing methods, three MAIHDA models were fitted (32). Model 1 as a base model with the intersectional strata dimensions as random intercepts; models 2a-c as partially adjusted intersectional models including each social dimension as separate fixed effect; model 3 as a fully adjusted intersectional interaction model with all three social dimensions as fixed effects. For the models, the intra-class correlation (ICC), the between-stratum variance, and the proportional change in the between-stratum variance (PCV) were calculated. The ICC describes the discriminatory accuracy of the model in identifying individuals with higher or lower health anxiety. Higher ICC indicates a greater similarity in health anxiety within the intersectional strata and a greater difference between the intersectional strata. The PCV indicates how much of the total proportion of explained variance by the intersectional strata can be contributed to each of the social dimensions. Therefore, model 2a-c and model 3 were compared to model 1. To answer the question whether social inequalities in health anxiety were of additive or multiplicative effect, the PCV (and corresponding ICC) of model 3 was assessed. A high PCV (close to 1) indicates additive effects, as the social dimensions (included as fixed effects) explain all the variance, whereas a low PCV indicates multiplicative effects beyond additive effects. To identify the social dimension contributing most to social inequalities in health anxiety, models 2a-c were compared to each other regarding the estimate (highest coefficients), the ICC (lowest coefficients), and the PCV (highest coefficients). To gain insights into the amount of health anxiety in the intersectional strata, estimated marginal means (emm) of the WI-7 score based on the random effects of model 1 were calculated. By applying post-hoc pairwise comparison, the question whether disadvantaged intersectional strata (including female gender, a history of migration, and low income) were significantly greater affected by health anxiety than the more privileged ones (including male gender, no history of migration, and high income) was pursued. We obtained 18 intersectional strata, which were derived from the three social dimensions gender, history of migration, and income ($2 \times 3 \times 3 = 18$).

To comply with model assumptions, especially to adjust for right-skewness of the WI-7, the logarithmized WI-7 score was used as outcome for all models and coefficients were back-transformed (33). All MAIHDA models were adjusted for age and somatic symptom severity. It would have been preferable to also include these variables as social dimensions. However, this was not possible due to the insufficient sample size. All analyses were carried out using weighted data to correct for selection bias and improve the accuracy and reliability of the results obtained from the data analysis. In terms of robustness, analyses using weighted and unweighted data yielded comparable results. The significance level for p-values was set to $p < 0.05$. Analyses were conducted in R 4.2.2 using the packages "mice" (30), "glmmTMB" (34), and "ggeffects" (35).

Ethics approval

The survey is part of a large interdisciplinary project on persistence of somatic symptoms. The framework and study design of the

Research Unit 5211 "Persistent SOMAtic Symptoms ACROSS Diseases: From Risk Factors to Modification (SOMACROSS)" and the subproject "Social Inequalities in Aggravating Factors of Persistent Somatic Symptoms (SOMA.SOC)" have been described in detail in the published study protocols (24, 36). The study was approved by the Ethics Commission of the Hamburg Medical Chamber (No. 2020-10194-BO-ff). All research was performed in accordance with relevant guidelines/regulations and the Declaration of Helsinki.

Results

Table 1 gives an overview of the study sample in terms of health anxiety. The mean WI-7 score of the total study population was 1.69 (SD = 1.70). Significant differences in health anxiety in the two social dimensions income and history of migration as well as age (as a covariate) indicate unidimensional social inequalities in health anxiety. Regarding gender, no significant differences emerged. Somatic symptom severity was positively associated with health anxiety.

The intersectional MAIHDA models are presented in Table 2. According to the base model 1, social inequalities in health anxiety are apparent. The ICC was 0.039 and the conditional R^2 0.251.

TABLE 1 Health anxiety (WI-7, range 0–7) according to social dimensions and covariates (n = 2,411).

	%	Mean (SD)	p*
Total		1.69 (1.70)	
Social dimensions			
Gender			0.458
Male	48.9	1.66 (1.59)	
Female	51.1	1.71 (1.80)	
History of migration			0.000
No history of migration	77.4	1.59 (1.67)	
Parent(s) immigrated	11.2	1.93 (1.80)	
Immigrated themselves	11.4	2.13 (1.88)	
Income (in Euro)			0.000
High (≥ 2,100)	34.5	1.34 (1.48)	
Medium (1,251 – < 2,100)	29.8	1.49 (1.56)	
Low (≤ 1,250)	35.7	2.19 (1.90)	
Covariates			
Age groups			0.000
18–40	32.2	1.39 (1.56)	
41–60	34.0	1.92 (1.81)	
≥ 61	33.8	1.74 (1.68)	
	Mean (SD)	r (95%-CI)	p
Somatic symptom severity (SSS-8)	5.85 (5.70)	0.55 (0.53–0.58)	0.000

CI, Confidence interval; r, Pearson correlation.
*Analyses of variance.

The social inequalities found are most likely of additive effect. This can be concluded from the PCV of 0.995 and a corresponding ICC of 0.000 of model 3, indicating that all of the explained variance by the intersectional strata can be ascribed to the three social dimensions. Furthermore, among the three social dimensions, low income contributed most to the social inequalities found in health anxiety. This can be inferred from the highest coefficient of 1.19, the highest PCV of 0.495 and the corresponding lowest ICC of 0.020 in model 2c (partially adjusted models 2a-c).

Figure 1 presents the estimated marginal means of the WI-7 score across the 18 intersectional strata derived from base model 1. The intersectional strata most affected by health anxiety were females with low income who immigrated themselves (emm = 1.42, 95%-CI 1.15–1.72), males with low income whose parent(s) immigrated (emm = 1.41, 95%-CI 1.15–1.72), and males with medium income who immigrated themselves (emm = 1.41, 95%-CI 1.10–1.77). In contrast, the intersectional strata least affected by health anxiety were females with no history of migration and medium (emm = 0.83, 95%-CI 0.71–0.95) or high income (emm = 0.84, 95%-CI 0.73–0.97), and males with high income whose parent(s) immigrated (emm = 0.87, 95%-CI 0.61–1.18). The WI-7 score of the most affected intersectional strata was about 0.6 points higher than the least affected intersectional strata. The differences between the most and least affected intersectional strata were statistically significant ($p < 0.001$). However, no clear intersectional gradient emerged.

Discussion

Summary of main results and discussion of current state of research

Our study contributes to the understanding of intersectional mental health disparities. By applying the novel intersectional MAIHDA, we examined the broader social context of health anxiety as an important but overlooked mental health outcome. In particular, we investigated 18 intersectional strata derived from three key social determinants of health, namely gender, history of migration, and income, which were previously examined separately, if at all. Thus, differentiating between one's own and parent(s) immigration provides new insights into the intersections of people with a history of migration. Previously, in intersectional research, these were commonly divided into born inside or outside of the respective country (18, 20). Using intersectional MAIHDA has several advantages compared to conventional multivariate analyses, for instance the differentiation of between- and within-stratum variance and robust estimates (19, 31).

Our analyses revealed additive social inequalities in health anxiety. Among the three social dimensions, low income contributed most to these social inequalities. However, no clear intersectional gradient emerged. The intersectional strata most affected by health anxiety were females who immigrated themselves with low income, males whose parent(s) immigrated with low income, and males who immigrated themselves with medium income. On the contrary, the intersectional strata least affected by health anxiety were females with no history of migration and medium or high income, and males whose parent(s) immigrated with high income. The intersectional strata most and least affected by health anxiety differed significantly from each other.

TABLE 2 Results from the intersectional multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA) in health anxiety (WI-7; $n = 2,411$).

	Model 1 – base model[a]	Model 2a – gender adjusted[a]	Model 2b – migration adjusted[a]	Model 2c – income adjusted[a]	Model 3 – interaction effects[a]
	Estimate (95%-CI)	Estimate (95%-CI)	Estimate (95%-CI)	Estimate (95%-CI)	Estimate (95%-CI)
Fixed effects					
Intercept	1.56 (1.46–1.67)	1.59 (1.46–1.73)	1.46 (1.35–1.59)	1.43 (1.31–1.56)	1.44 (1.36–1.52)
Gender (Ref male)					
Female		0.95 (0.85–1.07)			0.91 (0.86–0.96)
History of migration (Ref none)					
Parent(s) immigrated			1.07 (0.95–1.21)		1.07 (0.99–1.14)
Immigrated themselves			1.15 (1.02–1.30)		1.14 (1.07–1.22)
Income (Ref high)					
Medium				1.07 (0.95–1.19)	1.04 (0.99–1.10)
Low				1.19 (1.07–1.33)	1.17 (1.10–1.23)
Summary statistics					
ICC	0.039	0.036	0.027	0.020	0.000
Between-stratum variance (SD)	0.01 (0.11)	0.01 (0.10)	0.01 (0.09)	0.01 (0.08)	0.00 (0.01)
PCV		0.083	0.331	0.495	0.995
$R^2_{marginal/conditional}$	0.221 / 0.251	0.220 / 0.248	0.231 / 0.251	0.249 / 0.246	0.253 / 0.253

CI, Confidence interval; ICC, Intra-class correlation; PCV, Proportional change in variance; SD, Standard deviation; $R^2_{marginal}$, Variance explained by fixed effects; $R^2_{conditional}$, Variance explained by fixed and random effects.
[a]Adjusted for age, somatic symptom severity (SSS-8).

As hypothesized, the intersection a priori set as the most disadvantaged, namely females with low income who immigrated themselves, were most affected by health anxiety. The high (mental) health burden of this disadvantaged intersectional stratum is in line with other studies relating to intersectional mental health disparities (18, 20, 21). The second intersectional strata particularly affected by health anxiety were males with low income whose parent(s) immigrated. Since the differentiation of history of migration is specific to German health research, we refer to studies investigating the German population. Concordant, a longer duration of residence was found to be an important determinant of depressive symptoms and worse subjective health status, especially among men (14, 37). Contrary to our expectations, the intersectional strata a priori defined as the most advantaged, namely males with no migration history and high income, only had the fourth lowest level of health anxiety. Rather, females with no history of migration and medium income were least affected by health anxiety. Further intersectional studies regarding health anxiety or similar mental health outcomes like generalized anxiety disorder or somatoform disorders are needed to contextualize these findings.

The WI-7 score of the most affected intersectional strata (emm = 1.42) was 0.6 points higher compared to the least affected intersectional strata (emm = 0.83). According to the validation study by Fink et al. (2) this corresponds to an increase in the WI-7category from low (0 points) to medium (1–2 points). This is relevant for healthcare, since a WI-7 of one point or higher was associated with at least one ICD-10 somatoform disorder (2). Furthermore, an increase of the WI-7 of minimum one point was associated with a significant increase in health care use and costs as well as reduced self-rated health (38).

The social inequalities in health anxiety found in our study were most likely of an additive effect. In light of the current discussion regarding multiplicative or additive intersectional effects, the latter does not disprove intersectionality in health anxiety, as intersectionality is above all a framework to understand heterogeneity and social power rather than a testable hypothesis (16).

Against the background of low income as the most impactful of the three investigated social dimensions, our study revealed further evidence for the great importance of economic deprivation in light of other social characteristics such as history of migration (14). The relevance of socioeconomic disadvantage in health anxiety was also demonstrated in a recent meta-analysis (9). The etiology of health anxiety is strongly related to negative life events, negative illness experiences, and ongoing life stressors (4). Besides structural oppression, psychosocial, material, and behavioral stressors (subsumed as intermediary determinants) as well as higher health burden and limited access to health care occur more often in the course of a low socio-economic background (as well as pre, during, and post-migration). These factors can contribute to increased health anxiety in disadvantaged intersectional strata due to concerns about individual well-being and limited individual as well as structural resources to address stress exposure and health issues appropriately (10, 14).

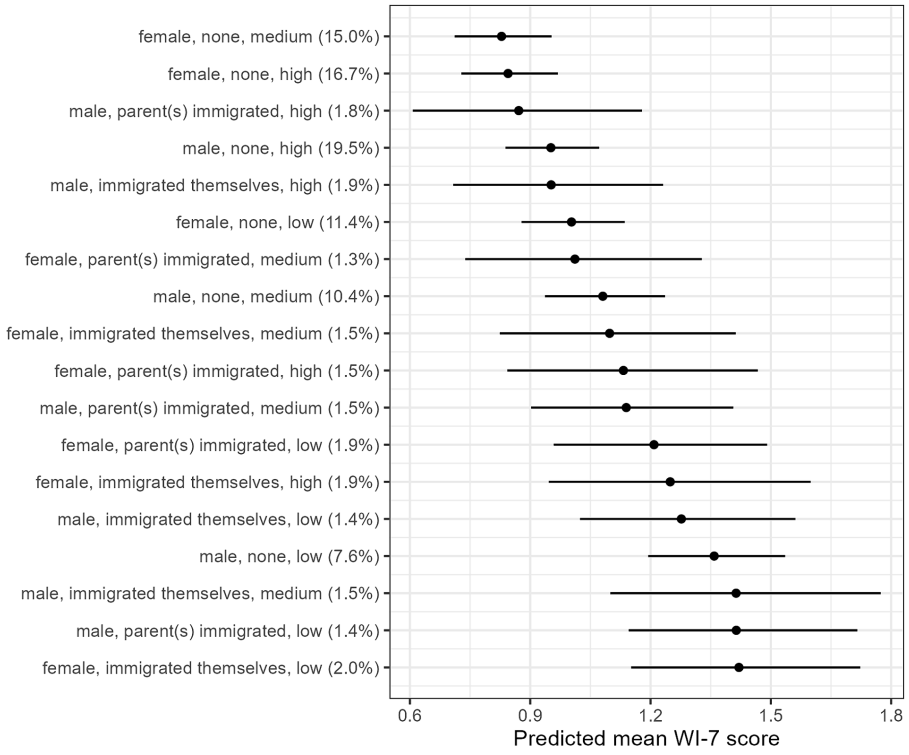

FIGURE 1
Estimated marginal means of health anxiety (WI-7) across 18 intersectional strata defined by combinations of gender, history of migration, and income based on model 1 (n = 2,411). Gender: male/female, history of migration: none/parent(s) immigrated/immigrated themselves, income: high/medium/low. (%) Proportion of intersectional strata in the sample. Adjusted for age, somatic symptom severity (SSS-8).

Limitations

Some methodological aspects have to be considered when interpreting our results. To reduce selection bias affecting internal and external validity, a weighted data set based on a standardized three steps weighting-approach was used (22, 25). However, the study sample did not fully cover the population with a history of migration (39) because individuals with insufficient German language skills were excluded. Since history of migration showed to be a significant predictor of health anxiety, associations might be even stronger for some subgroups like refugees. Future migration-related research should cover different languages to gain access to specific migration populations like refugees (14). In addition, regarding external validity, generalizability of our results to other countries is limited due to country-specific social structures. In terms of internal validity, our cross-sectional data solely provided evidence regarding associations but no conclusions regarding causality. Hence, longitudinal data is needed to shed light on the causal relationship between the social dimensions and health anxiety, particularly in light of the feedback effect of ill health on the socioeconomic status, e.g., due to worse employment (10).

Concerning construct validity, although validated self-reported measures were used, especially in the context of telephone interviews, aspects like social desirability might have affected the measurement validity (40). Against the background of measurement invariance, future research should also focus on differences in language and cultural habits in diverse populations when implementing appropriate assessment tools (41). Besides, intersectionality served as a theoretical framework including three key social determinants of health. However, future studies could enhance the implementation of the framework in quantitative research by including further social dimensions, like age (1), gender practice and/or sexual orientation (12), and intensify the assessment of structural discrimination (42).

Conclusion

Intersectionality serves as a framework in health disparity research to examine the complex interaction of multiple forms of disadvantage or oppression and the influence on peoples' health experiences. By applying intersectional MAIHDA, the study revealed additive social inequalities in health anxiety as one important mental health outcome. Low income showed greatest impact, but no clear intersectional gradient emerged. Most affected by health anxiety were females who immigrated themselves with low income, males whose parent(s) immigrated with low income, and males who immigrated themselves with medium income. To reduce social and health-related inequalities in general, a more just distribution of key material and social resources is needed. Therefore, interventions should address intersectional inequalities on the structural as well as intermediary level, e.g., equalizing (gender-specific) income differences, creating a healthy working and living environment as well as diversity-friendly (access to) healthcare, and strengthening the sense of belonging in multi-cultural communities. To reduce inequalities in health anxiety in particular, proportionate universal interventions combining broad

multi-language screening in outpatient and inpatient care and enabling access to targeted psychotherapeutic treatment seem promising. Future intersectional research should emphasize the actual experiences of disadvantage and privilege and apply novel approaches like MAIHDA as well as qualitative research to disaggregate the complex interaction of social categories contributing to mental health disparities.

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 Ethics Commission of the Hamburg Medical Chamber (No. 2020-10194-BO-ff). The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin because data was collected via a telephone survey and oral informed consent was given at the beginning of the telephone interview.

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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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Negligence in biomedical research: an anti-racist approach for substance use researchers

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Racism is embedded in the fabric of society at structural, disciplinary, hegemonic, and interpersonal levels, working as a mechanism that drives health disparities. In particular, stigmatized views of substance use get entangled with racialization, serving as a tool to uphold oppressive systems. While national health institutions have made commitments to dismantle these systems in the United States, anti-racism has not been integrated into biomedical research practice. The ways in which substance use researchers use and interpret race data—without engaging in structural racism as a mechanism of health inequity—can only be described as inadequate. Drawing upon concepts from the Public Health Critical Race praxis, QuantCrit, and an anti-racism research framework, we recommend a set of guidelines to help biomedical researchers conceptualize and engage with race more responsibly in substance use research.

KEYWORDS

antiracism, research, J-DEI, equity, substance use, critical race theory (CRT), racialization, racism

1 Introduction

Since the 1950s, substance use has been medically defined as a psychopathology (1). While early definitions once categorized addiction as a "sociopathic personality disturbance" (2), distinct substance abuse and substance dependence labels have existed since 1980 with the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM-III) (1, 3). Despite the establishment of a biomedical model of substance use, views of substance use as a personal moral failing have persisted in both the public and medical spheres (4). The moral rhetoric against individuals with substance use disorders (SUDs) goes hand in hand with perceptions that substance use warrants punishment; when paired with prejudice and animosity, these beliefs lay the foundation to target groups of people with the selective enforcement of drug laws, as seen with the US War on Drugs (5). Policies that ignore public health recommendations and employ racism—such as Nixon's refusal to deschedule and decriminalize cannabis in the 1970s—mold "moral failings" into systemic tools of oppression

(6). Hence, it is vital to reject unfounded beliefs about individuals with SUDs that get entangled with racism, which must begin with the scientific community.

Unfortunately, biomedical researchers often report race-related findings without critically considering the systems driving their observations (7–11). Social epidemiologist Dr. Nancy Krieger describes this dilemma as a two-edged sword, where the omission of race data from investigations ignores existing injustice, and the mishandling of race data exacerbates further injustice, reinforcing harmful beliefs about marginalized groups (12, 13). Investigators fall short by not incorporating anti-racist, equity-focused frameworks into their work, such as Critical Race Theory (CRT). Originally a framework for legal analysis, CRT underscores the relationship between race, racism, and power and denotes many ways in which oppression manifests across all forms of expression (14), providing language to examine how social, political, and historical forces give race meaning as a construct (see Table 1 for CRT tenets and principles). Frameworks like CRT can be used to recognize structural racism and racialization as the drivers of differential health outcomes, not race. This gets at a fundamental limitation of the biomedical model of substance use: the model minimizes the impact of psychosocial factors on SUDs (17); in turn, this risks positioning race as a biological driver of SUDs.

Therefore, in order to engage with race data with diligence, substance use researchers must employ anti-racist praxes in their investigations. Given that many research institutions have been created and maintained through white supremacy, anti-racist progress requires transformative action driven by the perspectives and priorities of minoritized communities (18). Drawing on concepts from the Public Health Critical Race praxis (PHCR) (13), QuantCrit (15), and an anti-racism research framework from Goings and colleagues (16), we recommend a set of guidelines to help biomedical researchers conceptualize and engage with race more responsibly in substance use research (SUR).

2 Mishandling race in health disparities and substance use research

The use of race as a broad proxy for structural racism can be extremely harmful to minoritized groups, thereby reinforcing racialized stigma and perpetuating biological determinism (7). Whether explicit or implicit, any use of biological determinism has no place in published literature (7). Across biomedical SUR literature, few studies systematically evaluate whether substance use researchers appropriately define race or report race data. In a recent scoping review of studies from 2000 to 2020 involving maternal–infant dyads with Opioid Use Disorder, investigators found that of the 63 identified quantitative studies that used race/ethnicity in their statistical analyses, only 17 mentioned race/ethnicity in their discussion sections (8). None of the included studies defined race as a social construct, leaving the authors to conclude that SUR "can benefit from a reckoning with how poorly race data have been incorporated to date" (8).

While there are limited critical evaluations of anti-racism in SUR, publications in adjacent health sciences fields highlight a concerning pattern. For example, a systematic review of 329 epidemiology studies published in five prominent journals from 1995 to 2018 found that 61% of studies failed to justify using race or ethnicity data (9). In more recent publications from 2020 to 2021, a review of 192 epidemiology studies revealed that only 23% of articles discussed systemic mechanisms that might drive observed racial health disparities (10). Perhaps even more concerning, three of the identified articles considered biological mechanisms as reasons for racial disparities (10). Similar trends are seen across both public health and medical journals; with broad failures to discuss the role of structural racism in driving health disparities, suggesting that these practices are not outliers but instead the norm (11, 19).

3 Guidelines on conducting anti-racist substance use research

The direct link between intersectional oppression and racial health inequity has been recently recognized as a public health crisis (20–22). While institutions like the National Institutes of Health have proposed direct commitments to address racial health inequity in research moving forward (19, 23), such commitments have not yet translated into tangible changes in published biomedical research. Anti-racist research frameworks are especially needed for biomedical SUR, where (1) racism is deeply intertwined with the moralization of substance use, and (2) research findings shape public perceptions, institutional norms, federal policies, and biases from medical providers (4, 24). To this end, we outline a foundational set of guidelines on conducting anti-racist research in the following sections, drawing on principles from PHCR (13), QuantCrit (15), and a framework on conducting anti-racist research (16) (see Table 1 for definitions and tenets/ principles of these frameworks).

3.1 Study design considerations

Guideline 1: *Employ mixed methods study designs to help contextualize and supplement quantitative findings.*

As previously discussed, the biomedical model of substance use disregards the role psychosocial factors play in SUDs (17), omitting the lived experiences of black, indigenous, and other people of color (BIPOC); these experiences are central to understanding the relationship between structural racism and quantitative findings (13, 15, 16). Considering that addiction neuroscience literature often refrains from engaging with social determinants of health relevant to their study samples (25), it is all the more prudent to seek out additional forms of knowledge and forms of knowing (26). This can be accomplished with mixed methods study designs, where quantitative findings can be contextualized using qualitative representations of lived experience (13, 27, 28). Furthermore, qualitative data from mixed-methods studies can provide information that could not otherwise be captured with quantitative methods, like identifying unexplored manifestations of structural racism (22, 29). These methodologies can be strengthened by applying a community-based participatory research (CBPR) paradigm, which integrates community voice, ownership, and decision making at each stage of the research process (30).

TABLE 1 Definitions and major tenets/principles of the anti-racist, equity-focused frameworks that influenced this article's suggested guidelines for biomedical SUR.

Theory + Definition	Tenets/ Principles
Critical Race Theory (CRT) An academic and legal framework that denotes that systemic racism is part of all aspects of American society, providing language through which we can examine the ways in which social, political, and historical forces result in race having meaning as a construct (14).	1. Race is socially constructed. 2. Ordinariness: Racism in the US is normal. 3. Interest convergence: advances for people of color only occur when they serve the interests of dominant white groups. 4. Members of minority groups undergo differential racialization. 5. Intersectionality: No individual can be described by membership in a single group.
Public Health Critical Race Praxis (PHCR) An iterative, semi-structured research methodology that guides investigators through a systematic process to conduct self-reflexive, race-conscious research into the root cause of health inequities (13). The four focuses of this research methodology include Contemporary Patterns of Racial Relations, Knowledge Production, Conceptualization & Measurement, and Action.	1. Race consciousness 2. Primacy of racialization 3. Race as social construct 4. Ordinariness of racism 5. Structural determinism 6. Social construction of knowledge 7. Critical approaches 8. Intersectionality 9. Disciplinary self-critique 10. Voice
QuantCrit An interdisciplinary framework that applies CRT's principles to challenge assumptions about the neutrality of quantitative data, offering guidelines on its interpretation and use (15).	1. The centrality of racism 2. Numbers are not neutral 3. Categories/groups are neither "natural" nor given: for "race" read "racism." 4. Voice and insight: data cannot "speak for itself." 5. Social justice/equity orientation
Goings' Anti-racism Research Principles A framework on conducting anti-racist research that centers race and racism, encouraging discernment in how a researcher's positionality relates to a research population, and emphasizing the value of lived experience at each stage of the research process (16).	1. Racism is embedded in structures, policies, and procedures that maintain the status quo. 2. Anti-racist research seeks to dismantle racism. 3. Anti-racist research centers BIPOC experiences. 4. A marginalized racial identity often intersects with other marginalized identities. 5. Anti-racist research foregrounds the importance of self-knowledge. 6. Anti-racist researchers practice what they preach. 7. Anti-racist research involves scientific empowerment, not scientific colonization. 8. Anti-racist researchers prioritize community engagement of the target population. 9. Anti-racist research uses team science to benefit from diverse perspectives. 10. Anti-racist research is concerned with sharing findings with those who support and oppose liberation, social justice, and reduced inequity.

As an example of a mixed-methods research project that employs CBPR, the University of Minnesota's Randolph Lab is conducting an ongoing comprehensive needs assessment on mental health and substance use in Minnesota youth. This initiative—the Minnesota Youth Needs Assessment (MYNA)—draws on a community of practice model to bring together a network of youth and outreach organizations to collaboratively address the incidence of mental health and substance use among youth aged 12–24 (31, 32). Bringing these stakeholders together allowed us to draw on their experiential knowledge to co-design this study, centering the comfort of youth when broaching certain topics, using unbiased language in study materials, and understanding that youth are the experts of their own experiences. These conversations provided social validity for the study prior to data collection, ensuring that the study methods and aims were aligned with the priorities of, and were accepted by, the community (33, 34). The assessment included a mixture of quantitative and qualitative methods, allowing for an eventual triangulation of data elements to represent a comprehensive picture of the youths' lived experiences. Although our study is ongoing, we aim to use social context to highlight the systematic factors that are driving mental health and substance use concerns in youth.

Guideline 2: *Ensure that samples are not only representative of the minoritized populations being investigated, but also large enough to draw valid conclusions concerning these groups.*

A pivotal goal in human neuroscience—including substance use neuroscience—is building models that are reproducible and generalizable; however, this field has historically relied on small convenience samples from populations that are western, educated, industrialized, rich, and democratic (WEIRD) (35). Although there has been a recent emphasis on larger sample sizes for improved reproducibility of brain-behavior linkages (36), larger samples alone do not guarantee generalizability of brain-based models across individuals from diverse backgrounds. While it may be difficult to find representative samples of certain minoritized groups, it would be inappropriate to draw conclusions using non-representative samples (37). However, representative samples do not guarantee the

validity of a model stratified by race, as insufficient sample sizes in stratified groups can result in invalid, harmful findings (37–39).

3.2 Diverse, interdisciplinary research teams

Guideline 3: *Examine one's own positionality in relation to a target population, recognizing the limitations of one's perspectives and embracing diverse, equitable collaborations.*

The social distance between a researcher and a research population is a fundamental consideration factor in ensuring an investigation does not perpetuate scientific racism, stemming from limitations in a researcher's lived experience (13, 16, 40). Dr. Krieger notes that data does not speak for itself, instead, it is "always produced by people, out of what they observe, fail to see, or suppress in the world in which they live" (12). To this end, biases can determine what research questions get asked, how data are collected and analyzed, how findings are interpreted, and what findings are reported (13, 15, 16, 40). Therefore, it is critical that researchers seek out diverse, equitable collaborations with both fellow scholars and with community stakeholders through CBPR to draw on the wisdom of lived experience.

Guideline 4: *Because of how embedded racism is in society, anti-racist research requires a breadth of interdisciplinary expertise.*

Similar to how lived experiences provide socio-contextual expertise to anti-racism research, interdisciplinary teams are necessary to develop robust, comprehensive solutions that address structural racism. Anti-racist research benefits from a range of "unique perspectives, expertise, and approaches" that are drawn from various disciplines, improving the impact, novelty, and reach of research publications (16, 41). Because racism and racialization permeate all aspects of society, specialized (e.g., mixed method), interdisciplinary teams are needed to adequately address health inequity (16, 18, 27, 42).

3.3 Use and interpretation of race data

Guideline 5: *Whenever possible, measure structural racism directly instead of using race as a proxy for racism or racialization. When analyzing race data, racism or racialization should be framed as risk factors for group differences, not race.*

Since researchers operate under the structures and policies of academic institutions, they are subject to systems that uphold structural racism (13, 16, 18). It is clear that biomedical researchers have not done enough to embrace anti-racism in their work and must move beyond solely documenting inequality (8–11, 13, 19). Therefore it is paramount for researchers to acknowledge structural racism as a driver of health disparities by measuring it directly whenever possible (e.g., racialized economic segregation) (43), rather than using race as a proxy for racism or racialization (7, 13, 16, 44). This shift is needed to eliminate any possibility of erroneous interpretation that racial health disparities are a result of inherent differences or deficiencies (7, 15, 44–46). However, there are circumstances where using race data is required or appropriate, including in identifying populations that are at risk for specific racism exposures (13). Therefore, in these scenarios, researchers must frame racism and racialization as risk factors for outcome differences, not race.

4 Discussion

As scientists, our paradigms must reflect the consensus that systemic oppression and social conditions are the drivers of health inequity, otherwise scientific racism persists (7). The many factors that contribute to health disparities (e.g., neighborhood disadvantage) often go unmeasured and ignored with typological thinking in epidemiological studies related to substance use (47); letting researchers "off the hook" from identifying the structural and political forces that give rise to racial social stratification (48). Even when studies do consider some social conditions like the impact of social class on health, they still sidestep addressing structural racism by placing class and race as independent and mutually exclusive of one another, rather than acknowledging their intersectional relationship (38, 49). When researchers omit systemic context, BIPOC populations bear the consequences of structural racism, like lower rates of opioid medication receipt following inpatient admissions compared to white populations, and widening overdose rates (50–52). Hence, it is critical to dismantle the systems that sustain racism and racialization through the use of anti-racist, CRT-informed approaches in SUR.

An interconnection between theory and practice toward social justice must be at the forefront of SUR, from project ideation to implementation. Although there are challenges to integrating anti-racist research into practice that require further attention (e.g., securing funding for community engagement, balancing time-intensive methodologies with systemic pressures for frequent publications), it is nonetheless crucial that we redefine institutional norms to disrupt oppressive systems (16, 53). This includes moving beyond the biomedical model of substance use and shifting the focus of health inequity from race to racism (13, 15–17). While this paper aims to help substance use researchers engage with race more responsibly, we are not the first to make such a call to biomedical researchers, nor are the guidelines presented here exhaustive [e.g., see (38) for considerations on how researchers can operationalize race and ethnicity]. However, given the scarcity of publications systematically examining how the field of SUR handles race, it is necessary to have ongoing, evolving discussions about what anti-racist practices look like within SUR, as seen in adjacent fields [see (10, 13, 15, 16, 38, 54)]. In addition to conducting future systematic reviews, the field must also work to place a greater emphasis on the collective uplift of historically marginalized communities, especially concerning the applicability, acceptability, and community usability of research findings. As noted by race, gender, and law scholar Dorothy Roberts, "Race persists neither because it is scientifically valid nor because its invalidity remains to be proven. Race persists because it continues to be politically useful" (55). It is therefore our duty as substance use researchers to integrate anti-racism into our work in efforts to disentangle racialization from the moralization of substance use, thereby disarming structural racism as a tool of oppression.

Positionality statement

This manuscript was collaboratively written by a group of early-career researchers whose backgrounds span a spectrum of lived experience and expertise. As a collective, our identities—Mexican,

Honduran, Latinx, White, Black, and African—shape our perspectives and our work. Our understanding of SUR as a field stems from our multidisciplinary specializations, including substance use neuroscience, cognitive neuroscience, prenatal substance exposure, pediatric neuroimaging, structural and social determinants of health, community engaged research, sociology, and reproductive justice. Through our engagement and interaction with communities, our perspectives are further informed by community voice. Overall, our outlooks represent a collection of cultural knowledge, expertise, anti-racism scholarship, and community engagement.

Data availability statement

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

Author contributions

JL: Conceptualization, Writing – original draft, Writing – review & editing. DB: Writing – original draft, Writing – review & editing, Conceptualization. AM: Writing – original draft, Writing – review & editing, Conceptualization. CC-I: Writing – original draft, Writing – review & editing, Conceptualization. SM: Writing – original draft, Writing – review & editing. AR: Writing – original draft, Writing – review & editing, Conceptualization, Supervision.

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From trauma to resilience: advancing cultural responsiveness and equity in the Muskowekwan First Nation's healing journey

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Introduction: The Muskowekwan First Nation (MFN) in Saskatchewan, Canada, epitomizes the enduring strength and cultural preservation of the Saulteaux people. This community faces the lasting effects of colonial trauma, especially the violence, abuse, and adversity experienced by students at the Muskowequan Indian Residential School (MIRS). Decades of abuse by institutional leaders caused generational trauma, contributing to current mental health and well-being challenges. This study highlights the community's role in sharing experiences and shaping healing processes to develop the MFN Family Healing and Wellness Centre in response to urgent community concerns. It examines the integration of Justice, Diversity, Equity, and Inclusion (J-DEI) principles and cultural responsiveness in fostering community resilience and mental well-being.

Methods: Adopting a community-based participatory research framework, this study employs a mixed-methods approach, including community engagement sessions and surveys. Collaborating closely with the MFN leadership, it draws upon the specialized expertise of Author2 and Author1, leaders in Indigenous health and research. The research uses qualitative and quantitative data collection, emphasizing the importance of community input and leadership in shaping the research process and outcomes.

Results: Findings emphasize the community's commitment to spiritual and cultural practices as vital healing components. Amidst the heightened awareness of the lingering effects of the MIRS within the MFN community, these insights informed the development of the Centre, ensuring it incorporates the community's desires for culturally relevant healing practices. The grand opening of Phase I of the Centre in February 2023 emerged as a significant step forward, symbolizing a move towards holistic community health that honors resilience, holistic wellness, and cultural continuity.

Discussion: This case study contributes to the literature on integrated, culturally responsive healthcare models that address the needs of Indigenous peoples and communities. The study provides insights to guide the Centre's future programs and services, ensuring they are culturally tailored and responsive to the community's needs. By illustrating the potential for traditional wisdom and contemporary health practices to foster well-being, the case study advocates for holistic approaches to healing in Indigenous settings, offering a replicable framework for similar initiatives globally.

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KEYWORDS

historic trauma, cultural responsiveness, Justice, Diversity, Equity, Inclusion (J-DEI), Indigenous healing practices, Indigenous community resilience, mental health and wellness, residential schools in Canada, Indigenous community health

1 Introduction

1.1 Muskowekwan First Nation: a community contextual analysis

In Saskatchewan, Canada, the Muskowekwan First Nation (MFN) epitomizes the resilience, cultural richness, and spirit of the Saulteaux people. Spanning 16,479 acres near Lestock, Saskatchewan, and recognized as Band 392, this community's deep-rooted connection to its land was formalized through Treaty 4 in 1874, emphasizing its historical and contemporary significance. As of 2024, MFN comprises 2,173 registered members, with 588 living on the First Nation, reflecting a dynamic balance between historical legacies and modern challenges (1). The historical narrative of the MFN is profoundly marked by the MIRS, which was operational from 1921 to 1997. This institution is a stark reminder of the cultural, linguistic, and identity erosion experienced by many Indigenous communities across Canada, leaving a legacy of intergenerational trauma that continues to reverberate today.

1.2 Community initiatives

In response to this legacy, the former Muskowekwan Chief and Council initiated a collaborative effort in 2016 with the Touchwood Agency Tribal Council (TATC) and the Federation of Sovereign Indigenous Nations (FSIN) to establish a Healing and Wellness Centre. Under the research leadership of Dr. Author 1 from Royal Roads University and Dr. Author 2, CIHR Chair in Applied Public Health, Indigenous Wellness at the University of Regina, this research initiative was developed following an invitation from the MFN Chief and Council. The Muskowekwan Family Healing and Wellness Centre, which celebrated its grand opening in February 2023, embodies a forward-looking approach to community health, emphasizing resilience, holistic wellness, and cultural continuity.

1.3 Significance of the Healing and Wellness Centre

The envisioned Healing and Wellness Centre is a pillar of hope, providing a sacred space for cultural reconnection, resilience building, and holistic wellness promotion across generations. This center is a tribute to the community's enduring strength and vitality. It is a model for integrating traditional wisdom with contemporary health practices, empowering individuals and families toward sustained health, spirit, and unity. By presenting the research and development of the Healing and Wellness Centre as a case study, this analysis aims to establish a replicable framework for creating similar centers. This model emphasizes the importance of community-driven engagement, advocating for a system that supports the community's healing journey while respecting its rich cultural heritage and aspirations.

1.4 The enduring impact of historical injustices on Indigenous communities

Historical injustices have perpetuated a cycle of mental health disorders and substance abuse among Indigenous communities in Canada. Research has highlighted the links between historical trauma, adverse childhood experiences (ACEs), and mental health disparities, emphasizing the need for culturally respectful interventions (2–4). Colonization efforts to suppress Indigenous cultures through forced assimilation and family separations have profoundly affected First Nations and Métis peoples' mental health. The connection between residential school experiences and mental health issues, including distress, suicidal behavior, and intergenerational trauma, is well documented (2, 5).

ACE research underscores the impact of early trauma on lifelong mental and physical health, highlighting the need for early intervention and culturally attuned care (6, 7). Historical traumas correlate with increased psychological distress, depression, anxiety, PTSD, cancer, hypertension, diabetes, and substance abuse (8, 9). The residential school system's dietary patterns have contributed to higher diabetes rates among Indigenous populations (10). Personal accounts reveal residential school trauma leading to alcoholism, religious disconnection, and relationship difficulties in adulthood (11). Intergenerational trauma amplifies these mental health issues, and the loss of cultural identity and traditional healing practices heightens vulnerability to mental health conditions (4).

1.5 The role of the Muskowekwan Family Healing and Wellness Centre

Acknowledging this past and embracing culturally sensitive, trauma-informed approaches are vital for aiding Indigenous communities in their healing and wellness journeys. The Centre is a critical response to these needs, offering a pathway to healing grounded in cultural reconciliation.

These findings highlight the need for targeted, culturally informed interventions at the Centre, addressing mental health disparities rooted in historical trauma. The Centre will provide physical and mental healing while serving as a hub for cultural restoration and community strengthening. By integrating traditional healing practices with contemporary mental health care, the Centre embodies a holistic approach that honors Indigenous cultural heritage. This initiative demonstrates the positive effects of culturally respectful, community-driven health interventions in overcoming historical injustices and promoting holistic wellness in Indigenous communities.

1.6 The Muskowekwan Family Healing and Wellness Centre: a paradigm of cultural reconciliation and recovery

Within this context, the Muskowekwan Family Healing and Wellness Centre emerges as an innovative model for Indigenous communities' mental health and recovery needs. It operationalizes therapeutic landscape concepts and cultural responsiveness, grounding its strategies in the historical and cultural realities of the communities it serves. Informed by the Cultural Responsiveness Framework (CRF) (12, 13) and Indigenous epistemologies, the Centre articulates a holistic healing approach, weaving Indigenous knowledge and practices into its foundational ethos.

1.7 Therapeutic landscapes and the path to decolonization

Adopting Gesler's (14) concept of therapeutic landscapes, the Centre's design integrates architectural elements inspired by decolonization theories and Indigenous knowledge, including circular layouts and skylights aligned with the four cardinal directions. Such design features helped to associate the land and culture, essential for mitigating colonization's persistent mental health effects (15, 16). Smith (17) argues that decolonizing healthcare involves the critical task of dismantling colonial structures within treatment approaches to confront the root causes of Indigenous mental health disparities. Marques et al. (18) explore the concept of Therapeutic Cultural Environments (TCE), which meld Indigenous knowledge (Mātauranga Māori) with the natural landscape (19), proposing a culturally attuned framework to promote health and well-being within Māori communities and provide insights into health-and-wellness.

1.8 Implementing the cultural responsiveness framework

The cultural responsiveness framework (CRF), co-created with consultation and insights from 74 First Nations communities, guides the Centre's approach to addressing mental health and substance use challenges. It advocates for revitalizing First Nations health systems and the cultural adaptation of service delivery (13, 20). The Centre's architectural emphasis on environmental integration and using natural materials exemplifies the CRF's application, presenting a tangible manifestation of cultural elements in promoting wellness and addressing mental health challenges (12).

1.9 Confronting historical trauma through culturally grounded methodologies

Historical trauma and systemic inequities underscore the need for culturally sensitive and equitable health interventions. Community-driven responses that incorporate cultural supports are crucial for reducing morbidity and mortality and addressing social determinants of health (21, 22). The Muskowekwan Centre's adoption of Justice, Diversity, Equity, and Inclusion (J-DEI) principles represents a significant step toward meeting the health needs of Indigenous peoples. This approach tackles historical injustices, values cultural diversity, ensures equitable access to health resources, and prioritizes Indigenous perspectives in health service planning and implementation.

1.10 Land as methodology: reaffirming Indigenous health paradigms

The Centre's alignment with Indigenous methods, particularly emphasizing the land, respects the MFN's cultural protocols. By incorporating traditional ceremonies, community narratives, and storytelling, the Centre acknowledges the land's intrinsic value to Indigenous health, identity, and spirituality (23, 24). The mental health challenges facing First Nations and Métis populations stem from colonization's traumatic legacies, requiring acknowledgment of historical and systemic injustices. The Muskowekwan Family Healing and Wellness Centre integrates cultural knowledge and ecological mindfulness, offering effective, culturally responsive mental health interventions in Indigenous settings (13, 25).

2 Methods

2.1 Community-Based Participatory Research approach

Our project used a Community-Based Participatory Research (CBPR) approach, known for effectively addressing public health concerns, advancing social and environmental justice, and empowering individuals to influence their health determinants (26). In collaboration with the Muskowekwan First Nation, we conducted community engagement sessions that were pivotal in creating the Healing and Wellness Centre. Led by Author 1, with support from University of Regina research assistants and Muskowekwan community-based researchers (Authors 3 and 4), our team's capabilities in community-based research were enhanced. This collaborative effort fostered professional growth and built capacity for community-sensitive engagements (27).

2.2 Research questions

The following research questions guided the study:

1 Qualitative Research Questions:

- What are the personal and communal experiences of trauma associated with the Muskowequan Indian Residential School?
- How do community members perceive the long-term impacts of this trauma on their mental health, social relationships, and cultural practices?
- What are the community's visions and recommendations for healing and wellness?

2 Quantitative Research Questions:

- What are the demographic characteristics of the community members affected by the Muskowequan Indian Residential School?

- How do community members rate their feelings toward family, community, and the natural environment?
- What is the level of engagement and perceived effectiveness of culturally based therapeutic interventions?

2.3 Data collection tools

1 Qualitative Data Collection:

- Round Table Discussions: Open-ended questions such as "What happened to you?" and "How do you want to heal?" were used to facilitate in-depth discussions. Research team members and community participants documented responses.
- Narrative Accounts: Participants were encouraged to share detailed personal narratives, which were recorded and transcribed for analysis.

2.4 Quantitative data collection

1 Demographic Questionnaire: A structured questionnaire collected demographic data, including age, gender, education level, and relationship to the Muskowequan Indian Residential School (e.g., survivor, descendant).

2 Survey: This survey included questions modified from the Native Wellness Assessment NWA™ (28) and the Awareness of Connectedness Scale (29). It featured Likert-scale questions to assess feelings toward family, community, and the natural environment, as well as the level of engagement in and perceived effectiveness of culturally and spiritually based therapeutic interventions. The Awareness of Connectedness Scale measures the holistic sense of connectedness of the individual with their family, community, and natural environment, an essential element of Indigenous worldviews and a protective factor against substance use and suicide, as well as an aid in recovery from substance use disorders.

2.5 Implications for culturally responsive healing framework

The findings from both qualitative and quantitative data are integrated to inform the development of the Family Healing and Wellness Centre. The qualitative insights provided a deep understanding of the community's experiences and needs, while the quantitative data offered measurable indicators of health and well-being. Together, these data sources illuminate the importance of a culturally responsive healing framework tailored to the specific context of the Muskowekwan First Nation community.

2.5.1 Historical context and research framing

The detrimental impact of the Indian Residential School System on the Muskowekwan First Nation established a vital historical context for our research aims. Guided by the Truth and Reconciliation Commission's calls to action (2015) and the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2), our methodological approach was culturally sensitive, delving into the complex layers of intergenerational trauma and its extensive consequences (30).

2.5.2 Execution of engagement sessions

Since 18 February 2017, and over 6 years, community engagement sessions have been conducted within the Muskowekwan First Nation. These sessions were developed in collaboration with community leaders and promoted across the region, including First Nations individuals affected by the Muskowequan residential school. The initial session set the groundwork for future sessions and gathered foundational data. Traditional prayers initiated the session, fostering an atmosphere of respect and openness. Approximately 50 participants, including elders, knowledge keepers, youth, residential school survivors and their descendants, and other community members, provided comprehensive perspectives on the community's experiences and needs (Figure 1).

2.5.3 Study design overview

The session was structured into two main parts:

1 Exploring the trauma:
- Participants were asked, "What happened to you?" allowing them to share personal experiences and narratives about the trauma endured, mainly focusing on the violence and abuse at the Muskowequan Indian Residential School. This discussion took the entire morning, ensuring ample time for sharing in a supportive environment. Educational psychology students on the research team provided emotional support.

2 Designing the healing process:
- Following lunch, participants completed a questionnaire on demographics and feelings toward family, community, and cultural interventions. The discussion then resumed with, "How do you want to heal from it?" gathering insights and suggestions on their visions for healing and how the Family Healing and Wellness Centre could support this process.

2.5.4 Detailed process and discussion starters

Counselor Cindy Desjarlais welcomed participants, providing background information about the collaboration between FSIN, TATC, Muskowekwan, and the research team. Drs. Pete and Sasakamoose introduced themselves and the research assistants, explaining the session's purpose and format. During round table discussions, research team members, including educational psychology students, sat with participants to offer support, recognizing the challenges of discussing personal and community traumas. Responses were documented and reviewed with the community for accuracy and additional input.

2.6 Data collection and analytical strategy

Our approach to engagement facilitated thorough and iterative discussions with community members. Feedback from sessions was analyzed and integrated into conference-style posters, fostering continuous community involvement. Descriptive statistical analysis examined the quantitative data, while thematic analysis was used for

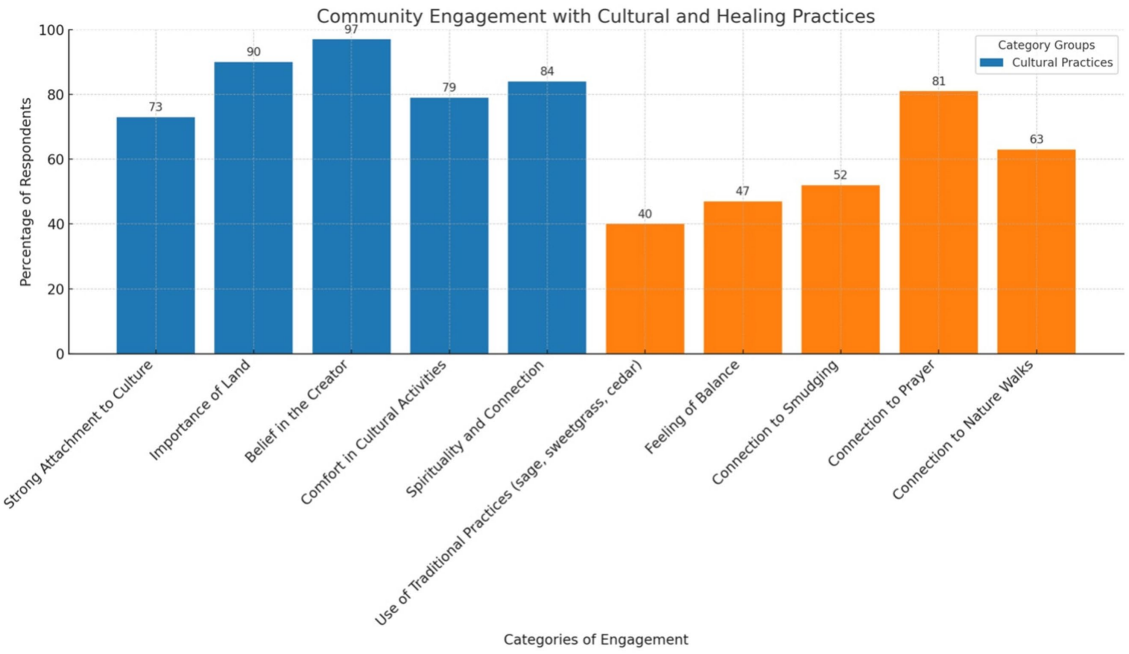

FIGURE 1
Categories of engagement with cultural healing practices.

qualitative data. This dual approach provided an in-depth understanding of the community's priorities and requirements, influencing the Healing and Wellness Centre's design and construction.

2.7 Ethical considerations and participant engagement

Given the project's sensitive nature, ethical rigor was paramount, emphasizing respect for Indigenous knowledge, cultural protocols, and historical injustices (31). The study received ethical approval from the appropriate review board, and all participants provided informed consent. An iterative feedback mechanism stressed the CBPR tenets of reciprocity, respect, and genuine community partnership (32). Our approach honored the Ownership, Control, Access, and Possession (OCAP)™ principles, affirming the community's sovereignty over their data.

2.8 Study design and inclusivity

The study focused on understanding the trauma experienced by those who attended the MIRS, recognizing it as a critical source of historical and current community trauma. MFN community leadership included diverse members affected by the school's presence to capture the broader intergenerational impacts. Central to our methodology was integrating traditional knowledge and practices, aligning our research with community values, and cementing the efficacy of the CBPR approach. Over 6 years, this project engaged the First Nation community in sessions pivotal to developing the Centre. Led by the principal investigator, with support from university research assistants and community-based researchers, these sessions enhanced the team's community-based research capabilities and facilitated professional growth.

3 Data analysis

We employed a multifaceted qualitative method grounded in thematic analysis, enriched by grounded theory principles, allowing themes to emerge naturally from the data (33). This was augmented by content analysis to explore textual data for recurring patterns, meanings, and relationships (34). Hierarchical coding techniques structured our analysis, organizing data into themes and sub-themes reflecting the community's experiences and insights. A mind map diagram visually represented our findings, enhancing accessibility and interpretability (35).

3.1 Identification of themes

A thorough review of the qualitative data highlighted themes like the impact of historical trauma, community healing needs, and visions for the healing center. This iterative process aligned with grounded theory's emphasis on data-driven category development (36). Detailed examination of participant responses distilled sub-themes, providing a granular view of the community's perspectives, such as "Residential School Effects" and "Intergenerational Consequences," each supported by direct participant quotes. Specific points highlighted by community members were outlined within each sub-theme, capturing the depth of the community's experiences and the multifaceted nature of historical trauma (Figure 2).

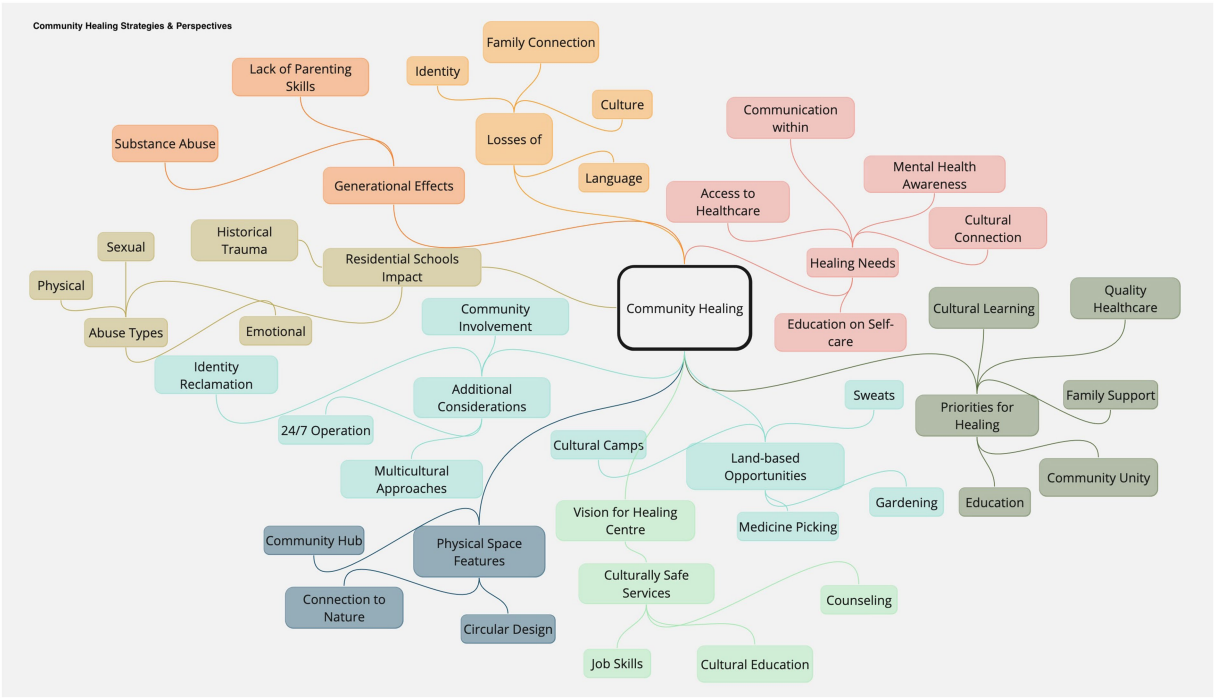

FIGURE 2
Community healing strategies and perspectives.

3.2 Structural clarity in mind map

Themes, sub-themes, and specific points were organized in a hierarchical mind map, visually representing complex data illustrating relationships between broad themes and particular insights.

3.3 Incorporating emotional and ethical reflections

The emotionally charged data required a sensitive approach, incorporating "two-eyed seeing" or Etuaptmumk, which uses both Indigenous and Western perspectives to emphasize empathy and ethical responsibility (37). Reflecting on the emotional impact of historical trauma narratives, our methodologies respected the community's voice and adhered to ethical standards in Indigenous research (17). Through this reflective process, we documented the Muskowekwan First Nation's journey toward healing and contributed to the discourse on culturally responsive methodologies in Indigenous health research. Our approach integrated traditional knowledge with qualitative research practices, representing the community's experiences, challenges, and aspirations for healing and wellness.

3.4 Applying the cultural responsiveness framework

The CRF within the Muskowekwan First Nation and the broader Indigenous community in Saskatchewan demonstrated impacts on healing and restoration, surpassing initial expectations. Our research extended beyond traditional academic pursuits to embrace healing the land and its people, marked by the legacies of ancestors and children. Genuine engagement with the community's stories of sorrow and resilience marks a crucial phase in their trauma recovery and healing journey. This reflective journey reinforces the critical need for research that adheres to ethical standards and resonates with Indigenous communities' emotional and cultural realities. It highlights the transformative potential of embracing culturally grounded methods and the essential role of empathy in navigating the complexities of Indigenous health research.

4 Findings

This case study reveals the Muskowekwan First Nation's significant progress towards healing and well-being, anchored in its rich cultural practices and traditional healing methods. Employing a mixed-methods approach, this case study provides insights into these practices' critical role in the community's collective path to healing.

4.1 Quantitative insights

Data indicates a high level of engagement within the community with spiritual and cultural beliefs. Approximately 97% of participants acknowledged the importance of belief in the Creator, and 90% emphasized the connection to the land for their well-being. Participation in cultural activities (79%) and spiritual practices (84%)

demonstrates the community's dedication to maintaining spiritual health and fostering a sense of belonging.

4.1.1 Diversity and nuances in traditional healing practices

The community's engagement with traditional healing practices showcases a spectrum of activities. While prayer (81%) and nature walks (63%) emerge as common practices, using sage, sweetgrass, and cedar is less prevalent, with 40% of respondents incorporating these elements into their healing routines. This variation suggests a rich tapestry of healing practices within the community, each carrying its significance and pointing to areas where community knowledge and access to traditional materials could be enhanced.

4.1.2 Implications for community healing

The quantitative outcomes reveal the pivotal role of cultural and spiritual engagement in the community's healing journey. By engaging in various spiritual and cultural practices, community members foster a sense of identity, belonging, and well-being, highlighting the importance of these elements. The diversity in traditional healing practices reveals the community's rich cultural heritage. It suggests opportunities for further enriching this aspect of communal life through educational initiatives and increased support for accessing and preserving traditional healing materials and knowledge.

4.2 Qualitative insights

Discussions with the MFN about the healing and wellness center revealed key themes:

4.2.1 Historical trauma and its legacy

Participants' narratives illustrated the lasting scars from the residential school system, highlighting the urgent need for healing initiatives that address psychological impacts and foster reconnection with lost cultural identities and practices.

4.2.2 Priority for holistic healing approaches

There is consensus on the need for holistic healing that addresses mental, physical, emotional, and spiritual health. This aligns with Indigenous views on health and wellness, reflecting a desire to integrate traditional healing practices with contemporary health interventions.

4.2.3 Cultural safety and land-based healing

Participants emphasized the importance of land and cultural practices in healing, expressing a desire for spaces that respect traditional values and aim to reclaim and revitalize land-based healing practices. Integrating these insights with quantitative data provides a comprehensive view of the Muskowekwan First Nation's healing journey, underscoring a community drawing strength from its cultural roots while navigating historical traumas. The collective aspiration for a holistic, culturally grounded approach to wellness emphasizes the need for policies that honor Indigenous healing practices. The Family Healing and Wellness Centre exemplifies the community's commitment to intertwining healing with cultural traditions and collective history, offering valuable insights for other communities seeking healing and cultural reclamation.

4.3 Fulfilling the vision: Muskowekwan Family Healing and Wellness Centre takes shape

The MFN is constructing a $2 million Family Healing and Wellness Centre, funded by stakeholders including Indigenous Services Canada, to address the historical effects of residential schools, the Sixties Scoop, and other traumatic events.

4.3.1 The urgent need for healing

Former Chief Reginald Bellerose emphasizes the urgency of this project in addressing historical traumas. The Centre aims to foster an environment where families in crisis can come together and embark on a collective healing journey.

4.3.2 Community-driven approach

The Centre is conceived and propelled "by the community for the community," aiming to create a welcoming, homelike environment where families can find the support they need to heal collectively.

4.3.3 A model informed by cultural responsiveness

Rooted in the Cultural Responsiveness Framework, the Centre addresses the systemic and long-term effects of historical trauma from the residential schooling system and the Sixties Scoop in Canada.

4.3.4 Holistic healing for families

The Centre focuses on healing families rather than individuals, integrating various health, mental health, and wellness services. It emphasizes cultural and traditional support, mainly land-based programming.

4.3.5 Extended in-residence healing

The Centre will house families for extended periods, prioritizing patient- and family-centered outcomes with trauma-informed care, wrap-around support, and multidisciplinary practitioners.

4.3.6 Guiding principles and cultural integration

Guided by community engagement sessions, the design integrates cultural nuances, with the circle symbolizing tradition and cultural significance. The center uses natural materials and aims for a "feel like home" ambiance.

4.3.7 Visualizing healing spaces

Conceptual renderings show family dwelling units facing a central circle, supporting outdoor gatherings and cultural events. An intimate gathering circle facilitates family healing ceremonies, discussions, and cultural practices.

The Muskowekwan Family Healing and Wellness Centre is more than a construction project; it is a testament to resilience, cultural revival, and a community's commitment to healing, shaping a future that honors its past.

5 The painful discovery of unmarked graves: a solemn tribute and ongoing investigation

Global media have covered stories about First Nations and the legacy of residential schools. Honoring the community's oral history

was crucial for building a new Healing and Wellness Centre on MFN land, revealing unmarked graves of children and adults from the residential school. Collaborative efforts between the MFN, University of Saskatchewan, and University of Alberta using ground-penetrating radar in 2018 and 2019 identified at least 35 graves (38). Earlier water line construction in the 1990s suggested more graves might await discovery. Elders believe unexplored areas remain, a task delayed due to funding challenges and the COVID-19 pandemic. The Federation of Sovereign Indigenous Nations (FSIN) and the Saskatchewan government are advocating for federal support to fund further radar searches at residential schools. FSIN Chief Bobby Cameron praised Saskatchewan's proactive stance in organizing these searches, stating, "The Muskowekwan community continues its path to healing and building upon resiliencies from enduring Canadian residential school trauma."

In acknowledgment of the residential schools' dark legacy, the MFN laid out 35 pairs of children's moccasins and shoes at the former residential school site, each pair symbolizing an unmarked grave discovered during investigations in 2018 and 2019. The ceremony also honored the 215 children found at Kamloops residential school and the 751 at Cowesses First Nation's Marieval Residential School.

During a somber gathering, Brian Wolfe [pseudonym], who spent 9 years at the Muskowekwan Indian Residential School, shared his experience. Taken from his family at seven, he recalls the experience of being separated from his family. Despite living mere meters away, he was forbidden to rejoin his family. Recounting instances of enjoyment, such as playing sports and hardship, enduring physical abuse for trying to learn his language, Wolfe reflects on the lost opportunity to inherit his father's Cree language.

> I missed out on learning my father's Cree language. It's like a piece of my identity is missing, Wolfe shared, grieving the cultural connections lost to him.

Jimmy Sayer attended the MFN residential school from 1983 to 1984, and he articulates his experience.

> I've spent half my life incarcerated, and I blame the residential school for that. But I also know I must give up my hate because I'm responsible for myself. I have three adult daughters, and I was in jail for the duration of their childhoods. I have a two-year-old son now, and I need to be there for him; I have to be different.

The discoveries of unmarked graves at the site of the former residential school on MFN territory starkly remind us of the painful legacies that persist within Indigenous communities. This solemn tribute and ongoing investigation unearth truths that have long been silenced, igniting a collective resolve to honor those lost and support the healing journeys of survivors. The collaborative efforts to map out and reclaim these sacred spaces are acts of resilience and restoration, reaffirming the community's commitment to remembering and learning from the past. As we look to the future, we must continue to support these endeavors, ensuring that the voices of the community guide us and that we never forget the profound impacts of these historical injustices. Through remembrance, acknowledgment, and informed action, we contribute to the healing and strengthening of the community, paving the way for a future where such injustices are no longer repeated.

5.1 Moving towards reconciliation: a symbolic designation and commitment to truth

Acknowledging the residential school system as a shameful and racist colonial policy, as stated in the government's news release, marked a critical step towards reconciliation. Designating the former school as a national historic site aligned with Canada's commitment to the Truth and Reconciliation Commission's calls to action, particularly addressing call 79. This call urges implementing a national heritage plan and strategy to commemorate residential school sites and their histories.

Former Chief Reginald Bellerose of the MFN emphasized the significance of this designation, expressing hope for a new era of reconciliation and learning. The national historic site stands as a solemn reminder of the enduring negative impacts of residential schools on Indigenous communities, cultures, and ways of life. The MFN can now share its truth and rewrite a narrative long overlooked in the broader Canadian historical context.

6 Discussion: implications, lessons learned, and embracing land-based healing across spiritual practices

This investigation into the Muskowekwan Family Healing and Wellness Centre demonstrates the Muskowekwan First Nation's commitment to healing and wellness, rooted in cultural and spiritual practices. Through integrating quantitative and qualitative research methodologies, the study has illuminated the significant role of cultural and spiritual engagement in the community's healing journey. It has highlighted how the connection to land and the embrace of land-based healing practices provide a unifying foundation across the diversity of spiritual beliefs, including traditional Indigenous spirituality and Christianity.

6.1 Cultural and spiritual engagement

The data showcases a diverse community where spiritual practices and beliefs reflect a rich tapestry of traditional Indigenous spirituality alongside Christianity. Despite this diversity, land-based healing is a common thread that unites these varying practices. The Muskowekwan Family Healing and Wellness Centre, guided by the Cultural Responsiveness Framework (CRF), navigates this diversity by focusing on land as a central element in healing, respecting the deep-rooted connection that traditional and Christian community members feel towards the land.

6.2 Embracing land-based healing

The emphasis on land-based healing practices presents a unique opportunity to bridge traditional Indigenous and Christian spiritual approaches. This focus acknowledges the land as a source of healing, wisdom, and identity for the Muskowekwan community, transcending individual spiritual beliefs. By grounding healing interventions in the

land, the center fosters an inclusive environment where all community members, regardless of their spiritual orientation, can find common ground and support in their healing journeys.

6.3 Challenges and opportunities

Integrating diverse spiritual practices focusing on land-based healing brings challenges and opens pathways for meaningful community engagement and healing. Key lessons from the MFN Family Healing and Wellness Centre include:

- Unified Healing Approach: Successful healing practices recognize the unifying power of the land. Emphasizing land-based interventions can transcend the diversity of spiritual beliefs within Indigenous communities, offering a shared space for healing and connection.
- Inclusive Community Engagement: Involving the community in developing and initiatives ensures diverse spiritual practices are respected and integrated, with land-based healing serving as a common platform for engagement.
- Educational and Dialogical Initiatives: Educational programs play a valuable role in highlighting the significance of land in healing practices. Creating spaces for dialog about the intersections of land, spirituality, and healing can enhance understanding and respect among community members who follow different spiritual paths.

6.4 Toward a culturally responsive healing framework

This study underscores the importance of culturally congruent health interventions that honor the land's role in Indigenous healing. The Muskowekwan First Nation's experience illustrates how healthcare models can embrace a holistic approach, using land-based healing to bridge diverse spiritual beliefs. The Muskowekwan Family Healing and Wellness Centre is a model for creating inclusive healing spaces that accommodate Indigenous spiritual and cultural diversity, promoting unity, resilience, and wellness.

6.5 Future directions

Future research could explore the long-term impacts of culturally grounded health programs, providing a replicable model for other Indigenous communities. Key areas of focus include:

- Expanding participatory research to include a broader spectrum of Indigenous communities, enriching the analysis of healing practices.
- Investigating the implementation and efficacy of policy and practice changes, particularly those emphasizing J-DEI principles.

These insights informed the development of the Family Healing and Wellness Centre, ensuring that services align with the community's needs and preferences for culturally integrated healing practices.

6.6 Policy and practice implications

This study highlights the need for policies prioritizing Indigenous healing traditions within broader health initiatives. Recommendations include:

- Formal recognition and integration of traditional healing practices within public health frameworks.
- Implementing cultural safety training for healthcare providers to enhance respectful and inclusive services.
- Allocating resources to support language and cultural revitalization programs as integral to mental health and wellness initiatives.
- Developing land-based healing programs that align with Indigenous perspectives on health and well-being.

Incorporating these recommendations can create a healthcare landscape that addresses the unique needs of Indigenous communities while celebrating and preserving their rich cultural heritage. This study contributes to the discourse on Indigenous health, highlighting the transformative potential of culturally responsive healing initiatives in fostering resilience, well-being, and vibrant community life for the Muskowekwan First Nation and beyond.

Data availability statement

The datasets presented in this article are not readily available because in alignment with the OCAP® principles that govern the rights of Indigenous communities to own, control, access, and possess information about themselves, the datasets generated and analyzed during this study are not publicly available. The Muskowekwan First Nation, as the custodian of the data, has determined that the sensitive nature of the mental health information and the small community size necessitate stringent confidentiality measures to protect individuals' anonymity and privacy. Given the intimate connection between the data and the community's well-being, coupled with the ethical considerations surrounding mental health research, all data remains under the direct stewardship of the Muskowekwan First Nation. Access to the data is restricted to authorized personnel approved by the community, following agreed-upon protocols that respect the community's sovereignty and the individual participants' confidentiality. For researchers interested in understanding more about the methodologies employed or the insights garnered from this study in a manner that respects these constraints, we encourage direct communication with our corresponding author. We are committed to sharing knowledge and best practices derived from our work with the Muskowekwan First Nation in ways that honor and uphold the principles of OCAP® and the community's requirements. Further information on the ethical guidelines and community agreements that underpin this study's data management practices can be found in the "Availability of Data" section of our

Materials and Data Policies, as outlined in the Author Guidelines. These policies have been developed to ensure that our research practices comply and actively support the rights and responsibilities articulated through OCAP®. Requests to access the datasets should be directed to jolee.sasakamoose@uregina.ca.

Ethics statement

The studies involving humans were approved by University of Regina Ethics Board. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants.

Author contributions

JS: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. SP: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing – review & editing, Writing – original draft. FO'S: Data curation, Formal analysis, Investigation, Validation, Writing – review & editing, Writing – original draft. TW: Data curation, Formal analysis, Investigation, Validation, Writing – review & editing, Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted with no commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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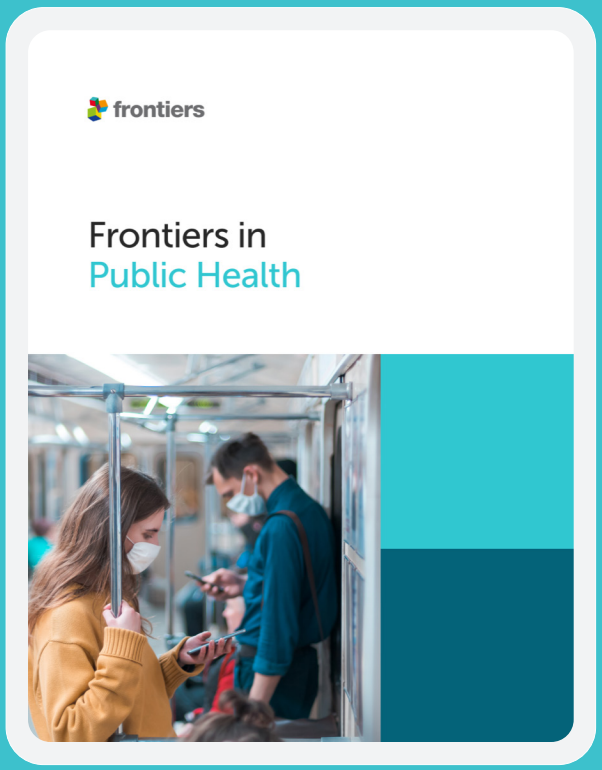

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