

Differences in Depression and Suicidal Ideation between Sexual Minority and Heterosexual Adults: National Health and Nutrition Examination Survey 2005- 2016

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Abstract

Importance: Research on depression and suicidal ideation of sexual minority adults is needed to guide the development of targeted mechanism research and future tailored behavioral interventions.

Objective: To investigate sexual identity differences in depression and suicidal ideation among adults in the US.

Design, setting, and participants: The present cross-sectional study analyzed population-based data from the National Health and Nutrition Examination Survey (2005-2016). Participants included participants aged from 20 to 59 year weighted to represent approximately 788 million US adults.

Exposures: Self-reported sexual identity categorized as heterosexual, gay/lesbian, bisexual, or others.

Main outcomes and measures: The main outcomes were depression and suicidal ideation which defined based on the Patient Health Questionnaire-9.

Results: Our study included 16602 participants (mean age, 39.5 years [95% CI, 39.2-39.9]; 8109 male participants [49.02%]). Male participants who identified as others had higher rate of depression than heterosexual male adults (odds ratio [OR], 3.08; 95% CI [1.06-8.99]). Bisexual male individuals had higher rate of suicidal ideation than heterosexual male participants (OR, 4.53; 95% CI [2.31-8.88]). Compared with heterosexual female participants, bisexual female had higher rate of depression (OR, 2.32; 95% CI [1.68-3.19]) and suicidal ideation (OR, 3.53; 95% CI [2.28-5.48]). There were no significant differences between gay/lesbian and their same sex heterosexual counterparts in depression and suicidal ideation.

Conclusions and relevance: Results of this cross-sectional study suggested that bisexual female participants and others group of male participants had higher rate of depression compared with their counterpart heterosexual participants, furthermore, bisexual male/female participants had higher rate of suicidal ideation than those of heterosexual participants. There is a need for development of tailored interventions to depression symptoms of sexual minority individuals. Future cohort research is needed to examine factors that might contribute to these results among sexual minority individuals.

Introduction

Depression is a chronic and recurrent condition that presents a major public health problem[1]. The World Health Organization has approximated that around 4.4% of the global population grapples with depressive disorder, positioning depression as the primary contributor to worldwide disability and non-fatal health loss[2]. In a comprehensive national survey of American adults, the prevalence rates for severe depression over a 12-month and lifetime period were 10.4% and 20.6%, respectively[3].

Psychological autopsy studies have repeatedly reported that depression is the most common mental illness among suicide victims[4, 5]. Additionally, the interpersonal theory of suicide deems despair and depression as crucial factors contributing to suicidal tendencies[6–8].

Members of sexual minority groups, such as those identifying as gay/lesbian, bisexual, not exclusively heterosexual, or uncertain about their sexual orientation, are more prone to depression, self-harm, and suicide attempts compared to their heterosexual counterparts[9]. Unlike heterosexual individuals, the heightened presence of mental health symptoms in sexual minority groups can be partially accounted for by the minority stress theory[10–12]. The prolonged exposure to minority stress is linked to the development of various detrimental mental health issues among sexual minority individuals, including depression and anxiety[13–15].

While there have been improvements in the acceptance and equitable treatment of sexual minority individuals, the status of being a sexual minority continues to be linked to risks affecting both physical and mental well-being[16]. However, past investigations into the link between sexual minority communities and depression, as well as suicidal thoughts, have been constrained by the size of samples and the breadth of population coverage, hampering their overall representativeness of societal context in the United States[17–21].

In this cross-sectional study, we aimed to utilize data from the National Health and Nutrition Examination Survey (NHANES) to explore differences in depression between sexual minority and heterosexual adults. We also examined sexual identity differences in suicidal ideation. We hypothesized that sexual minority male/female would have higher rate of depression and suicidal ideation than their heterosexual counterparts.

Materials and methods

Study Design

This study utilized publicly available data obtained from the National Health and Nutrition Examination Survey (NHANES), a comprehensive cross-sectional survey administered by physicians and highly trained medical personnel. The survey encompasses questionnaires, physical examinations, and laboratory data. NHANES aims to ascertain the prevalence and identify risk factors associated with major diseases in the U.S. population. Released biannually, the survey provides data collected from participants across the United States, selected through a sophisticated multistage, stratified sampling method. Each year, a representative sample of approximately 5000 noninstitutionalized individuals are surveyed across the US; data are released in 2-year cycles. This method has been demonstrated to yield a cohort that accurately represents the diverse demographic composition of the U.S. population[22, 23]. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines for cross-sectional studies.

Study Population

This was a cross-sectional analysis, using six 2-year NHANES cycles (2005–2016). By setting the inclusion criteria as Fig. 1 shown, a total of 16602 adults who had complete examination data on 9-item

Patient Health Questionnaire (PHQ-9) questionnaire, sexual identity questionnaire, and other covariables, were included in this study.

Sexual Identity

Participants from 2005–2014 were categorized as heterosexual, gay/lesbian, bisexual, and others based on the following item: “Do you think of yourself as heterosexual or straight, homosexual or lesbian, bisexual, something else, or not sure?”. After the extensive cognitive and field testing, the sexual identity item was updated in 2015–2016 cycle[24]. The new item asked: “Which of the following best represents how you think of yourself?”. We excluded participants who responded “refused”, “don’t know”, or “I don’t know the answer” to the sexual identity item. The others category included participants who identified as something other than gay/lesbian, heterosexual, or bisexual. However, we are unable to determine which identities are represented in this category.

Depression Symptoms

The depression screener was composed of the PHQ-9 depression assessment tool. In our analyses, depression symptoms were defined as the summed score on the PHQ-9 was greater than or equal to 10 points (range, 0–27). The use of a PHQ-9 score cutoff of 10 points has been shown to offer a favorable balance between sensitivity and specificity[25].

Suicidal ideation was assessed by the following item: “Have you had thoughts that you would be better off dead or hurting yourself in some way?”. Then the participants responding “yes” for several days a week or more were subsequently considered as have a suicidal ideation in the further analysis[26].

Covariates

Based on the previous studies[27–29], the study considered the following covariates: age at the interview, sex (male, female), race/ethnicity (Mexican American, Other Hispanic, non-Hispanic white, non-Hispanic black, other race/multiracial), education levels (high school or below, greater than high school), family Poverty Income Ratio (PIR) (< 1.30 , $1.31–3.50$, ≥ 3.50), marital status (married, never married, living with a partner/ widowed/divorced/separated), body mass index (BMI) (< 25 , $25–30$, ≥ 30 kg/m²). Serum cotinine concentration was utilized as a proxy for environmental tobacco exposure and categorized into active/secondhand smoker (> 0.011 ng/mL) and nonsmoker (≤ 0.011 ng/mL). Alcohol drinking status was determined by the survey question, “In any year, have you had at least 12 drinks of any type of alcoholic beverage?”, with those responding “yes” subsequently considered as alcohol drinkers. We also considered the covariates related to medical history of hypertension (no or yes), and diabetes (no or yes). The drug use was defined as participants responded “yes” to the item: “Ever used marijuana or hashish?”.

Statistical analysis

Our data were analyzed following analytic guidelines and using the recommended survey weight for NHANES data[30]. All analyses in our study were sex stratified, and heterosexual participants of same sex were the reference group. To describe the characteristics of participants, we used mean (95% CI) for continuous variables and percentage frequency (95% CI) for categorical variables. Continuous data were compared using *t*-tests, and categorical data were compared using χ^2 test. Because the percentage of missing data was small (missing rate range from 0–6.6%) for any variable, no imputation method was used.

Sex stratified multiple logistic regression models were performed to examine sexual identity differences in depression and suicidal ideation. Model 1 was unadjusted (crude model), Model 2 was adjusted for sociodemographic variables including age, sex, and race/ethnicity, education level, marital status, family PIR, Model 3 was fully adjusted model which including age, sex, race/ethnicity, education level, marital status, family PIR, BMI, alcohol drinker, serum cotinine, hypertension, diabetes, and drug use. A Bonferroni correction was used for multiple comparison.

All statistical analyses were performed with R (version 4.1.3, R Project for Statistical Computing, Vienna, Austria) and EmpowerStats (version 4.1, Boston, Massachusetts). In all tests, $P < 0.05$ (2-sided) was considered to indicate statistical significance.

Results

Basic characteristics of the participants

The final analytic sample consisted of 16602 participants, and 8109 (49.02%) male participants were included, of which 7752 (95.4%) were heterosexual, 181 (2.7%) were gay, 130 (1.4%) were bisexual, and 46 (0.5%) were others. Table 1 presents sexual identity differences across study variables among the male participants. Compared with heterosexual male individuals, gay participants were more likely to have education level that greater than high school (weighted percentage, 82.9% versus 60.5%), less likely to be obesity (weighted percentage, 25.1% versus 35.1%), more likely to use marijuana or hashish (weighted percentage, 76.0% versus 65.8%). Compared with the heterosexual male individuals, bisexual male participants were less likely to have high family income to poverty ratios (PIR > 3.5, weighted percentage, 33.3% versus 46.4%), less likely to be non-smoker (weighted percentage, 8.2% versus 20.5%). Furthermore, compared with heterosexual male men, both gay (weighted percentage, 57.8% versus 22.5%) and bisexual men (weighted percentage, 41.8% versus 22.5%) had higher proportion of never married.

Table 1
Sexual Identity Differences in Characteristics Among Male Participants in the NHANES 2005–2016 Cycles

Participants ^a					
Characteristics	Heterosexual (N = 7752)	Gay (N = 181)	Bisexual (N = 130)	Others ^b (N = 46)	P value
Age, mean [95% CI], y	39.4 [39.0-39.8]	40.5 [37.9– 43.0]	38.9 [36.3– 41.4]	36.0 [31.7– 40.3]	.37
Race/ethnicity ^c					
Mexican American	10.0 [8.5–11.8]	5.5 [3.0-9.8]	6.7 [3.5– 12.3]	10.6 [3.1– 30.5]	.30
Other Hispanic	5.4 [4.4–6.5]	4.6 [2.6–7.9]	5.4 [2.6– 10.6]	6.3 [1.4– 23.8]	
Non-Hispanic					
White	67.7 [64.8– 70.5]	74.6 [65.0- 82.3]	69.3 [59.3– 77.7]	60.6 [35.3– 81.3]	
Black	10.1 [8.9–11.5]	8.4 [5.1– 13.8]	13.2 [8.7– 19.5]	11.3 [3.3– 32.1]	
Other race/multiracial	6.8 [6.0-7.7]	6.9 [4.0- 11.6]	5.4 [3.3-9.0]	11.2 [2.2– 41.5]	
Education level					
High school or below	39.5 [37.1– 41.8]	17.1 [11.0- 25.6]	41.1 [30.1– 53.1]	26.7 [10.3– 53.4]	< .001
Great than high school	60.5 [58.2– 62.9]	82.9 [74.4– 89.0]	58.9 [46.9– 69.9]	73.3 [46.6– 89.7]	
Marital status					
Married	56.7 [55.0-58.4]	8.4 [3.1– 20.9]	27.7 [18.8– 38.7]	53.7 [23.0- 81.8]	< .001
Never married	22.5 [20.9– 24.2]	57.8 [47.0- 67.9]	41.8 [32.0- 52.2]	22.9 [7.6– 51.7]	
Other ^d	20.8 [19.7– 21.9]	33.8 [25.0- 43.8]	30.5 [20.6– 42.7]	23.4 [7.9– 52.2]	
Family PIR					
< 1.3	19.7 [18.2– 21.4]	18.4 [12.9– 25.6]	27.8 [20.3– 36.8]	33.5 [13.5– 61.7]	.11
1.3–3.5	33.9 [32.2–	30.7 [22.1–	38.9 [28.7–	34.5 [11.4–	

Participants ^a					
Characteristics	Heterosexual (N = 7752)	Gay (N = 181)	Bisexual (N = 130)	Others ^b (N = 46)	P value
	35.6]	41.0]	50.0]	68.3]	
≥ 3.5	46.4 [44.1– 48.7]	50.8 [40.7– 60.9]	33.3 [23.3– 45.2]	32.0 [9.0– 69.3]	
BMI					
< 25	26.6 [25.1– 28.1]	41.4 [33.1– 50.1]	35.5 [25.2– 47.3]	40.2 [16.1– 70.1]	< .001
25–30	38.3 [36.8– 39.8]	33.5 [24.8– 43.5]	21.6 [13.8– 32.2]	40.2 [18.2– 67.0]	
≥ 30	35.1 [33.4– 36.9]	25.1 [17.6– 34.6]	42.9 [32.7– 53.8]	19.6 [5.9– 48.7]	
Alcohol drinker ^e					
No	12.4 [11.0– 14.0]	12.3 [7.3– 20.1]	16.6 [10.5– 25.3]	15.9 [3.0– 53.9]	.69
Yes	87.6 [86.0– 89.0]	87.7 [79.9– 92.7]	83.4 [74.7– 89.5]	84.0 [46.1– 97.0]	
Serum cotinine ^f					
≤ 0.011 ng/mL	20.5 [18.9– 22.3]	21.4 [13.2– 32.7]	8.2 [3.8– 16.9]	18.8 [3.5– 59.5]	.14
> 0.011 ng/mL	79.5 [77.7– 81.1]	78.6 [67.3– 86.8]	91.8 [83.1– 96.2]	81.2 [40.5– 96.5]	
Hypertension					
No	76.3 [74.9– 77.6]	79.7 [72.5– 85.3]	68.5 [55.1– 79.3]	85.3 [55.6– 96.4]	.17
Yes	23.7 [22.4– 25.1]	20.3 [14.7– 27.5]	31.5 [20.7– 44.9]	14.7 [3.6– 44.4]	
Diabetes					
No	94.5 [93.7– 95.1]	95.7 [90.2– 98.2]	92.5 [84.3– 96.6]	94.5 [74.1– 99.0]	.77
Yes	5.5 [4.9–6.3]	4.3 [1.8–9.8]	7.5 [3.4– 15.7]	5.5 [1.0–25.9]	
Drug use					

Characteristics	Participants ^a				P value
	Heterosexual (N = 7752)	Gay (N = 181)	Bisexual (N = 130)	Others ^b (N = 46)	
No	34.2 [32.6–35.8]	24.0 [16.0–34.3]	32.2 [22.2–44.1]	38.9 [14.3–70.8]	.12
Yes	65.8 [64.2–67.4]	76.0 [65.7–84.0]	67.8 [55.9–77.8]	61.1 [29.2–85.7]	
PHQ-9 Score, mean [95% CI]	2.5 [2.4–2.6]	3.4 [2.6–4.2]	4.1 [3.4–4.9]	3.9 [2.0–5.9]	< .001
Depression ^g					
No	94.7 [94.0–95.3]	90.8 [83.9–94.9]	88.9 [81.2–93.8]	85.9 [58.4–96.4]	.002
Yes	5.3 [4.7–6.0]	9.2 [5.1–16.1]	11.1 [6.2–18.8]	14.1 [3.6–41.6]	
Suicidal ideation					
No	97.5 [97.0–97.9]	92.9 [85.9–96.6]	86.3 [77.4–92.1]	95.8 [79.5–99.3]	< .001
Yes	2.5 [2.1–3.0]	7.1 [3.4–14.1]	13.7 [7.9–22.6]	4.2 [0.7–20.5]	
Abbreviations: NHANES, National Health and Nutrition Examination Survey; PIR, Poverty Income Ratio; BMI, Body Mass Index.					
^a The others category included participants who identified as something other than gay, heterosexual, or bisexual.					
^b Data are presented as weighted percentage [95% CI] unless otherwise specified.					
^c Race and ethnicity were self-reported.					
^d Included living with a partner, widowed/divorced/separated.					
^e Determined by the survey question, “In any year, have you had at least 12 drinks of any type of alcoholic beverage?”.					
^f Categorized into active/secondhand smoker (> 0.011 ng/mL) and nonsmoker (≤ 0.011 ng/mL)					
^g Defined as Patient Health Questionnaire–9 score of 10 or more.					

Table 2 presents sexual identity differences across study variables among female participants. And 8434 (50.98%) female participants were included, of which 7887 (93.7%) were heterosexual, 107 (1.3%) were

lesbian, 367 (4.4%) were bisexual, and 73 (0.6%) were others. Compared with the heterosexual female participants, both the lesbian and bisexual participants had lower proportion of married (weighted percentage, 9.9% and 27.9% versus 56.4%), lower proportion of high family income to poverty ratios (PIR > 3.5, weighted percentage, 35.1% and 30.5% versus 45.1%), higher proportion of alcohol drinker (weighted percentage, 87.4% and 87.5% versus 73.2%), higher proportion of active/secondhand smoker (weighted percentage, 83.9% and 83.9% versus 69.2%), and were more likely to use marijuana or hashish (weighted percentage, 74.5% and 83.0% versus 54.2%). Furthermore, compared with the heterosexual female individuals, the participants who identified their sexual identity as others were more likely to identify as Mexican American (weighted percentage, 19.0% versus 8.2%) and Other race/multiracial (weighted percentage, 17.6% versus 6.7%), more likely to have high school or below education (weighted percentage, 50.7% versus 30.9%), more likely to be never married (weighted percentage, 39.6% versus 18.6%), less likely to have high family income to poverty ratios (PIR > 3.5, weighted percentage, 19.2% versus 45.1%), less likely to be alcohol drinker (weighted percentage, 45.4% versus 73.2%) and drug user (weighted percentage, 38.5% versus 54.2%).

Table 2
Sexual Identity Differences in Characteristics Among Female Participants in the NHANES 2005–2016 Cycles

Participants ^a					
Characteristics	Heterosexual (N = 7887)	Lesbian (N = 107)	Bisexual (N = 367)	Others ^b (N = 73)	P value
Age, mean [95% CI], y	40.1 [39.6– 40.5]	38.5 [36.1– 40.9]	32.1 [30.9– 33.4]	39.4 [36.4– 42.4]	< .001
Race/ethnicity ^c					
Mexican American	8.2 [6.9–9.7]	4.3 [2.0-8.9]	5.3 [3.5–7.9]	19.0 [9.9– 33.3]	< .001
Other Hispanic	5.5 [4.6–6.6]	4.8 [1.7– 13.0]	4.6 [2.7–7.6]	8.7 [3.9– 18.2]	
Non-Hispanic					
White	67.8 [64.7– 70.8]	68.5 [56.0- 78.7]	68.7 [63.4– 73.5]	33.8 [17.7– 54.7]	
Black	11.8 [10.1– 13.6]	16.4 [9.8– 26.3]	14.1 [10.6– 18.4]	21.0 [11.4– 35.4]	
Other race/multiracial	6.7 [6.0-7.5]	6.0 [2.8– 12.7]	7.4 [5.0-10.7]	17.6 [8.2– 33.8]	
Education level					
High school or below	30.9 [28.8– 33.1]	31.1 [20.0- 44.8]	38.6 [32.2– 45.4]	50.7 [33.9– 67.4]	.007
Great than high school	69.1 [66.9– 71.2]	68.9 [55.2– 80.0]	61.4 [54.6– 67.8]	49.3 [32.6– 66.1]	
Marital status					
Married	56.4 [54.6– 58.1]	9.9 [4.0-22.2]	27.9 [22.7– 33.8]	29.9 [17.8– 45.7]	< .001
Never married	18.6 [17.1– 20.2]	49.0 [36.9– 61.2]	36.9 [31.2– 43.0]	39.6 [25.1– 56.2]	
Other ^d	25.0 [23.8– 26.3]	41.1 [29.0- 54.4]	35.2 [30.2– 40.6]	30.5 [16.8– 48.8]	
Family PIR					
< 1.3	21.1 [19.4– 22.9]	25.2 [16.6– 36.3]	36.2 [29.9– 42.9]	42.0 [27.2– 58.3]	< .001
1.3–3.5	33.8 [32.1–	39.8 [29.4–	33.3 [27.3–	38.8 [23.5–	

	Participants ^a				
Characteristics	Heterosexual (N = 7887)	Lesbian (N = 107)	Bisexual (N = 367)	Others ^b (N = 73)	P value
	35.5]	51.1]	39.9]	56.8]	
≥ 3.5	45.1 [42.6– 47.6]	35.1 [23.9– 48.2]	30.5 [24.5– 37.3]	19.2 [9.1– 36.1]	
BMI					
< 25	36.0 [34.3– 37.7]	29.5 [19.0– 42.8]	34.5 [28.9– 40.5]	25.6 [13.4– 43.4]	.03
25–30	26.8 [25.4– 28.3]	27.5 [17.5– 40.4]	19.8 [15.3– 25.3]	27.0 [14.2– 45.3]	
≥ 30	37.2 [35.7– 38.7]	43.0 [31.7– 55.0]	45.7 [39.9– 52.2]	47.3 [32.8– 62.3]	
Alcohol drinker ^e					
No	26.8 [24.9– 28.7]	12.6 [6.3– 23.6]	12.5 [8.9– 17.2]	54.6 [38.5– 69.8]	< .001
Yes	73.2 [71.3– 75.1]	87.4 [76.4– 93.7]	87.5 [82.8– 91.1]	45.4 [30.2– 61.5]	
Serum cotinine ^f					
≤ 0.011 ng/mL	30.8 [28.7– 33.1]	16.1 [8.3– 29.0]	16.1 [11.6– 21.9]	28.2 [14.9– 46.9]	< .001
> 0.011 ng/mL	69.2 [66.9– 71.3]	83.9 [71.0– 91.7]	83.9 [78.1– 88.4]	71.8 [53.1– 85.1]	
Hypertension					
No	78.1 [76.7– 79.3]	80.2 [69.8– 87.7]	84.7 [79.8– 88.7]	77.1 [63.1– 86.9]	.03
Yes	21.9 [20.7– 23.3]	19.8 [12.3– 30.2]	15.3 [11.3– 20.2]	22.9 [13.1– 36.9]	
Diabetes					
No	94.2 [93.6– 94.8]	96.2 [90.8– 98.4]	95.3 [91.9– 97.4]	93.6 [84.3– 97.5]	.64
Yes	5.8 [5.2–6.4]	3.8 [1.6–9.2]	4.7 [2.6–8.1]	6.4 [2.5– 15.7]	
Drug use					

	Participants ^a				
Characteristics	Heterosexual (N = 7887)	Lesbian (N = 107)	Bisexual (N = 367)	Others ^b (N = 73)	P value
No	45.8 [44.0-47.6]	25.5 [16.0–38.0]	17.0 [13.4–21.4]	61.5 [44.3–76.2]	< .001
Yes	54.2 [52.4–56.0]	74.5 [62.0–84.0]	83.0 [78.6–86.6]	38.5 [23.8–55.7]	
PHQ-9 Score, mean [95% CI]	3.4 [3.3–3.6]	4.5 [3.4–5.7]	6.1 [5.4–6.7]	4.2 [3.1–5.4]	< .001
Depression ^g					
No	90.7 [89.9–91.5]	85.8 [75.2–92.3]	76.4 [70.6–81.4]	87.9 [73.6–95.0]	< .001
Yes	9.3 [8.5–10.1]	14.2 [7.7–24.8]	23.6 [18.6–29.4]	12.1 [5.0–26.4]	
Suicidal ideation					
No	96.8 [96.3–97.3]	93.1 [83.1–97.4]	88.9 [84.8–92.0]	90.2 [75.5–96.5]	< .001
Yes	3.2 [2.7–3.7]	6.9 [2.6–16.9]	11.1 [8.0–15.2]	9.8 [3.5–24.5]	
Abbreviations: NHANES, National Health and Nutrition Examination Survey; PIR, Poverty Income Ratio; BMI, Body Mass Index.					
^a The others category included participants who identified as something other than gay, heterosexual, or bisexual.					
^b Data are presented as weighted percentage [95% CI] unless otherwise specified.					
^c Race and ethnicity were self-reported.					
^d Included living with a partner, widowed/divorced/separated.					
^e Determined by the survey question, “In any year, have you had at least 12 drinks of any type of alcoholic beverage?”.					
^f Categorized into active/secondhand smoker (> 0.011 ng/mL) and nonsmoker (≤ 0.011 ng/mL)					
^g Defined as Patient Health Questionnaire–9 score of 10 or more.					

Multivariable Regression Analyses in Male Participants

Results of multivariable regression analyses examining sexual identity differences in depression symptoms among male participants are shown in Table 3. In fully adjusted model (model 3, adjusted for age, sex, race/ethnicity, education level, marital status, family PIR, BMI, alcohol drinker, serum cotinine, hypertension, diabetes, and drug use), the odds of having depression were high in participants who identified their sexual identity as others (OR, 3.08; 95% CI [1.06–8.99]) than those of heterosexual. No significant differences in depression were found when comparing gay/bisexual participants with heterosexual participants.

Table 3
Results of Multivariable Analyses Examining Sexual Identity Differences in Depression Among Male Participants in the NHANES 2005–2016 Cycles

Participants (N = 8109)				
Models	Heterosexual	Gay	Bisexual	Others^d
Depression, OR (95% CI)				
Model 1 ^a	1 [Reference]	1.81 [0.98–3.34]	2.22 [1.21–4.09] ^e	2.94 [1.20–7.17] ^e
Model 2 ^b	1 [Reference]	1.38 [0.72–2.63]	1.60 [0.88–2.93]	2.97 [1.04–8.42] ^e
Model 3 ^c	1 [Reference]	1.38 [0.71–2.67]	1.54 [0.83–2.88]	3.08 [1.06–8.99] ^e
Suicidal ideation, OR (95% CI)				
Model 1 ^a	1 [Reference]	2.96 [1.41–6.18] ^e	6.17 [3.34–11.39] ^e	1.70 [0.57–5.15]
Model 2 ^b	1 [Reference]	2.31 [1.04–5.14] ^e	4.70 [2.43–9.07] ^e	1.59 [0.53–4.76]
Model 3 ^c	1 [Reference]	2.28 [0.99–5.24]	4.53 [2.31–8.88] ^e	1.60 [0.52–4.90]
Abbreviations: NHANES, National Health and Nutrition Examination Survey; OR, odd ratio.				
^a Crude model.				
^b Adjusted for age, sex, and race/ethnicity, education level, marital status, family PIR.				
^c Adjusted for age, sex, race/ethnicity, education level, marital status, family PIR, BMI, alcohol drinker, serum cotinine, hypertension, diabetes, and drug use.				
^d The others category included participants who identified as something other than gay, heterosexual, or bisexual.				
^e $P < .05$.				

In addition, the bisexual participants had higher odds of suicidal ideation by 353% (OR, 4.53; 95% CI [2.31–8.88]) relative to the heterosexual counterpart. No significant differences in suicidal ideation were

found between other groups of sexual minority participants and their heterosexual counterparts.

Multivariable Regression Analyses in Female participants

Table 4 presents results of multivariable regression analyses examining sexual identity differences in depression symptoms. In fully adjusted model, bisexual participants had higher odds of depression (OR, 2.32; 95% CI [1.68–3.19]) and suicidal ideation (OR, 3.53; 95% CI [2.28–5.48]) relative to the heterosexual counterpart. However, there is no significant differences when comparing lesbian/others participants with heterosexual participants both in depression and suicidal ideation.

Table 4

Results of Multivariable Analyses Examining Sexual Identity Differences in Depression Among Female Participants in the NHANES 2005–2016 Cycles

Participants (N = 8434)				
Models	Heterosexual	Lesbian	Bisexual	Others^d
Depression, OR (95% CI)				
Model 1 ^a	1 [Reference]	1.63 [0.86–3.07]	3.02 [2.21–4.13] ^e	1.35 [0.61–2.99]
Model 2 ^b	1 [Reference]	1.35 [0.68–2.69]	2.74 [1.98–3.79] ^e	0.89 [0.41–1.96]
Model 3 ^c	1 [Reference]	1.23 [0.62–2.42]	2.32 [1.68–3.19] ^e	0.94 [0.41–2.15]
Suicidal ideation, OR (95% CI)				
Model 1 ^a	1 [Reference]	2.27 [0.87–5.94]	3.82 [2.58–5.64] ^e	3.32 [1.32–8.36] ^e
Model 2 ^b	1 [Reference]	1.89 [0.69–5.19]	3.69 [2.37–5.74] ^e	2.07 [0.81–5.30]
Model 3 ^c	1 [Reference]	1.86 [0.66–5.20]	3.53 [2.28–5.48] ^e	2.19 [0.85–5.63]
Abbreviations: NHANES, National Health and Nutrition Examination Survey; OR, odd ratio.				
^a Crude model.				
^b Adjusted for age, sex, and race/ethnicity, education level, marital status, family PIR.				
^c Adjusted for age, sex, race/ethnicity, education level, marital status, family PIR, BMI, alcohol drinker, serum cotinine, hypertension, diabetes, and drug use.				
^d The others category included participants who identified as something other than gay, heterosexual, or bisexual.				
^e $P < .05$.				

Discussion

To the best of our knowledge, our study, serving as one of the rare nationwide representative research endeavors examining the disparities in depression and suicidal ideation between sexual minority and heterosexual adults in the United States, makes a significant contribution to the existing body of research on the association between depression, suicidal ideation, and sexual minority adults[31, 32]. In present study, we found that gay/lesbian participants showed a higher OR compared with their same sex heterosexual counterparts, but there was no significant differences, which may contrary to many prior studies[33, 34]. Considering that our study accounted for the NHANES design to obtain US nationally representative estimates and additionally adjusted for the relationship between drug use and depression[33, 35], our results may be more precise and generalizable to the population of US adults. This observation could also be attributed to substantial internal differences among homosexual and bisexual individuals. Additionally, improvements in societal awareness and acceptance of sexual minority groups, as evidenced by the increasing number of older individuals openly identifying with sexual minority identities in recent years, might contribute to these findings[36]. However, the likelihood of depression among others male participants is significantly higher than that of heterosexual individuals. Moreover, given that others male participants did not exhibit significant differences in demographic characteristics, we believe this could be attributed to the NHANES study's lack of detailed assessment of gender identity, hindering our more accurate identification of the gender identity of sexual minority groups. For instance, participants with a gender identity as "others" may include individuals such as transgender, genderqueer, and questioning individuals[37]. It is noteworthy that, in this study, others female participants exhibited a higher odds ratio (OR) for depression. However, this elevation was not statistically significant compared to heterosexual females. This observation could also be attributed to the potentially poorer discriminative ability within the group of others participants.

Bisexual male participants exhibited higher levels of suicidal ideation compared to heterosexual individuals, aligning with previous research findings. Similarly, bisexual female participants showed elevated rates of suicidal ideation and depression compared to their heterosexual counterparts, consistent with previous studies[19, 38, 39]. Despite all sexual minority individuals facing the risks of discrimination and hostility, bisexual individuals often encounter heightened degrees of rejection and discrimination. This heightened adversity may result in a diminished sense of belonging for them[40]. Bisexual individuals frequently confront negative attitudes from various sources, as both heterosexual and homosexual individuals may harbor resentment towards them. For instance, there might be a denial of the legitimacy of bisexuality as a valid and stable sexual identity, and a reluctance to engage intimately with bisexual individuals[41]. Compared to heterosexual counterparts, bisexual female participants exhibit higher rates of substance use (such as tobacco, alcohol, and marijuana)[27, 35, 42, 43], lower income[44], and elevated BMI[45, 46], which may partially account for their increased risk of depression and suicidal ideation. Moreover, the NHANES dataset does not encompass data on discovered societal determinants affecting depression and suicide in sexual minority individuals, such as discrimination and violence. Our study findings underscore the need for more comprehensive longitudinal research to thoroughly examine the factors that might contribute to the heightened

likelihood of depression and suicidal ideation among bisexual women. Researchers should also commit to incorporating more robust Sexual Orientation and Gender Identity (SOGI) measures into population-based surveys.

This study holds significant advantages over previous research by separately examining the disparities in depression and suicidal ideation among male and female sexual minority adults compared to their heterosexual counterparts. Additionally, this research marks the first instance of incorporating individuals who identify their gender as something else into a study on depression and suicidal ideation. Findings suggest the need to develop, test, and disseminate interventions to improve mental health condition among sexual minority adults.

Limitations

This study has several limitations. First, as a result of the cross-sectional nature of the study, causality cannot be inferred from our findings. Additional well-designed cohort studies are needed. Second, the small sample sizes of sexual minorities, which may have limited the statistical power. Third, researchers have discovered that individuals who identify their sexual orientation as "something else" (defined as "others" in our study) constitute a diverse group, including individuals with pansexual, questioning, or asexual orientations, and these individuals express a sense of inadequacy with the conventional response options provided in health surveys to capture the nuances of their sexual identities[28, 47, 48]. Although we found that there was no significant difference between participants who identified as others and those who were heterosexual in depression among female participants, further work is needed to better understand the depression symptoms of this group. Forth, there is no data about gender identity in NHANES, therefore, we were unable to assess the potential influence of gender minority (such as transgenders) on depression symptoms[49, 50]. Moreover, sexual identity in adults over the age of 60 is not assessed in NHANES, there remains a gap to further understand the depression symptoms among sexual minority older adults[36]. Finally, we used a PHQ-9 score of 10 or greater as the threshold to define depression, although the PHQ-9 is an established and validated tool for assessing depression (sensitivity and specificity of 88%)[25], some individuals may receive a different diagnosis as compared to examination by a mental health professional.

Conclusion

In this cross-sectional study, our findings suggested that others group of participants had higher rate of depression than heterosexual participants among male adults. Bisexual female participants had higher rate of depression than those of heterosexual. Furthermore, both male/female bisexual participants had higher rate of suicidal ideation than heterosexual adults. These findings significant implications for future research and development of tailored interventions for depression symptoms of sexual minority individuals.

Abbreviations

NHANES, National Health and Nutrition Examination Survey; PIR, Poverty Income Ratio; BMI, Body Mass Index; OR, odd ratio; SOGI, Sexual Orientation and Gender Identity.

Declarations

Ethics statement

The survey plan and study procedure have been approved by the National Center for Health Statistics' Ethics Review Board, and the participants/patients have given their written informed consent. We conducted a study that was exempt from institutional review since it involves secondary data analysis from the National Health and Nutrition Examination Survey

Availability of data

All data generated and/or analyzed in this study are included in this published article

Competing interests

The authors declare that they have no competing nonfinancial interests to declare.

Authors' contributions

Mr. Zhang had full access to the all data in the study and takes responsibility for the integrity for the data and the accuracy of the data analysis.

Study concept and design: Zhang, Fu, Lv.

Acquisition, analysis, or interpretation of data: All authors.

Drafting of the manuscript: Zhang, Fu.

Statistical analysis: All authors.

Supervision: Zhang, Lv.

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The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the

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Figures

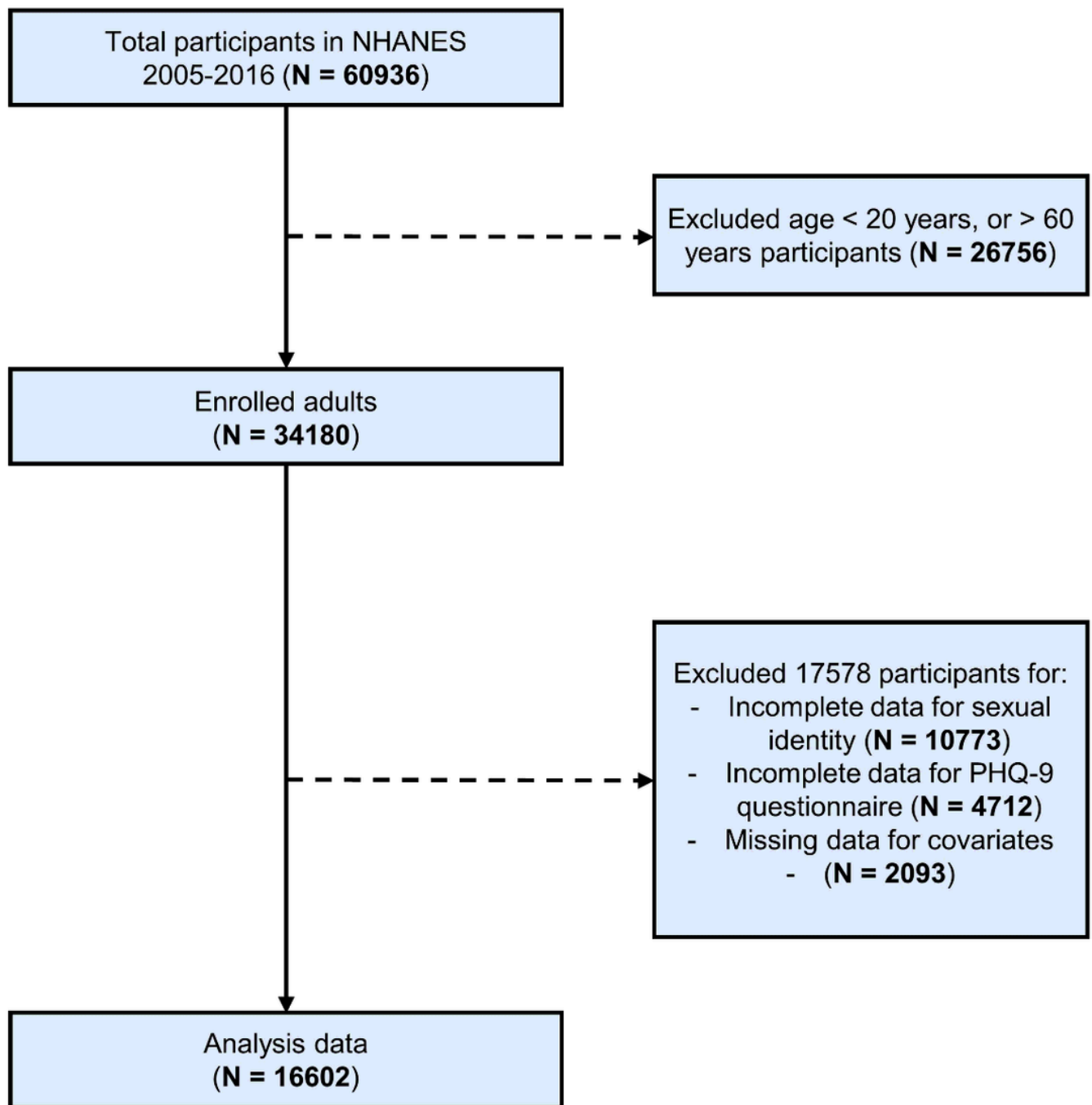


Figure 1

Flow Diagram of the Participants Included in Our Final Analysis Data.

Abbreviations: NHANES, National Health and Nutrition Examination Survey.