

RESEARCH

Open Access



Influence of biopsychosocial factors on self-reported anxiety/depression symptoms among first-generation immigrant population in the U.S.

David Adzrago^{1*}, Kiran Thapa^{2†}, Janani Rajbhandari-Thapa^{3†}, Saanie Sulley^{4†} and Faustine Williams¹

Abstract

Background Despite increasing studies on mental health among immigrants, there are limited studies using nationally representative samples to examine immigrants' mental health and its potential biopsychosocial contributing factors, especially during the COVID-19 pandemic. We explored and estimated the influence of life satisfaction, social/emotional support, and other biopsychosocial factors on self-reported anxiety/depression symptoms among a nationally representative sample of first-generation immigrants in the U.S.

Methods We conducted a secondary data analysis using the 2021 National Health Interview Survey among first-generation adults aged ≥ 18 years ($n = 4295$). We applied survey weights and developed multivariable logistic regression model to evaluate the study objective.

Results The prevalence of daily, weekly, or monthly anxiety/depression symptoms was 10.22% in the first-generation immigrant population. There were 2.04% daily, 3.27% weekly, and 4.91% monthly anxiety/depression among the population: about 8.20%, 9.94%, and 9.60% experienced anxiety symptoms, whereas 2.49%, 3.54%, and 5.34% experienced depression symptoms daily, weekly, and monthly, respectively. The first-generation population aged 26–49 years were less likely to experience anxiety/depression daily, weekly, or monthly compared to those aged 18–25. Females (versus males) were more likely to experience anxiety/depression daily, weekly, or monthly. Those who identified as gay/lesbian had higher odds of experiencing anxiety/depression daily, weekly, or monthly compared to heterosexual persons. Relative to non-Hispanic White individuals, non-Hispanic Asian, Black/African American, and Hispanic individuals had lower odds, while other/multi-racial/ethnic groups were more likely to experience anxiety/depression daily, weekly, or monthly. A higher life satisfaction score was associated with lower odds of experiencing anxiety/depression daily, weekly, or monthly. Having social/emotional support sometimes/rarely or using healthcare within the past one/two years was associated with experiencing anxiety/depression daily, weekly, or monthly.

[†]Kiran Thapa, Janani Rajbhandari-Thapa, Saanie Sulley Equal contribution as second coauthors.

*Correspondence:
David Adzrago
david.adzrago@nih.gov

Full list of author information is available at the end of the article



This is a U.S. Government work and not under copyright protection in the US; foreign copyright protection may apply 2024. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

Conclusions The findings reveal significant burden of anxiety and depression among first-generation population in the U.S., with higher risks among subgroups like young adults, females, sexual minorities, and non-Hispanic White and other/multi-racial individuals. Additionally, individuals with lower life satisfaction scores, limited social/emotional support, or healthcare utilization in the past one or two years present increased risk. These findings highlight the need for personalized mental health screening and interventions for first-generation individuals in the U.S. based on their diversity and health-related risks.

Keywords Mental health, Immigrants, First-generation, Foreign-born, Nativity, Disparities, Psychological, Biopsychosocial

Background

First-generation immigrants (i.e., individuals who are foreign born or not born in their host country) often face higher socioeconomic challenges with associated stress than second, third, and higher generation individuals (native-born or born in the host country) [1–4]. First-generation immigrants in the United States (U.S.) in 2018 account for 13.7% of the U.S. population, which is close to the historic high in 1890 (14.8%) [5]. Labor force participation also increased from 17.2% in 2007 to 21.2% in 2017 for lawful immigrants [5]. Despite increasing participation in the labor force and important contribution to the U.S. economy, immigrants are largely understudied in mental health research. Immigrant-specific struggles, such as language barriers, social isolation, discrimination, and a loss of social support networks, can exacerbate existing mental health issues or trigger new ones among immigrants. The experience of acculturative stress, a psychological distress that results from the process of adapting to a new culture, may also contribute to mental health issues among immigrants [6]. Many immigrants might have experienced trauma, including war or persecution, in their country of origin, which can further complicate their mental health [7]. Post-migration stress and trauma have also been found to impact the mental health of these populations [8], suggesting the need to evaluate the potential risk factors for mental health conditions that can vary for immigrant subgroups, especially during pandemic like the COVID-19.

Mental health disorder symptoms, including anxiety and depression that are the most common symptoms, have increased risks for morbidity (e.g., cancer, cardiovascular diseases, stroke, diabetes, Alzheimer's disease) and mortality [9–20]. Anxiety and depression symptoms, often assessed together to measure overall psychological distress or mental health, commonly co-occur with elevated disability severity [9, 15, 20–24]. The detrimental impacts of mental health disorder symptoms further highlight the need to assess these symptoms, especially anxiety and depression symptoms, among immigrant population who are generally understudied in the mental health field to augment the literature and enhance tailored mental health interventions.

The need for mental health research has become increasingly apparent during the COVID-19 pandemic. The pandemic has exacerbated existing mental health issues and also given rise to new ones, disproportionately impacting immigrant communities [25, 26]. Immigrants faced heightened health risks, economic challenges, and social isolation due to the pandemic [27, 28]. Immigrants may not only encounter unique challenges that lead to increasing prevalence of anxiety and depression, but also distinct barriers related to accessing mental health services including language, lack of insurance, and stigma surrounding mental health [29]. Lai and colleagues, for example, found that Chinese immigrants were less likely to seek help for mental health issues due to stigma and a lack of understanding about mental health [30]. Similarly, another study found that female Latino immigrants were less likely to use mental health services compared to non-immigrant Latinos due to financial and logistical barriers [31]. In recent years, there has been a growing interest in studying mental health and its associated factors among immigrants. In particular, one study examined the role of social support in the mental health of Somali refugees, revealed that high levels of social support were associated with better mental health outcomes [32]. Another study focused on the experiences of immigrant women in Canada, highlighting the importance of culturally sensitive care and the need to address social and structural determinants of health [33].

Despite increasing research on mental health among immigrants, there are limited studies using nationally representative samples to examine immigrants' mental health, especially during the COVID-19 pandemic. An area less examined is life satisfaction, a significant determinant of overall wellbeing or quality of life, among immigrants and its association with mental health [34, 35]. The associated health benefits of life satisfaction include longer and healthier lives, better mental health, and reduced mortality risks [34–40]. Life satisfaction thus reduces the risk of experiencing mental health problems, including anxiety and depression [41–44]. Individuals with higher life satisfaction have lower mental health problems, particularly psychological distress, anxiety, depression, and suicidality [41–44]. Given the importance of life satisfaction, especially for immigrants

who seek better socioeconomic conditions and safety in their host countries [39, 45], there is a need to evaluate the influence of life satisfaction on mental health among immigrants.

Given the distinctive acculturative stressors immigrants face, it is crucial to study mental health-related factors specific to the immigrant population to develop effective interventions and support systems for this population. Mental health is the central factor of biopsychosocial factors (i.e., interaction between biological, psychological, and socio-environmental experiences) among immigrants. That is, according to the biopsychosocial model or framework perspective, mental health conditions are easily influenced by biological (e.g., age, sex, weight), psychological (e.g., life satisfaction), and socio-environmental (e.g., income, education, sexual orientation, health utilization) factors among immigrants [46–57]. Understanding how biopsychosocial factors or experiences contribute to mental health issues among immigrants, during this COVID-19 pandemic, can inform the development of culturally sensitive and linguistically appropriate services during and after epidemiologic crisis. This can help ensure that immigrants receive the care they need to manage their mental health and lead healthy, productive lives in their new home countries and continue to make contributions to the U.S. economy. This study aimed to (a) explore the patterns/frequency of anxiety, depression, and anxiety/depression symptoms and (b) estimate the influence of life satisfaction, social support, and other biopsychosocial factors (i.e., sociodemographic characteristics, health utilization) on anxiety/depression symptoms among foreign-born or first-generation immigrant population during the COVID-19 pandemic. The insights obtained from this study will be timely and essential in informing the development of targeted and culturally sensitive interventions to mitigate the mental health impacts of the pandemic on immigrant populations.

Methods

Study design

We conducted a secondary data analysis using the 2021 National Health Interview Survey (2021 NHIS) deidentified public use file. NHIS is a nationally representative household-level cross-sectional survey conducted among the civilian noninstitutionalized population of the U.S. to assess health information and the demographic and socioeconomic characteristics of the population [35]. It is conducted annually among children (0–17 years) and adults ≥ 18 years by the National Center for Health Statistics (NCHS). The NHIS involves a stratified, multi-stage, complex clustered sampling of random dwelling units and participants [35]. First, the U.S. is partitioned into geographic areas including counties, a small group of

contiguous counties, or a metropolitan area within state boundaries. Next, geographical areas are divided into strata based on population density (i.e., urban and rural counties) within some states (i.e., populous states), while all the geographical areas form one stratum within the remaining states. Third, clusters of addresses or houses are systematically defined within each stratum. Finally, a child and an adult are randomly chosen from each selected household to form the NHIS sample. The 2021 survey was conducted between January and December 2021. The data were collected through in-person and telephone interviews. The 2021 NHIS includes a total of 29,482 adults (response rate was 50.9%) [35]. For this analysis, we conducted a subpopulation analysis using the sample of foreign-born or first-generation adults, individuals not born in the U.S. or U.S. territory ($n=4709$). We performed a complete case analysis resulting in 4295 first-generation adults.

Measures

Self-reported measures anxiety/depression

The dependent variable was self-reported anxiety/depression symptoms. Anxiety symptoms were assessed by asking the participants to self-report, “How often do you feel worried, nervous, or anxious? Would you say daily, weekly, monthly, a few times a year, or never?” Depression symptoms were evaluated by asking the participants, “How often do you feel depressed? Would you say daily, weekly, monthly, a few times a year, or never?” The response options were the same for anxiety and depression symptoms: 1=Daily, 2=Weekly, 3=Monthly, 4=A few times a year, 5=Never, 7=Refused, 8=Not Ascertained, 9=Don't Know. We combined anxiety and depression symptoms to form anxiety/depression symptoms. Similar to the literature [58], we dichotomized the anxiety/depression symptoms into a positive outcome if the participants experienced the symptoms of either anxiety or depression daily, weekly, or monthly; otherwise, the participants were assigned a negative outcome.

Biopsychosocial factors

Life satisfaction was assessed via a single-item measure by asking the participants, “Using a scale of 0 to 10, where 0 means “very dissatisfied” and 10 means “very satisfied,” how do you feel about your life as a whole these days?” Higher values represent higher life satisfaction among the participants.

Social/emotional support frequency was measured through “How often do you get the social and emotional support you need? Would you say always, usually, sometimes, rarely, or never?” The response options included 1=Always, 2=Usually, 3=Sometimes, 4=Rarely, 5=Never, 7=Refused, 8=Not Ascertained, or 9=Don't

Know. We recoded this variable as always/usually, sometimes/rarely, or never.

We also analyzed the following independent variables: age (18–25, 26–34, 35–49, 50–64, 65 or older), biological sex (male or female), sexual orientation (heterosexual, lesbian/gay, bisexual, or other [something else, or uncertain]), citizenship status (citizen or non-citizen), race/ethnicity (non-Hispanic White, non-Hispanic Black/African American, non-Hispanic Asian, Hispanic, or other race/ethnic group [American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, or other single and multiple races]), level of education completed (Less than high school, high school diploma or G.E.D., some college/associate degree, or college or higher degree), family income to poverty ratio (0.00–11+), health insurance status (Not insured or insured), marital status (Single/never married, married, or divorced/separated/widowed), acculturation/length of stay in the U.S. (Less than 5 years or ≥5 years), and BMI (Healthy weight [BMI=18.5 to <25], underweight [BMI<18.5], Overweight [BMI≥25 to <30], or obese [BMI≥30]). Healthcare

utilization was assessed by asking, “About how long has it been since you last saw a doctor or other health professional about your health?” Response options were 0=Never, 1=Within the past year (anytime less than 12 months ago), 2=Within the last 2 years (1 year but less than 2 years ago), 3=Within the last 3 years (2 years but less than 3 years ago), 4=Within the last 5 years (3 years but less than 5 years ago), 5=Within the last 10 years (5 years but less than 10 years ago), 6=10 years ago or more, 7=Refused, 8=Not Ascertained, or 9=Don’t Know. We recategorized this variable as within the last three years or more/never used, within the last two years, or the past year or 12 months.

Statistical analyses

We first generated patterns/frequency of anxiety, depression, and anxiety/depression symptoms among the first-generation population (Fig. 1). Next, we computed descriptive and bivariate statistics of anxiety/depression symptoms by the biopsychosocial risk factors among the first-generation population (Table 1).

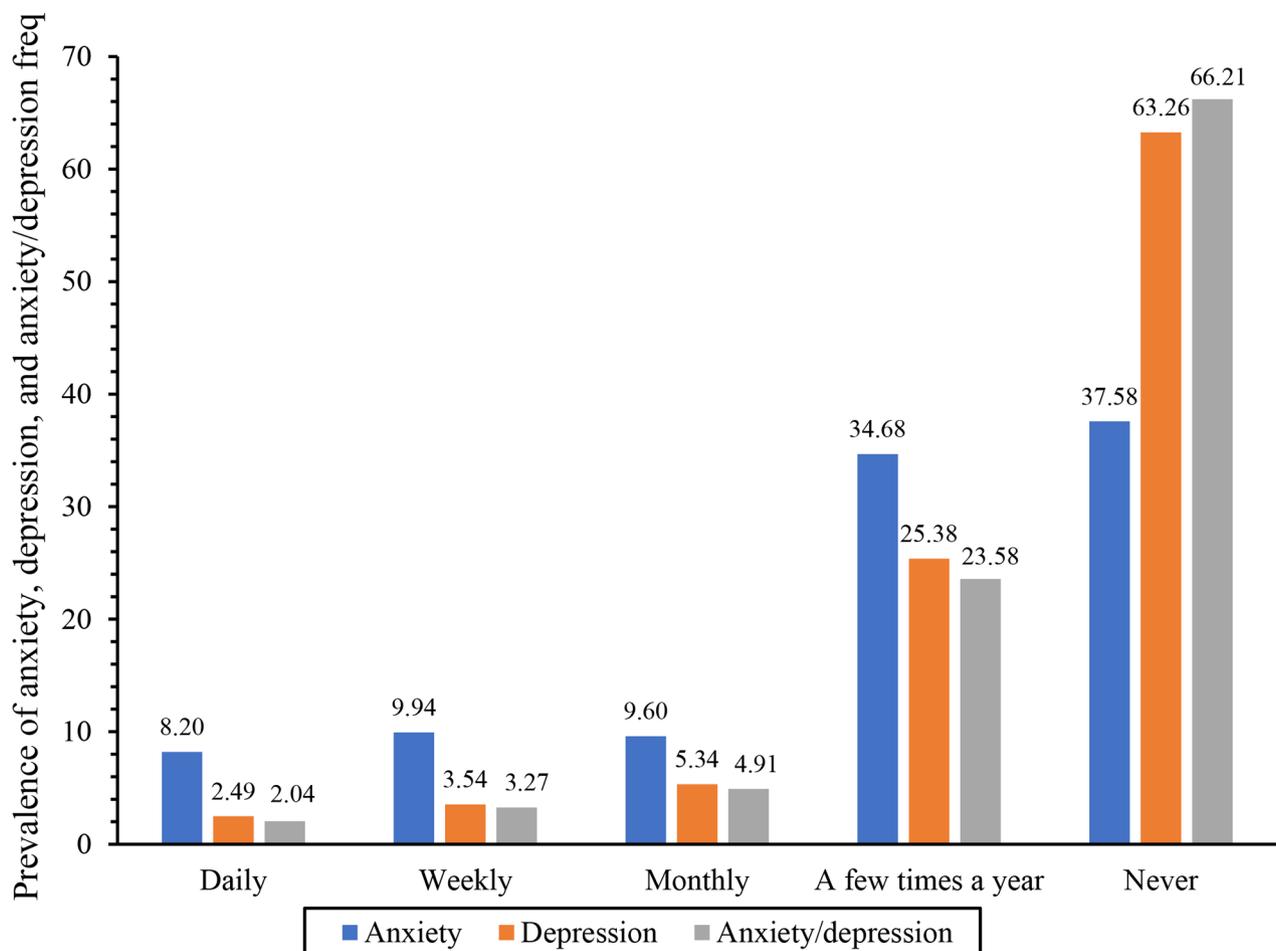


Fig. 1 Prevalence of anxiety, depression, and anxiety/depression symptoms among the foreign-born/first-generation population

Table 1 Descriptive and bivariate statistics of the frequency of anxiety/depression symptoms by life satisfaction, and other sociodemographic characteristics among the first-generation population (Unweight $n=4295$ and Weighted $N=40,990,369$)

	Frequency of anxiety/depression			P-value
	Overall Sample n (%)	A few times a year or never n (%)	Daily/weekly/monthly n (%)	
Overall		3,841 (89.78)	454 (10.22)	
Age groups				0.0002
18–25	223 (7.87)	191 (86.10)	32 (13.90)	
26–34	615 (15.25)	563 (92.69)	52 (7.31)	
35–49	1416 (33.04)	1296 (92.32)	120 (7.68)	
50–64	1160 (26.75)	1015 (87.18)	145 (12.82)	
65 and older	881 (17.09)	776 (88.03)	105 (11.97)	
Sex				0.0062
Male	1926 (48.11)	1760 (91.32)	166 (8.68)	
Female	2369 (51.89)	2081 (88.36)	288 (11.65)	
Sexual orientation				0.0032
Heterosexual	4126 (96.09)	3705 (90.13)	421 (9.87)	
Gay/Lesbian	54 (1.07)	41 (79.28)	13 (20.72)	
Bisexual	30 (0.64)	21 (71.73)	9 (28.27)	
Other/uncertain	85 (2.20)	74 (84.78)	11 (15.22)	
Citizenship status				0.2918
Citizen	2661 (58.43)	2365 (89.27)	296 (10.73)	
Non-citizen	1634 (41.58)	1476 (90.50)	158 (9.50)	
Race/ethnicity				0.0002
Non-Hispanic White	915 (18.02)	789 (86.97)	126 (13.03)	
Non-Hispanic Black/African American	361 (10.07)	329 (91.23)	32 (8.77)	
Non-Hispanic Asian	1275 (25.76)	1178 (91.60)	97 (8.40)	
Hispanic	1679 (44.86)	1496 (90.05)	183 (9.95)	
Other/Multi-racial group	65 (1.30)	49 (72.27)	16 (27.73)	
Level of education completed				0.1076
Less than high school	765 (20.76)	683 (89.79)	82 (10.21)	
High school diploma or GED	895 (24.31)	802 (90.62)	93 (9.38)	
Some college/associate degree	844 (18.68)	740 (87.00)	104 (13.00)	
Family income to poverty ratio (Mean: SD)	4295 (3.65: 2.93)	3841 (3.67: 2.92)	454 (3.47: 2.99)	0.2404
Health insurance status				0.1843
Not insured	579 (17.04)	526 (91.55)	53 (8.45)	
Insured	3716 (82.96)	3315 (89.42)	401 (10.58)	
Marital status				0.0004
Single/never married	828 (20.35)	726 (88.62)	102 (11.38)	
Married	2586 (64.86)	2363 (91.20)	223 (8.80)	
Divorced/Separated/Widowed	881 (14.80)	752 (85.16)	129 (14.84)	
Acculturation/length of stay in the U.S.				0.3301
Less than five years	263 (6.72)	242 (91.91)	21 (8.09)	
Five years or more	4032 (93.28)	3599 (89.63)	433 (10.37)	
Life satisfaction (Mean: SD)	4295 (8.41: 1.73)	3841 (8.58: 1.54)	454 (6.86: 2.42)	< 0.0001
Social/emotional support frequency				0.0001
Never	367 (8.69)	337 (91.66)	30 (8.34)	
Sometimes or rarely	705 (15.55)	555 (80.55)	150 (19.45)	
Always or usually	3223 (75.76)	2949 (91.46)	274 (8.54)	
Healthcare utilization				0.0001
Within the last three years or more/never used	383 (9.65)	359 (95.58)	24 (4.42)	
Within the last two years	541 (12.81)	498 (92.07)	43 (7.93)	
Within the past year	3371 (77.54)	2984 (88.68)	387 (11.32)	
BMI status				0.0347
Healthy weight	1651 (35.69)	1490 (89.99)	161 (10.01)	

Table 1 (continued)

	Overall Sample n (%)	Frequency of anxiety/depression		P-value
		A few times a year or never n (%)	Daily/weekly/monthly n (%)	
Underweight	75 (1.66)	60 (77.76)	15 (22.24)	
Overweight	1598 (38.16)	1437 (90.45)	161 (9.56)	
Obese	971 (24.49)	854 (89.25)	117 (10.75)	

SD=standard deviation

The bivariate statistics were calculated using Rao–Scott χ^2 tests and t-test or ANOVA to determine differences in the frequency of anxiety/depression symptoms by the biopsychosocial risk factors. We used the Rao–Scott χ^2 because of its widely use with design-based approach and accounts for complex survey or sampling design [59–61]. A statistical significance level of ≤ 0.0005 , instead of < 0.05 , was used at the bivariate analysis level to determine group differences to reduce uncertainty in the significance of the groups.

We conducted a series of unadjusted logistic regression models to assess the association between anxiety/depression symptoms and each of the biopsychosocial risk factors (Table 2). Next, we used an adjusted multivariable logistic regression model to examine the association between the anxiety/depression symptoms and the biopsychosocial risk factors (Table 2); for each variable, the remaining variables were controlled for in the model. All the analyses, including the logistic regression analyses, were weighted using the NHIS 2021 sampling weight to account for the complex survey or sampling design (i.e., cluster, strata, and sampling weight) and offset nonresponse and produce nationally representative estimates. STATA 17.0 was used to conduct the analyses. We conducted a complete case analysis. The logistic regression models estimated adjusted odds ratios (AORs) with 95% confidence intervals (CIs) and crude or unadjusted ORs.

Results

Sociodemographic characteristics of the first-generation population

Table 1 presents the descriptive and bivariate statistics. Most of the first-generation population was 35–49 years of age (33.04%), female (51.89%), heterosexual (96.09%), U.S. citizen (58.43%), Hispanic (44.86%), completed college or higher education (36.26%), mean family income to poverty ratio of 3.65 (SD=2.93), had insurance (82.96%), married (64.86%), lived in the U.S. for five years or more (93.28%), had a mean life satisfaction score of 8.41 (SD=1.73), had social/emotional always or usually (75.76%), used healthcare within the past 12 months (77.54%), or were overweight (38.16%).

Prevalence of anxiety/depression, anxiety, and depression

The prevalence of daily, weekly, or monthly anxiety/depression symptoms was 10.22% in the population (Table 1). There were 2.04% daily, 3.27% weekly, and 4.91% monthly anxiety/depression symptoms among the population (Fig. 1); about 8.20%, 9.94%, and 9.60% experienced anxiety symptoms, whereas 2.49%, 3.54%, and 5.34% experienced depression symptoms daily, weekly, and monthly, respectively. Overall, anxiety symptoms were more frequent compared to depression symptoms and anxiety/depression symptoms. We observed statistically significant differences between anxiety and depression patterns ($p < 0.0001$).

There were significant differences in the frequency of anxiety/depression symptoms based on the biopsychosocial risk factors (Table 1). Of the population with daily, weekly, or monthly anxiety/depression symptoms, the majority were 18–25 years (13.90%), females (11.65%), bisexual individuals (28.27%), non-Hispanic White (13.03%) or other racial/ethnic groups (27.73%), were divorced/separated/widowed (14.84%), had a lower life satisfaction score (mean: 6.86, SD=2.42), sometimes or rarely had social/emotion support (19.45%), used healthcare within the past 12 months (11.32%), and were underweight (22.24%).

Biopsychosocial factors associated with anxiety/depression

The odds ratio estimates are presented in Table 2. The first-generation population aged 26–34 (AOR: 0.52; 95% CI: 0.30, 0.91) or 35–49 (AOR: 0.58; 95% CI: 0.34, 0.98) years were less likely to experience anxiety/depression daily, weekly, or monthly compared to those aged 18–25 years. Females, compared to males, were more likely to experience anxiety/depression daily, weekly, or monthly (AOR.: 1.39; 95% CI: 1.05, 1.84). Those who identified as gay/lesbian individuals had higher odds of experiencing anxiety/depression daily, weekly, or monthly (AOR: 2.43; 95% CI: 1.02, 5.77) compared to their heterosexual counterparts. Non-Hispanic Asian (AOR: 0.60; 95% CI: 0.42, 0.86), Black/African American (Crude OR: 0.64; 95% CI: 0.41, 0.99 and AOR: 0.62; 95% CI: 0.38, 1.02), and Hispanic (Crude OR: 0.74; 95% CI: 0.55, 0.99 and AOR: 0.83; 95% CI: 0.57, 1.20) individuals had lower odds of experiencing anxiety/depression daily, weekly, or monthly

Table 2 Multivariable logistic regression analysis of the effects of biopsychosocial factors on anxiety/depression symptoms (Daily/weekly/monthly versus a few times a year or never)

	Crude OR (95% CI)	Adjusted OR (95% CI)
Age groups		
18–25	Ref	Ref
26–34	0.49** (0.29, 0.82)	0.52* (0.30, 0.91)
35–49	0.52** (0.33, 0.81)	0.58* (0.34, 0.98)
50–64	0.91 (0.57, 1.45)	0.84 (0.49, 1.45)
65 and older	0.84 (0.52, 1.36)	0.70 (0.39, 1.26)
Sex		
Male	Ref	Ref
Female	1.39** (1.10, 1.75)	1.39* (1.05, 1.84)
Sexual orientation		
Heterosexual	Ref	Ref
Gay/Lesbian	2.39* (1.14, 5.01)	2.43* (1.02, 5.77)
Bisexual	3.60** (1.39, 9.32)	2.18 (0.70, 6.83)
Other/uncertain	1.64 (0.80, 3.37)	1.44 (0.63, 3.31)
Citizenship status		
Citizen	Ref	Ref
Non-citizen	0.87 (0.68, 1.12)	0.97 (0.71, 1.34)
Race/ethnicity		
Non-Hispanic White	Ref	Ref
Non-Hispanic Black/African American	0.64* (0.41, 0.99)	0.62 (0.38, 1.02)
Non-Hispanic Asian	0.61** (0.44, 0.85)	0.60** (0.42, 0.86)
Hispanic	0.74* (0.55, 0.99)	0.83 (0.57, 1.20)
Other/Multi-racial group	2.56** (1.28, 5.10)	2.64* (1.08, 6.42)
Level of education completed		
Less than high school	Ref	Ref
High school diploma or GED	0.91 (0.63, 1.32)	0.95 (0.62, 1.45)
Some college/associate degree	1.31 (0.90, 1.91)	1.13 (0.72, 1.77)
Family income to poverty ratio		
	0.98 (0.94, 1.02)	1.00 (0.95, 1.05)
Health insurance status		
Not insured	Ref	Ref
Insured	1.28 (0.89, 1.85)	0.79 (0.50, 1.24)
Marital status		
Single/never married	Ref	Ref
Married	0.75 (0.56, 1.01)	0.95 (0.67, 1.36)
Divorced/Separated/Widowed	1.36 (0.95, 1.94)	1.20 (0.79, 1.82)
Acculturation/length of stay in the U.S.		
Less than five years	Ref	Ref
Five years or more	1.32 (0.76, 2.29)	1.20 (0.65, 2.23)
Life satisfaction		
	0.65*** (0.61, 0.70)	0.67*** (0.63, 0.72)
Social/emotional support frequency		
Never	Ref	Ref
Sometimes or rarely	2.65*** (1.60, 4.40)	2.39** (1.42, 4.04)
Always or usually	1.03 (0.62, 1.69)	1.18 (0.70, 1.98)
Healthcare utilization		
Within the last three years or more/never used	Ref	Ref
Within the last two years	1.86 (0.99, 3.52)	2.05* (1.03, 4.07)
Within the past year	2.76*** (1.64, 4.67)	2.51** (1.39, 4.55)
BMI status		
Healthy weight	Ref	Ref
Underweight	2.57* (1.23, 5.38)	1.92 (0.89, 4.18)
Overweight	0.95 (0.73, 1.24)	1.04 (0.75, 1.42)
Obese	1.08 (0.81, 1.45)	1.10 (0.79, 1.55)

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

compared to non-Hispanic White individuals. The AORs were not statistically significant for Black/African American and Hispanics individuals though. The odds were higher, however, for other racial/ethnic groups (AOR: 2.64; 95% CI: 1.08, 6.42). A higher life satisfaction score was significantly associated with lower odds of experiencing anxiety/depression daily, weekly, or monthly (AOR: 0.67; 95% CI: 0.63, 0.72). Having social/emotional support sometimes or rarely (AOR: 2.39; 95% CI: 1.42, 4.04) or using healthcare within the past 12 months (AOR: 2.51; 95% CI: 1.39, 4.55) and the past two years (AOR: 2.05; 95% CI: 1.03, 4.07) was significantly associated with experiencing anxiety/depression daily, weekly, or monthly (Table 2).

Discussion

This study contributes to the immigrant mental health literature, by exploring anxiety/depression symptoms based on perceived social/emotional support, life satisfaction, and biopsychosocial risk factors among first-generation populations in the U.S. during the COVID-19 pandemic. This is particularly important given the often underrepresentation of these subpopulations in health research [62, 63]. As shown in our finding, the differences in the prevalence of anxiety and depression offer substantial evidence that although these disorder symptoms often co-occur, they still maintain distinct patterns of expression, as observed by Kessler et al. [64]. Contrary to previous findings, which suggested a ‘happiness advantage’ and a ‘healthy immigrant effect’ with better behavioral, physical, and mental health outcomes among immigrants, especially first-generation individuals and those with lower level of acculturation or years since immigration [49, 65–67], our study indicates a more nuanced and complex reality. Our findings revealed that anxiety/depression varied within the first-generation population, indicating that the ‘healthy immigrant effect’ paradox may not be applicable to all immigrant populations due to the diversity in the immigrant population. For instance, we found that individuals who reported receiving social/emotional support “sometimes” or “rarely” had higher odds of experiencing anxiety/depression symptoms, suggesting a potential protective role of stable social support against mental health issues [68–70]. These findings align with existing literature highlighting the positive influence of life satisfaction and social/emotional support on mental health outcomes [68, 71, 72].

The variation in the prevalence of depression/anxiety among the first-generation population observed in this study suggests that some groups may be more susceptible to certain mental health conditions than others. For example, we found that younger age groups (18–25 years) had higher odds of experiencing anxiety/depression, aligning with previous literature indicating that younger

individuals often face unique mental health stressors [73, 74]. These findings may be associated with diverse social factors such as acculturation, establishing independence, beginning careers, and forming relationships, which may contribute to an increased risk of mental health issues [75, 76].

Females had a higher likelihood of experiencing anxiety/depression symptoms, and this finding may be explained by hormonal differences, differential stress responses, and social factors contributing to this gender disparity in mental health [77–79]. Another potential explanation for this finding could be the compounded effect of gender discrimination and migration status [80]. Our results further show that the frequency of healthcare utilization was significantly associated with the reported symptoms of depression and anxiety. Individuals who had utilized healthcare services within the past year reported a higher frequency of these symptoms than those who had used these services less frequently or never. These results support previous findings in the general U.S. population, which indicate that individuals with mental health issues, such as depression and anxiety, are more likely to utilize healthcare services [81, 82]. This observation could be due to the need for medical treatment and follow-up for these conditions, or healthcare use for health needs other than mental health needs. Despite the high burdens of mental health problems among immigrants, they are generally less likely to use mental health services due to stigma, language barriers, lack of insurance and documentation, and turning to family, friends, or religious leaders for care [48, 83]. The possibility of unmet mental health needs or barriers to effective mental health care should be explored in future studies to expand understanding of the heterogeneity of the link between immigrant mental health and healthcare utilization over time.

Further, young adults, females, sexual minorities, and those from other/multi-racial groups displayed a higher prevalence of anxiety and depression symptoms. The minority stress theory by Meyer could aid in further explaining this phenomenon [84]. This theory suggests that individuals with minority status (e.g., racial/ethnic, sexual identity) experience unique forms of stress related to their marginalized positions in society, leading to elevated rates of mental health disorders [84]. Self-identified gay and lesbian individuals, who already face sexual orientation-related stressors, experience additional stress as a part of the immigrant subpopulation. More than one in five respondents who self-reported as gay/lesbian or bisexual reported daily/weekly or monthly anxiety and depression symptoms, and about 28% of the other or multi-racial group reported a high frequency of these symptoms. Participants self-identifying as belonging to a sexual minority subgroup and other/multi-racial groups

were significantly more likely to experience daily/weekly or monthly anxiety and depression symptoms. First-generation individuals that identify as gay/lesbian showed a higher likelihood of experiencing anxiety/depression symptoms, which is consistent with the findings of other studies demonstrating that sexual minorities often experience unique social stressors, such as discrimination and social stigma, contributing to poorer mental health outcomes [85, 86]. Other studies have also established the relationship between the intersectional nature of multiple minority status and health outcomes [87–89]. These show the need for interventions that account for the cultural and contextual experiences of immigrants as a whole and address the unique stressors these groups face.

Our findings further suggest differences in the frequency of self-reported depression and anxiety symptoms by race/ethnicity among the first-generation immigrant population. This is consistent with other studies that found persistent mental health disparities by race and ethnicity among the general U.S. population [90, 91]. Among all racial/ethnic groups, individuals identified as other/multi-racial (i.e., American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, or other single and multiple races) had the highest prevalence and odds of experiencing anxiety/depression daily, weekly, or monthly, significantly exceeding that of any other group. This finding implies the existence of unique mental health stressors within this population [92, 93]. Complex and multifaceted minority stressors (e.g., prejudice, discrimination, racism) might have exacerbated the mental health of other/multi-racial immigrant groups [87, 88, 92, 93]. Diverse factors, such as group-specific discrimination and subsequent mental health gap, have been reported [94]. The higher levels of anxiety and depression observed among first-generation immigrants of other-multi-racial backgrounds might also be a result of a perceived lack of belonging and solidarity. The potential conflict between their physical identity and self-identity could create stress and increase the likelihood of experiencing anxiety and depression [87, 88, 92, 93]. Several studies found that perceived discrimination (e.g., anti-immigrant and refugee discrimination) can negatively affect the health of immigrant and refugee populations, including their mental health [95, 96].

The evidence in the literature on Hispanic health paradox suggests that Hispanic immigrants have better health outcomes compared to native populations and other populations, even when they experience discrimination and other social determinants of health disparities [97]. Similarly, we observed racial differences in anxiety/depression between non-Hispanic White and Hispanic populations within the first-generation populations. Hispanic individuals were less likely to experience anxiety/depression daily/weekly/monthly. These findings underscore

the need for tailored mental health interventions that account for the unique experiences and stressors these at-risk immigrant subgroups face. They also highlight the need for further research to delineate disparities within immigrant populations more clearly to ensure that mental health interventions are accurately tailored for the most at-risk subgroups.

This study has some limitations. Firstly, it is a cross-sectional study and therefore the findings are limited to association instead of causal relationships. The self-reported nature of depression and anxiety is subject to an individual's self-perception bias, and willingness to disclose such information may impact the accuracy of mental health status among the population of interest. The willingness to disclose mental health symptoms may be particularly relevant to immigrant populations because of the stigma often associated within these communities [83]. The measurement and categorization of the frequency of anxiety/depression symptoms in this study did not assess the degree (i.e., normal, mild, moderate, and severe) of anxiety/depression symptoms. Objective assessment of the symptoms might lead to more accurate information about these mental health disorder symptoms. The diversity of the U.S. immigrant population necessitates a more detailed subgroup analysis to better understand the unique factor impacting the substantial U.S. immigrant population. Future studies using longitudinal data could aid in establishing causality and accounting for the cultural contexts of the immigrant population.

Conclusions

Our study underlines the significant burden of anxiety and depression among the first-generation population in the U.S., with higher prevalence and risks observed among specific subgroups like young adults, females, sexual minorities, and other/multi-racial individuals. The study also highlights the significant associations between these mental health outcomes and biopsychosocial factors such as life satisfaction, social/emotional support, and healthcare utilization. These findings further shed light on the need for personalized mental health screening and interventions for first-generation individuals in the U.S. considering the diversity of immigrant populations and their health-related risks. Also, it reveals the importance of strategies to address biopsychosocial determinants and mental health needs facing immigrants in the U.S. Furthermore, considering the heterogeneity and rapidly growing immigrant populations, research is recommended to explore specific at-risk subgroups, by examining potential barriers to effective mental health care, and implementing longitudinal and intervention studies to improve mental health outcomes.

Acknowledgements

DA and FW's efforts are supported by the Division of Intramural Research, National Institute on Minority Health and Health Disparities, National Institutes of Health. Opinions and comments expressed in this article belong to the authors and do not necessarily reflect those of the U.S. Government, Department of Health and Human Services, National Institutes of Health, and National Institute on Minority Health and Health Disparities.

Author contributions

DA: Conceptualization, Methodology, Data Curation, Formal Analysis, Validation, Visualization, Writing—Original Draft Preparation, Writing—Review & Editing. KT: Writing—Original Draft Preparation, Writing—Review & Editing. JRT: Writing—Original Draft Preparation, Writing—Review & Editing. SS: Writing—Original Draft Preparation, Writing—Review & Editing. FW: Conceptualization, Methodology, Visualization, Resources, Writing—Review & Editing, Supervision. All authors read and approved the final manuscript.

Funding

This work is supported by the Division of Intramural Research, National Institute on Minority Health and Health Disparities (ZIA MD000015). Opinions and comments expressed in this article belong to the authors and do not necessarily reflect those of the U.S. Government, Department of Health and Human Services, National Institutes of Health, and National Institute on Minority Health and Health Disparities.

Data availability

The datasets generated by the survey research during and/or analyzed during the current study are available in the CDC database repository, <https://www.cdc.gov/nchs/nhis/2021nhis.htm>.

Declarations

Ethics approval and consent to participate

Deidentified public-use secondary data were analyzed and therefore no protocol approval was required.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹Division of Intramural Research, National Institute on Minority Health and Health Disparities, National Institutes of Health, 20852 Bethesda, MD, USA

²Department of Epidemiology and Biostatistics, University of Georgia, Athens, GA, USA

³Department of Health Policy and Management, University of Georgia, Athens, GA, USA

⁴National Healthy Start Association, Washington, DC, USA

Received: 19 June 2023 / Accepted: 12 March 2024

Published online: 15 March 2024

References

- About the foreign-born population [<https://www.census.gov/topics/population/foreign-born/about.html>].
- Taylor P, Cohn D, Passel J, Livingston G, Wang W, Funk C, Gonzalez-Barrera A, Morin R, Patten E, Motel S. Second-generation americans: a portrait of the adult children of immigrants. *Pew Res Cent* 2013:1–130.
- Mindlis I, Boffetta P. Mood disorders in first-and second-generation immigrants: systematic review and meta-analysis. *Br J Psychiatry*. 2017;210(3):182–9.
- Salas-Wright CP, Kagotho N, Vaughn MG. Mood, anxiety, and personality disorders among first and second-generation immigrants to the United States. *Psychiatry Res*. 2014;220(3):1028–36.
- Budiman A. Key findings about U.S. immigrants. In: *Pew Research Center*. Pew Research Center; 2020.
- Berry JW. Acculturative Stress. In: *Handbook of Multicultural Perspectives on Stress and Coping* edn. Edited by Wong PTP, Wong LCJ. Boston, MA: Springer US; 2006: 287–298.
- Fazel M, Stein A. The mental health of refugee children. *Arch Dis Child*. 2002;87(5):366.
- Sangalang CC, Becerra D, Mitchell FM, Lechuga-Peña S, Lopez K, Kim I. Trauma, Post-migration Stress, and Mental Health: a comparative analysis of refugees and immigrants in the United States. *J Immigr Minor Health*. 2019;21(5):909–19.
- Anxiety Disorders - Facts & Statistics. [<https://adaa.org/understanding-anxiety/facts-statistics>].
- Association CMH. The relationship between mental health, mental illness and chronic physical conditions. *CMHA Ont* 2008.
- Cheng BT, Silverberg JI. Depression and psychological distress in US adults with atopic dermatitis. *Ann Allergy Asthma Immunol*. 2019;123(2):179–85.
- Dong L, Mezuk B, Lisabeth LD. Trends in Prevalence of Serious Psychological Distress and Depression among adults with stroke in the United States. *J Stroke Cerebrovasc Dis*. 2022;31(3):106235.
- Gullett LR, Alhasan DM, Gaston SA, Jackson WB, Kawachi I, Jackson CL. Neighborhood social cohesion and serious psychological distress among Asian, black, Hispanic/Latinx, and White adults in the United States: a cross-sectional study. *BMC Public Health*. 2022;22(1):1–17.
- Ikonte CO, Prigmore HL, Dawson AZ, Egede LE. Trends in prevalence of depression and serious psychological distress in United States immigrant and non-immigrant populations, 2010–2016. *J Affect Disord*. 2020;274:719–25.
- Kalin NH. The critical relationship between anxiety and depression. In., vol. 177: *Am Psychiatric Assoc*; 2020: 365–367.
- Lee H, Singh GK. Psychological distress and heart disease mortality in the United States: results from the 1997–2014 NHIS-NDI record linkage study. *Int J Maternal Child Health AIDS*. 2020;9(3):260.
- McLachlan KJ, Gale CR. The effects of psychological distress and its interaction with socioeconomic position on risk of developing four chronic diseases. *J Psychosom Res*. 2018;109:79–85.
- Russ TC, Stamatakis E, Hamer M, Starr JM, Kimimäki M, Batty GD. Association between psychological distress and mortality: individual participant pooled analysis of 10 prospective cohort studies. *BMJ* 2012, 345.
- Singh GK, Lee H. Psychological distress and Alzheimer's Disease Mortality in the United States: results from the 1997–2014 National Health interview survey-national death index record linkage study. *J Aging Health*. 2021;33(3–4):260–72.
- Katon W, Roy-Byrne P. Anxiety disorders: efficient screening is the first step in improving outcomes. *Ann Intern Med*. 2007;146(5):390–2.
- Kroenke K, Spitzer RL, Williams JB, Löwe B. An ultra-brief screening scale for anxiety and depression: the PHQ-4. *Psychosomatics*. 2009;50(6):613–21.
- Mills SD, Fox RS, Pan TM, Malcarne VL, Roesch SC, Sadler GR. Psychometric evaluation of the patient health questionnaire-4 in hispanic americans. *Hispanic J Behav Sci*. 2015;37(4):560–71.
- Löwe B, Wahl I, Rose M, Spitzer C, Glaesmer H, Wingenfeld K, Schneider A, Brähler E. A 4-item measure of depression and anxiety: validation and standardization of the Patient Health Questionnaire-4 (PHQ-4) in the general population. *J Affect Disord*. 2010;122(1–2):86–95.
- Kerper L, Spies C, Tillinger J, Wegscheider K, Salz A-L, Weiss-Gerlach E, Neumann T, Krampe H. Screening for depression, anxiety and general psychological distress in preoperative surgical patients: a psychometric analysis of the Patient Health Questionnaire 4 (PHQ-4). *Clin Health Promot*. 2014;4(1):5–14.
- Enriquez LE, Morales AE, Rodriguez VE, Chavarria K, Ro A. Mental Health and COVID-19 pandemic stressors among Latina/o/x College Students with varying self and parental Immigration Status. *J Racial Ethnic Health Disparities*. 2023;10(1):282–95.
- Goldman-Mellor S, Plancarte V, Perez-Lua F, Payán DD, De Trinidad Young M-E. Mental health among rural latino immigrants during the COVID-19 pandemic. *SSM - Mental Health*. 2023;3:100177.
- Đoàn LN, Chong SK, Misra S, Kwon SC, Yi SS. Immigrant communities and COVID-19: strengthening the Public Health response. *Am J Public Health*. 2021;111(S3):S224–31.
- Johnson S, Bacsu J, McIntosh T, Jeffery B, Novik N. Competing challenges for immigrant seniors: social isolation and the pandemic. *Healthc Manage Forum*. 2021;34(5):266–71.
- Khatib HE, Alyafei A, Shaikh M. Understanding experiences of mental health help-seeking in arab populations around the world: a systematic review and narrative synthesis. *BMC Psychiatry*. 2023;23(1):324.

30. Li Y, Dong F, Bullock LFC, Bloom T. Exploring help-seeking experiences of Chinese immigrant survivors of intimate partner violence in the U.S. *Psychol Trauma*. 2022;14(1):91–8.
31. Kaltman S, Hurtado de Mendoza A, Gonzales FA, Serrano A, Guarnaccia PJ. Contextualizing the trauma experience of women immigrants from Central America, South America, and Mexico. *J Trauma Stress*. 2011;24(6):635–42.
32. Zou L, Wang T, Herold F, Ludyga S, Liu W, Zhang Y, Healy S, Zhang Z, Kuang J, Taylor A, et al. Associations between sedentary behavior and negative emotions in adolescents during home confinement: mediating role of social support and sleep quality. *Int J Clin Health Psychol*. 2023;23(1):100337.
33. O'Mahony JM, Donnelly TT, Raffin Bouchal S, Este D. Cultural background and socioeconomic influence of immigrant and Refugee women coping with Postpartum Depression. *J Immigr Minor Health*. 2013;15(2):300–14.
34. Adzrago D, Williams F. Mediation analysis of mental health characteristics linking social needs to life satisfaction among immigrants. *SSM-Population Health*. 2023;24:101522.
35. National Health Interview Survey. 2021. Public-use data file and documentation [<https://www.cdc.gov/nchs/nhis/data-questionnaires-documentation.htm>].
36. Cheung F, Lucas RE. Assessing the validity of single-item life satisfaction measures: results from three large samples. *Qual Life Res*. 2014;23:2809–18.
37. Kim BJ, Chen L, Xu L, Lee Y. Self-rated health and subjective economic status in life satisfaction among older Chinese immigrants: a cross-sectional study. *Healthcare*. 2021. MDPI; 2021. p. 342.
38. George LK. Still happy after all these years: Research frontiers on subjective well-being in later life. *Journals Gerontol Ser B: Psychol Sci Social Sci*. 2010;65(3):331–9.
39. Calvo R, Carr DC, Matz-Costa C. Another Paradox? The life satisfaction of older hispanic immigrants in the United States. *J Aging Health*. 2017;29(1):3–24.
40. Calvo R, Carr DC, Matz-Costa C. Expanding the happiness paradox: ethnoracial disparities in life satisfaction among older immigrants in the United States. *J Aging Health*. 2019;31(2):231–55.
41. Fergusson DM, McLeod G, Horwood LJ, Swain NR, Chapple S, Poulton R. Life satisfaction and mental health problems (18 to 35 years). *Psychol Med*. 2015;45(11):2427–36.
42. Guney S, Kalafat T, Boysan M. Dimensions of mental health: life satisfaction, anxiety and depression: a preventive mental health study in Ankara University students population. *Procedia-Social Behav Sci*. 2010;2(2):1210–3.
43. Marquez J, Katsantonis I, Sellers R, Knies G. Life satisfaction and mental health from age 17 to 21 years in a general population sample. *Curr Psychol*. 2023;42(31):27047–57.
44. Hombados-Mendieta I, Millán-Franco M, Gómez-Jacinto L, Gonzalez-Castro F, Martos-Méndez MJ, García-Cid A. Positive influences of social support on sense of community, life satisfaction and the health of immigrants in Spain. *Front Psychol*. 2019;10:2555.
45. Berggren N, Bergh A, Bjørnskov C, Tanaka S. Migrants and life satisfaction: the role of the country of origin and the country of residence. *Kyklos*. 2020;73(3):436–63.
46. Alegría M, Álvarez K, DiMarzio K. Immigration and Mental Health. *Curr Epidemiol Rep*. 2017;4(2):145–55.
47. Alegría M, Yip T, Marks A, Juang L, Cohen L, Cuervo-Torello F. Editorial: improving Mental Health for immigrant populations. *Front Psychiatry*. 2021;12:785137.
48. Derr AS. Mental Health Service Use among immigrants in the United States: a systematic review. *Psychiatr Serv*. 2016;67(3):265–74.
49. Salas-Wright CP, Vaughn MG, Goings TC, Miller DP, Schwartz SJ. Immigrants and mental disorders in the United States: new evidence on the healthy migrant hypothesis. *Psychiatry Res*. 2018;267:438–45.
50. Shekunov J. Immigration and Risk of Psychiatric disorders: a review of existing literature. *Am J Psychiatry Residents' J*. 2016;11(2):3–5.
51. Szafarski M, Cubbins LA, Meganathan K. Anxiety disorders among US immigrants: the role of immigrant background and social-psychological factors. *Issues Ment Health Nurs*. 2017;38(4):317–26.
52. Egger JW. Biopsychosocial Medicine and Health—the body mind unity theory and its dynamic definition of health. *Psychologische Medizin*. 2013;24(1):24–9.
53. Tripathi A, Das A, Kar SK. Biopsychosocial Model in Contemporary Psychiatry: current validity and future prospects. *Indian J Psychol Med*. 2019;41(6):582–5.
54. Bolton D, Gillett G. The biopsychosocial model of health and disease: New philosophical and scientific developments. *Springer Nature*; 2019.
55. Babalola E, Noel P, White R. The biopsychosocial approach and global mental health: synergies and opportunities. *Indian J Social Psychiatry*. 2017;33(4):291–6.
56. Lehman BJ, David DM, Gruber JA. Rethinking the biopsychosocial model of health: understanding health as a dynamic system. *Soc Pers Psychol Compass*. 2017;11(8):e12328.
57. Fanali A, Giorgi F, Tramonti F. Thick description and systems thinking: reiterating the importance of a biopsychosocial approach to mental health. *J Eval Clin Pract* 2022.
58. Zablotsky B, Weeks JD, Terlizzi EP, Madans JH, Blumberg SJ. Assessing anxiety and depression: A comparison of National Health Interview Survey measures. 2022.
59. Lipsitz SR, Fitzmaurice GM, Sinha D, Hevelone N, Giovannucci E, Hu JC. Testing for independence in contingency tables with complex sample survey data. *Biometrics*. 2015;71(3):832–40.
60. Lovasi GS, Fink DS, Mooney SJ, Link BG. Model-based and design-based inference goals frame how to account for neighborhood clustering in studies of health in overlapping context types. *SSM-population Health*. 2017;3:600–8.
61. Scott A. Rao-Scott corrections and their impact. In: *Proceedings of the 2007 joint statistical meetings, Salt Lake City, Utah: 2007; 2007*.
62. Wagner JK. Ethical and legal considerations for the inclusion of Underserved and Underrepresented Immigrant Populations in Precision Health and Genomic Research in the United States. *Ethn Dis*. 2019;29(Suppl 3):641–50.
63. Castaneda AE, Cilenti K, Rask S, Lilja E, Skogberg N, Kuusio H, Salama E, Lahti J, Elovainio M, Suvisaari J et al. Migrants are underrepresented in Mental Health and Rehabilitation services-Survey and Register-based findings of Russian, Somali, and Kurdish origin adults in Finland. *Int J Environ Res Public Health* 2020, 17(17).
64. Kessler RC, Chiu WT, Demler O, Merikangas KR, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry*. 2005;62(6):617–27.
65. Akresh IR, Frank R. Health Selection among New immigrants. *Am J Public Health*. 2008;98(11):2058–64.
66. Calvo R, Carr DC, Matz-Costa C. Expanding the Happiness Paradox: Ethnoracial Disparities in life satisfaction among older immigrants in the United States. *J Aging Health*. 2017;31(2):231–55.
67. Markides KS, Coreil J. The health of hispanics in the southwestern United States: an epidemiologic paradox. *Public Health Rep*. 1986;101(3):253–65.
68. Chang Y-H, Yang C-T, Hsieh S. Social support enhances the mediating effect of psychological resilience on the relationship between life satisfaction and depressive symptom severity. *Sci Rep*. 2023;13(1):4818.
69. Li F, Luo S, Mu W, Li Y, Ye L, Zheng X, Xu B, Ding Y, Ling P, Zhou M, Chen X. Effects of sources of social support and resilience on the mental health of different age groups during the COVID-19 pandemic. *BMC Psychiatry*. 2021;21(1):16.
70. Longest K, Kang J-A. Social Media, Social Support, and Mental Health of young adults during COVID-19. *Front Communication* 2022, 7.
71. Holt-Lunstad J, Smith TB, Layton JB. Social relationships and Mortality Risk: a Meta-analytic review. *PLoS Med*. 2010;7(7):e1000316.
72. Proctor CL, Linley PA, Maltby J. Youth life satisfaction: a review of the literature. *J Happiness Stud*. 2009;10(5):583–630.
73. Goodwin RD, Weinberger AH, Kim JH, Wu M, Galea S. Trends in anxiety among adults in the United States, 2008–2018: Rapid increases among young adults. *J Psychiatr Res*. 2020;130:441–6.
74. United States. Public Health Service. Office of the Surgeon General: protecting youth mental health: the U.S. Surgeon General's advisory. 1 online resource. In: Washington (DC): US Department of Health and Human Services; 2021. (1 PDF file (53 pages)).
75. Arnett JJ. Emerging adulthood. A theory of development from the late teens through the twenties. *Am Psychol*. 2000;55(5):469–80.
76. Klein EM, Müller KW, Wölfling K, Dreier M, Ernst M, Beutel ME. The relationship between acculturation and mental health of 1st generation immigrant youth in a representative school survey: does gender matter? *Child Adolesc Psychiatry Mental Health*. 2020;14(1):29.
77. Albert PR. Why is depression more prevalent in women? *J Psychiatry Neurosci*. 2015;40(4):219–21.
78. Altemus M. Sex differences in depression and anxiety disorders: potential biological determinants. *Horm Behav*. 2006;50(4):534–8.
79. Altemus M, Sarvaiya N, Neill Epperson C. Sex differences in anxiety and depression clinical perspectives. *Front Neuroendocrinol*. 2014;35(3):320–30.

80. Gomez-Aguinaga B, Dominguez MS, Manzano S. Immigration and gender as Social Determinants of Mental Health during the COVID-19 outbreak: the case of US Latina/os. In: *Int J Environ Res Public Health* 18; 2021.
81. Coombs NC, Meriwether WE, Caringi J, Newcomer SR. Barriers to healthcare access among U.S. adults with mental health challenges: a population-based study. *SSM - Popul Health*. 2021;15:100847.
82. Terlizzi EP, Schiller JS. Mental Health treatment among adults aged 18–44: United States, 2019–2021. *NCHS Data Brief* 2022(444):1–8.
83. Mohammadifrouzeh M, Oh KM, Basnyat I, Gimm G. Factors Associated with Professional Mental help-seeking among U.S. immigrants: a systematic review. *J Immigr Minor Health* 2023:1–19.
84. Meyer IH. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. *Psychol Bull*. 2003;129(5):674–97.
85. Haghiri-Vijeh R, Clark N. If you can just Break the Stigma around it: LGBTQI+ migrants' experiences of Stigma and Mental Health. *Qual Health Res*. 2022;32(11):1595–606.
86. Yarwood V, Checchi F, Lau K, Zimmerman C. LGBTQI+ migrants: a systematic review and conceptual Framework of Health, Safety and Wellbeing during Migration. In: *Int J Environ Res Public Health* 19; 2022.
87. Balsam KF, Molina Y, Beadnell B, Simoni J, Walters K. Measuring multiple minority stress: the LGBT people of Color microaggressions Scale. *Cultur Divers Ethnic Minor Psychol*. 2011;17(2):163–74.
88. Ramirez JL, Paz Galupo M. Multiple minority stress: the role of proximal and distal stress on mental health outcomes among lesbian, gay, and bisexual people of color. *J Gay Lesbian Mental Health*. 2019;23(2):145–67.
89. Turpin RE, Akre EL, Williams ND, Boekeloo BO, Fish JN. Differences in Health Care Access and satisfaction across intersections of Race/Ethnicity and sexual identity. *Acad Med*. 2021;96(11):1592–7.
90. McKnight-Eily LR, Okoro CA, Strine TW, Verlenden J, Hollis ND, Njai R, Mitchell EW, Board A, Puddy R, Thomas C. Racial and ethnic disparities in the prevalence of stress and worry, Mental Health conditions, and increased substance use among adults during the COVID-19 pandemic - United States, April and May 2020. *MMWR Morb Mortal Wkly Rep*. 2021;70(5):162–6.
91. Thomeer MB, Moody MD, Yahirun J. Racial and Ethnic Disparities in Mental Health and Mental Health Care during the COVID-19 pandemic. *J Racial Ethnic Health Disparities*. 2023;10(2):961–76.
92. Miller B, Rocks S, Catalina S, Zemaitis N, Daniels K, Londono J. The missing link in contemporary health disparities research: a profile of the mental and self-rated health of multiracial young adults. *Health Sociol Rev*. 2019;28(2):209–27.
93. Oh H, Du J, Smith L, Koyanagi A. Mental health differences between multi-racial and monoracial college students in the United States: emerging racial disparities. *Int J Soc Psychiatry*. 2022;69(3):744–51.
94. Wu C, Qian Y, Wilkes R. Anti-asian discrimination and the asian-white mental health gap during COVID-19. *Ethnic Racial Stud*. 2021;44(5):819–35.
95. Brance K, Chatzimpyros V, Bentall RP. Perceived discrimination and Mental Health: the role of immigrant Social Connectedness during the COVID-19 pandemic. *J Migr Health*. 2022;6:100127.
96. Szaflarski M, Bauldry S. The effects of Perceived discrimination on immigrant and Refugee Physical and Mental Health. *Adv Med Sociol*. 2019;19:173–204.
97. Boen CE, Hummer RA. Longer-but Harder-Lives? The Hispanic Health Paradox and the Social Determinants of Racial, ethnic, and Immigrant-Native Health Disparities from midlife through late life. *J Health Soc Behav*. 2019;60(4):434–52.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.