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Author manuscript

*J Nerv Ment Dis.* Author manuscript; available in PMC 2021 November 01.

Published in final edited form as:

*J Nerv Ment Dis.* 2020 November ; 208(11): 876–883. doi:10.1097/NMD.0000000000001221.

## Explaining Disparities in Severe Headache and Migraine Among Sexual Minority Adults in the United States, 2013–2018

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### Abstract

Previous work has not examined how the association of sexual orientation and severe headache/migraine may be explained by differences between sexual minorities and heterosexuals in sociodemographic and health-related characteristics. Using data from the 2013–2018 National Health Interview Survey, regression decomposition was used to identify determinants of disparities in headache/migraine between sexual minorities collectively and heterosexuals, as well as between bisexual men and gay men, and bisexual women and lesbians. The prevalence of headache/migraine was the highest among bisexual women (36.8%), followed by lesbians (24.7%), bisexual men (22.8%), heterosexual women (19.7%), gay men (14.8%), and heterosexual men (9.8%). Across all models, the largest percentage of the disparity between sexual orientation/gender groups was attributable to age (range, 18.3%–42.2%), serious psychological distress (range, 6.6%–14.0%), and hours of regular sleep (range, 1.7%–8.2%). Although age accounted for the largest part of the disparity in headache/migraine by sexual orientation, several modifiable risk factors also played a role.

### Keywords

Headache; sexual and gender minorities; health disparities; epidemiology; National Health Interview Survey

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Migraine and other severe headache such as tension-type and cluster headache have impacts at the individual and societal levels. Migraine most commonly strikes people between the ages of 25 and 55 years, contributing to functional limitations and losses in earnings during some of the most productive years of life (Lipton and Bigal, 2005). In 2014, aggregate costs of inpatient stays involving principal diagnoses of headache-related conditions in the United States were estimated at \$406 million, and charges for 44% of these stays were billed to Medicare or Medicaid (Healthcare Cost and Utilization Project, 2019). Given these costs, headache disorders are an important target for prevention and treatment, and epidemiologic

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### DISCLOSURE

The author declares no conflict of interest.

research on representative samples can help focus these efforts on the population subgroups most likely to be affected.

Gender and age are strongly associated with migraine, tension-type, and cluster headache. Migraine is more common among boys than girls before puberty, and the sharper increase among girls after puberty suggests that sex hormones play a role in gender differences in adulthood (Burch et al., 2019). A 12-year prospective study in Denmark found that the incidence of migraine and tension-type headache was, respectively, six times and three times greater among women than men, with both genders showing decreases into middle age (Lyngberg et al., 2005). Cluster headache seems to be more common among men, and lower testosterone levels have been linked to this condition in both men and women (Delaruelle et al., 2018). These gender differences in migraine, tension-type, and cluster headache are reflected in the use of emergency department services in the United States, where females made the majority of visits for migraine (82.7%) and tension-type headache (70.9%) in 2016, whereas males made the majority of visits for cluster headache (57.3%) (Healthcare Cost and Utilization Project, 2019).

In summarizing the literature on migraine, a review article from 2013 concluded that “the descriptive epidemiology of migraine has reached its maturity” given that “prevalence rates and sociodemographic correlates have been stable across 50 years” (Merikangas, 2013). Regarding the large volume of descriptive work on migraine, however, it is worth noting that the National Health Interview Survey (NHIS)—a major source of representative data on health in the United States—included a sexual orientation question for the first time in 2013, the year that the review was published. More emerging than mature, the descriptive epidemiology of migraine and severe headache among sexual minorities is an important focus for several reasons, including this population’s higher prevalence of smoking (Greenwood et al., 2001; Tang et al., 2004)—a precipitating factor for migraine (Bradley, 2009)—and conditions such as depressive and anxiety disorders (Cochran et al., 2003; Cochran and Mays, 2000) that may influence the progression of migraine from an episodic to a chronic condition (Burch et al., 2019).

Sexual orientation and headache have been associated in several national and subnational samples, although the results are not consistent across gender. A multivariable analysis of telephone survey data including 263 gay men and 23 “homosexually experienced heterosexual” men in California found that the former group had more than twice the odds, and the latter group more than six times the odds, of reporting severe headache/migraine than did exclusively heterosexual men; however, when a separate model was fit to data on women, no differences by sexual orientation were found (Cochran and Mays, 2007). Similarly, the US National Longitudinal Study of Adolescent to Adult Health found that gay males had twice the adjusted odds of headache compared with heterosexual males, with no differences by sexual orientation among females (Katz-Wise et al., 2015). In the Netherlands, an analysis that included data on 64 gay men and 25 bisexual men in a sample from general medical practices also found that gay men had more than twice the adjusted odds of severe headache/migraine than did heterosexual men, but findings on differences among women were not mentioned (Sandfort et al., 2006).

There is growing interest in explaining disparities in the burden of migraine and severe headache, especially those related to race/ethnicity and socioeconomic factors (Befus et al., 2018). Previous work has not systematically examined how differences between sexual minorities and heterosexual individuals in sociodemographic and health-related characteristics may explain the association of sexual orientation and headache/migraine. The current study compares the prevalence of headache/migraine between sexual minority and heterosexual adults, and estimates the percentage of the difference in prevalence by sexual orientation that could be attributed to specific variables.

## METHODS

### Data Source

The NHIS is a nationally representative survey of the civilian noninstitutionalized population conducted by the National Center for Health Statistics (2019). Households are sampled for in-person interviews by the Census Bureau. Within households, families are identified, and a family respondent completes a brief interview on family demographics and health. From each family, one adult aged 18 years or older is randomly selected for a detailed interview as part of the Sample Adult interview. For the 2013–2018 period, Sample Adult response rates ranged from 53.0% (2017) to 61.2% (2013) and family response rates ranged from 63.4% (2018) to 74.9% (2013) (National Center for Health Statistics, 2019). Respondents to the family and Sample Adult interviews are not necessarily the same person, although both respondents would belong to the same family. The NHIS protocol is approved by the National Center for Health Statistics Research Ethics Review Board. No protocol approval was needed for the secondary data analysis in this study.

The 2013–2018 Sample Adult files were concatenated into one analytic file ( $n = 190,113$ ). Sampling weights for the concatenated file were created by dividing the weights from the annual files by the total number of files used (*i.e.*, six). Because the 2013–2018 files fall into different sample design periods, the primary sampling unit and stratification variables were also adjusted (National Center for Health Statistics, 2018). Results from the concatenated file can be interpreted as estimates for the midpoint or average of the 2013–2018 period. The unit of analysis is the Sample Adult respondent; however, variables from the 2013–2018 Family files were merged into the file for information on the families of which the Sample Adult respondents were members. Unless otherwise indicated, the variables described below are from the Sample Adult interview.

### Dependent Variable

Data on severe headache/migraine were collected with the question, “During the past 3 months, did you have severe headache or migraine?” Response options were yes and no. The analysis excluded 0.07% of the sample who refused or said they did not know the answer to the question.

### Independent Variables

The sexual orientation question was, “Which of the following best represents how you think of yourself?” Response options were “gay” (for women, “gay or lesbian”), “straight, that is,

not gay” (for women, “straight, that is, not gay or lesbian”), “bisexual,” “something else,” and “I do not know the answer” (Dahlhamer et al., 2014). These responses were used to create two key independent variables. The first independent variable combined responses on sexual orientation and gender to create a four-category measure for sexual minority (lesbian or bisexual) women, heterosexual women, sexual minority (gay or bisexual) men, and heterosexual men. In this article, the term “sexual minority” is used when referring to statistics created from data on bisexual men and gay men combined or bisexual women and lesbians combined. To examine disparities in headache/migraine between subgroups of sexual minorities more specifically, responses on sexual orientation and gender were also used to create a second key independent variable for bisexual women, lesbians, bisexual men, and gay men. The analyses excluded 1.0% of the sample who responded “something else” or “I do not know the answer” and 0.6% who refused to respond to the sexual orientation question.

The selection of variables was informed by the literature on migraine and other headache. Age is consistently associated with headache/migraine (Burch et al., 2019) and was included in the analysis as a continuous variable. Race/ethnicity was categorized as Hispanic, non-Hispanic Asian, non-Hispanic black, non-Hispanic white, and non-Hispanic “other.”

Chronic medical conditions may influence the transition of migraine from an episodic to chronic condition (Burch et al., 2019). For this analysis, a variable was included to indicate whether respondents had 4 or more of 10 chronic conditions, based on questions on whether they had ever been told by a health professional that they had hypertension, coronary heart disease, stroke, diabetes, cancer, arthritis, hepatitis, chronic obstructive pulmonary disease, weak/failing kidneys in the past 12 months, and current asthma. This definition of multiple chronic conditions has been used previously (Goodman et al., 2013; Ward et al., 2017). Studies suggest that increased body mass index (BMI) is a risk factor for headache (Bigal et al., 2006; Keith et al., 2008; Scher et al., 2003), so a categorization of BMI into underweight (BMI < 18.5), normal weight (18.5 < BMI < 25), overweight (25 < BMI < 30), and obese (BMI > 30) was included.

Because sleep disturbances are a trigger for migraine and tension-type headache (Houle et al., 2012), the analysis included a continuous variable indicating the typical number of hours that respondents reported sleeping each night. In addition to the carbon monoxide content of tobacco products, smoking can contribute to headache by constricting blood vessels and reducing blood flow to the brain (Bradley, 2009; Taylor, 2015). For this reason, the analysis included a variable on current smoking. Approximately 20% of individuals with chronic headache report that alcohol use is a precipitating factor for at least some of their attacks (Davis-Martin et al., 2017), so the analysis included a continuous variable based on responses to the question, “In the past year, on those days that you drank alcoholic beverages, on the average, how many drinks did you have?” For nondrinkers, the value on this variable was set to 0.

Although headache secondary to psychiatric disorder is rare, people with migraine are more likely than are people without migraine to have an anxiety or depressive disorder (Smitherman and Baskin, 2008). To assess the contribution of serious psychological distress

to disparities in headache/migraine, responses to the six-item Kessler-6 scale were summed (Cronbach's  $\alpha = 0.85$ ). For this analysis, a dichotomous variable indicating whether respondents had a total Kessler-6 scale score equal to or greater than 13 was used as a positive screening result for serious mental illness (SMI) (Kessler et al., 2003). Because a higher percentage of sexual minorities than heterosexuals live in poverty (Badgett et al., 2019) and adverse life circumstances can contribute to headache/migraine (Burch et al., 2019; Martin, 2016), the analysis included a summary measure of responses to eight "financial worry" questions on which respondents rated their worry about not having money for housing, bills, and other obligations on a four-category scale that ranged from "not at all worried" to "very worried." Responses were scored from 1 to 4, with higher numbers representing more worry, and summed to a total score with a maximum possible value of 32 ( $\alpha = 0.90$ ).

The 2013–2018 Family files provided information on potentially stressful circumstances at home that could contribute to headache/migraine (Martin, 2016). One variable was created to indicate whether the family respondent reported having family member(s) who needed help with basic activities of daily living (ADLs) or instrumental ADLs, and another was included to indicate the presence of family member(s) with unmet needs for medical care in the previous year. A food insecurity variable indicated whether the respondent had concerns about running out of money for food. Because socioeconomic status is inversely related to the risk of migraine/headache (Burch et al., 2019), a variable was included for the most education attained by any family member, ranging from "less than high school" to "bachelor's degree or more." The probability that a respondent lived in a household with food insecurity or family member(s) with unmet health care needs or ADL limitations would likely depend on the size of their family. To normalize estimates of the associations of these family characteristics with headache/migraine, the multivariate models included a variable on family size, topcoded at seven to deal with the long righthand tail of the distribution.

## Analysis

All analyses were adjusted for the NHIS complex sample design using the Stata 16.0 software. Bivariate analyses were conducted to compare the characteristics of the population across the groups defined by sexual orientation and gender. Consistent with previous studies examining pain by sexual orientation (Cochran and Mays, 2007; Katz-Wise et al., 2015; Sandfort et al., 2006), the multivariate models were stratified by gender. Two logistic regression models—one for men, one for women—were used to compare the prevalence of headache/migraine between sexual minorities collectively (bisexual, gay, or lesbian) and heterosexuals. Two additional regression models stratified by gender were restricted to data on sexual minorities (*i.e.*, excluding heterosexuals): one model to compare the prevalence of headache/migraine between bisexual men and gay men, and another model to compare bisexual women and lesbians.

The unweighted sample size for the bisexual men group was 509. When the variable distinguishing bisexual men and gay men was cross-tabulated with the five-category race/ethnicity variable and the dichotomous dependent variable on headache/migraine, the number of observations for several cells became too sparse for valid parameter estimation

and testing. For this reason, in all multivariate models, the race/ethnicity variable was collapsed into a two-category “racial/ethnic minority versus non-Hispanic white” variable. The original five-category variable on race/ethnicity was retained for descriptive statistics.

Because 1-year increments in age are likely to produce odds ratios (ORs) that are so small as to be uninterpretable, the age variable was divided by 5 so that estimates represent a change in the odds of headache/migraine with a 5-year age increase. To account for nonlinearities in the relationship between continuous independent variables and the dependent variable on headache/migraine, the models included quadratic terms for age/5, hours of sleep, average number of drinks per drinking day, and financial worry. A six-category variable for the NHIS survey year was included to adjust for residual differences between annual samples in the concatenated file. ORs and 95% confidence intervals (CIs) were calculated. In addition, the parameter estimates for sexual orientation variables in the multivariate models were presented as an adjusted percentage prevalence by multiplying predictive margins by 100.

Blinder-Oaxaca decomposition for logistic regression was used to examine mechanisms for the difference in the prevalence of headache/migraine between lesbian/bisexual and heterosexual women, and between gay/bisexual and heterosexual men (Sinning et al., 2008). For each gender, decomposition estimated how much of the total difference in prevalence by sexual orientation could be accounted for by each independent variable, controlling for the other variables (Fields, 2002). Decomposition partitions the difference into two components: the “explained” component, which is due to the fact that the groups have, on average, different values for the known characteristics (variables in the model); and the “unexplained” component, which reflects the different effects that the characteristics have on each group, as well as other unobserved characteristics. This study focuses on the explained component, that is, the degree to which the different distributions of sociodemographic and health-related characteristics by sexual orientation accounted for the difference in headache/migraine prevalence.

## RESULTS

The prevalence of severe headache/migraine among sexual minority women (30.5%) was higher than that among heterosexual women (19.7%), sexual minority men (16.7%), and heterosexual men (9.8%). The prevalence of headache/migraine also varied among sexual minority subgroups: 36.8% among bisexual women versus 24.7% among lesbians, and 22.8% among bisexual men versus 14.8% among gay men. Sexual minority women had the youngest average age (37.5 years), followed by sexual minority men (41.5 years), heterosexual men (46.6 years), and heterosexual women (48.2 years). The prevalence of smoking was similar for sexual minority women and men at 22.1% and 21.6%, respectively, compared with 13.3% for heterosexual women and 17.4% for heterosexual men. The average number of drinks per drinking day was the highest among sexual minority men, whereas a positive SMI screening result was the highest among sexual minority women (Table 1). All percentages met the National Center for Health Statistics standards for the reliability of proportions (Parker et al., 2017).

## Multivariable Results

Table 2 shows that sexual minority men collectively had 64% higher odds of headache/migraine in the past 3 months compared with heterosexual men (OR, 1.64; CI, 1.39–1.93). The unadjusted OR for this comparison was 1.84 (CI, 1.57–2.15) (not shown in table). Higher adjusted odds were also found for men who were older, had obesity (*vs.* normal weight), were positive for SMI (*vs.* not), smokers (*vs.* non-smokers), had four or more chronic conditions (*vs.* <4), more financial worry, food insecurity (*vs.* none), a highest family education below bachelor's degree (*vs.* bachelor's), who lived with family member(s) needing help with ADLs (*vs.* not), and who lived with family member(s) with unmet need for care in the previous year (*vs.* not). Lower odds were found for men who were racial/ethnic minorities (*vs.* non-Hispanic white), drank more, and slept more.

The decomposition shows that the variables accounted for 30.9% of the greater prevalence of headache/migraine among sexual minority men than heterosexual men, mostly attributable to age (22.8%), a positive SMI screening result (9.1%), and smoking (1.9%). These and other positively signed decomposition results suggest the degree to which the headache/migraine disparity would be decreased were sexual minority men to have the same values as heterosexual men on age, SMI, smoking, and other characteristics. By contrast, the negatively signed decomposition results detract from the explained component. For example, the –4.9% decomposition result for alcohol use suggests the degree to which the headache/migraine disparity would actually be increased were sexual minority men to have the same level on this characteristic as heterosexual men. The adjusted prevalence of headache/migraine among sexual minority men and heterosexual men was, respectively, 15.2% and 10.3%, for a 4.9% absolute difference between the groups. Consistent with the decomposition, this is approximately 30% smaller than the 6.9% absolute difference in unadjusted prevalence for the two groups in Table 1 (16.7%–9.8%).

As shown in Table 3, the adjusted odds of headache/migraine did not differ bisexual men and gay men; however, in an unadjusted analysis (not shown in table), bisexual men had 68% greater odds of headache/migraine compared with gay men (OR, 1.68; CI, 1.17–2.42). The decomposition shows that the variables accounted for 50.2% of the greater prevalence of headache/migraine among bisexuals than gay men, mostly attributable to age (18.3%), a positive SMI screening result (14.0%), and sleep (8.2%). The adjusted prevalence of headache/migraine among bisexual men and gay men was, respectively, 18.2% and 14.4%, for a 3.8% absolute difference between the groups. Consistent with the decomposition, this is approximately 50% smaller than the 8.0% absolute difference in unadjusted prevalence for the two groups in Table 1 (22.8%–14.8%).

Table 4 shows that sexual minority women collectively had 25% higher adjusted odds of headache/migraine compared with heterosexual women (OR, 1.25; CI, 1.09–1.42). The unadjusted OR for this comparison is 1.79 (CI, 1.59–2.01) (not shown in table). Results for the remaining variables were similar to those from the model for sexual minority men (Table 2) in the direction and statistical significance of the associations, with exceptions: increased odds of headache/migraine were found for those who were overweight (*vs.* normal weight) and those who drank more. The decomposition shows that the variables accounted for 67.8% of the difference in headache/migraine between sexual minority and heterosexual women,

mostly attributable to age (42.2%), a positive SMI screening result (6.6%), and financial worry (4.8%). The adjusted prevalence of headache/migraine among sexual minority women and heterosexual women was, respectively, 23.3% and 19.8%, for a 3.5% absolute difference between the groups. Consistent with the decomposition, this is approximately 68% smaller than the 10.8% difference in unadjusted prevalence in Table 1 (30.5%–19.7%).

The results in Table 5 show that bisexual women had 33% greater adjusted odds of headache/migraine than did lesbians; the corresponding unadjusted OR (not shown in table) comparing these groups was 1.76 (CI, 1.41–2.20). The decomposition shows that the variables accounted for 56.7% of the greater prevalence of headache/migraine among bisexual women than lesbians, mostly attributable to age (38.5%), a positive SMI screening result (7.2%), and sleep (4.1%). The adjusted prevalence of headache/migraine among bisexual women and lesbians was, respectively, 25.1% and 20.7%, for a 4.4% absolute difference between the groups. This is 63% smaller than the 12.1% absolute difference in unadjusted prevalence for the two groups in Table 1 (36.8%–24.7%).

## DISCUSSION

A persistent disparity in severe headache/migraine between sexual minority and heterosexual individuals remained after controlling for an array of sociodemographic and health-related variables, which together accounted for approximately two thirds of the disparity among sexual minority women and one third of the disparity among sexual minority men. The disparity between bisexual women and lesbians also remained after adjustments in the multivariable model. Across all analyses, age accounted for a large part of the disparity between all sexual orientation/gender groups being compared. Adults who identify as bisexual, gay, or lesbian are on average younger than those who identify as heterosexual, so this decomposition result is consistent with the literature on headache, where migraine is reported most frequently among individuals between the ages of 25 and 55 years (Lipton and Bigal, 2005).

With a prevalence more than twice as high as that among heterosexuals, positive SMI screening results accounted for 9.0% and 6.6% of the excess burden of headache/migraine among sexual minority men and women, respectively. Further, SMI accounted for 14.0% of the disparity between bisexual and gay men and 7.2% of the disparity between bisexual women and lesbians. This contribution of SMI to disparities in headache/migraine for bisexuals is consistent with a systematic literature review in which the majority of studies reported greater disparities in psychiatric disorders for bisexuals than for gay men and lesbians (Plöderl and Tremblay, 2015). These findings may have implications for the care of sexual minority patients with headache/migraine; however, a number of factors reflecting the social determinants of health are also important to consider. Consistent with previous work suggesting that adverse life circumstances can contribute to headache/migraine (Bradley, 2009; Martin, 2016), 11.8% of the disparity between sexual minority and heterosexual women was attributable to food insecurity, financial worry, and having family member(s) with unmet health care needs; by contrast, these factors accounted for 3.9% of the disparity in headache/migraine between bisexual women and lesbians. Modifiable health behaviors also played a role in disparities for both genders. For example, greater percentages of sexual



minority women and men were smokers compared with their heterosexual counterparts, and this behavior accounted for 2.4% and 1.9%, respectively, of the higher burden of headache/migraine in these groups.

Several limitations of this analysis should be mentioned. The interpretation of results is limited by the cross-sectional design and the inherent bidirectionality between headache and several independent variables (among men, does alcohol consumption decrease the risk of headache, or does the absence of headache enable greater consumption?). Although widely used in survey research as a measure of psychological distress, the Kessler-6 has been shown to have low sensitivity for detecting SMI (Kessler et al., 2003). Other than the identity-based measure of sexual orientation, the NHIS does not include other measures to characterize sexual and gender minorities such as the behavior and attraction dimensions of sexual orientation, gender identity or expression, or transgender status. Previous findings that a history of physical/emotional abuse as a teenager mediated an association between sexual orientation and reports of functional pain in multiple body sites (Roberts et al., 2013) suggest other potentially relevant variables that were not available for this analysis. Even after concatenating 6 years of NHIS survey data, the sparse cell sizes for bisexual racial/ethnic minorities necessitated the creation of an overall “racial/ethnic minority” indicator variable for the multivariable analysis, resulting in a loss of important detail on this characteristic. Finally, the NHIS question on headache/migraine lacks information on severity and specific symptoms, unlike more comprehensive measures.

## CONCLUSIONS

Severe headache and migraine can be debilitating for affected individuals, and disparities by sexual orientation raise the issue of equity in access to preventive services and treatment. A nationally representative survey from 2017 found that one in six sexual minority adults in the United States avoided using health care because of anticipated discrimination (Casey et al., 2019), even though sexual minorities have a relatively high burden of several types of cancer (Bowen et al., 2007; Daling et al., 1988), HIV disease (Centers for Disease Control and Prevention, 2019), suicide (Yildiz, 2017), and other health problems that can benefit from the use of health and social services. Concerns about stigmatization and discrimination may not only reduce the willingness to use health care but could also exacerbate the problem of headache/migraine itself—making this condition a relevant focus for work on health disparities affecting sexual minorities.

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Prevalence of Severe Headache/Migraine and Other Characteristics of the Adult Population by Sexual Orientation and Sex (United States, 2013–2018)

TABLE 1.

	Sexual Minority Women	Heterosexual Women	Sexual Minority Men	Heterosexual men
Total population (weighted n)	3,349,425	117,854,217	2,759,944	110,506,262
Sample size (unweighted n)	2,659	97,909	2,261	80,191
Severe headache/migraine, past 3 months (%)				
Sexual minority (lesbian, gay, or bisexual)	30.5	19.7	16.7	9.8
Bisexual	36.8	—	22.8	—
Lesbian or gay	24.7	—	14.8	—
Sociodemographic characteristics				
Age (mean)	37.5	48.2	41.5	46.6
Race/ethnicity (%)				
Hispanic	14.4	15.1	16.6	16.2
Non-Hispanic Asian	3.0	5.9	3.7	5.5
Non-Hispanic black	12.8	12.3	10.1	10.8
Non-Hispanic white	65.2	64.4	66.5	65.2
Non-Hispanic "other"	4.6	2.3	3.2	2.2
Highest education in family (%)				
<High school degree	5.0	6.8	3.6	6.3
High school degree	16.0	18.5	13.9	18.8
Associates degree/some college	33.9	32.8	31.0	31.5
Bachelor's degree	45.0	41.9	51.5	43.4
Financial worries score (mean)	16.7	15.9	15.0	15.1
Food insecurity in family (%)	22.8	14.4	14.9	12.3
Family member(s) had unmet need for care, past year (%)	17.5	10.3	11.1	9.5
Family member(s) needs ADL help (%)	9.5	10.0	7.2	8.0
Family size (mean)	2.5	2.8	2.0	2.8
Health-related characteristics				
Positive SMI screening result (%)	8.9	4.0	7.0	2.7
Typical sleep hours/night (mean)	7.0	7.1	7.0	7.1
Current smoker (%)	22.1	13.3	21.6	17.4

	Sexual Minority Women	Heterosexual Women	Sexual Minority Men	Heterosexual men
Average number of drinks/drinking day (mean)	1.8	1.2	2.3	1.9
Body mass index (%)				
Underweight	2.5	2.6	2.4	1.0
Normal weight	34.6	39.0	36.8	27.9
Overweight	23.9	28.7	35.4	40.7
Obese	39.1	29.7	25.4	30.4
4 chronic medical conditions (%)	4.8	6.1	4.4	5.3

For all categorical variables,  $p$  values for  $F$  tests were less than 0.001. For age,  $p$  values for all pairwise  $t$  tests of differences in means were  $<0.001$ . For average number of drinks,  $p$  values for all pairwise tests were  $<0.001$ , except sexual minority women vs. heterosexual men ( $p = 0.046$ ). For financial worry,  $p$  values for all pairwise tests were  $<0.001$ , except sexual minority men vs. heterosexual men ( $p = 0.436$ ). For hours of sleep,  $p$  values for all pairwise tests were  $<0.05$ , except sexual minority men vs. heterosexual men ( $p = 0.139$ ); sexual minority women vs. sexual minority men ( $p = 0.644$ ); and heterosexual women vs. sexual minority men ( $p = 0.054$ ).

**TABLE 2.** Multivariable Analysis and Decomposition of the Difference in Severe Headache/Migraine Prevalence Between Sexual Minority Men (Gay or Bisexual) and Heterosexual Men (United States, 2013–2018)

Variable (Reference Group)	Multivariable Analysis				Decomposition	
	Adjusted Prevalence <sup>a</sup>	OR	95% CI	p	% of Difference by Sexual Orientation	
<b>Sociodemographic characteristics</b>						
Sexual minority men	15.2%	1.64	1.39–1.93	<0.001	—	—
Heterosexual men	10.3%	—	—	—	—	—
Age/5		1.13	1.06–1.21	<0.001	22.8%	
Age/5 <sup>2</sup>		0.99	0.98–0.99	<0.001		
Racial/ethnic minority (non-Hispanic white)		0.77	0.71–0.83	<0.001	0.4%	
Highest education in family ( bachelor's degree)		1.18	1.04–1.34	0.011		–1.9%
<High school degree		1.12	1.02–1.23	0.020		
High school degree		1.24	1.14–1.35	<0.001		
Associates degree/some college		1.07	1.04–1.10	<0.001	0.3%	
Financial worry score		1.00	1.00–1.00	0.007		
Financial worry score <sup>2</sup>		1.36	1.24–1.49	<0.001	1.6%	
Food insecurity in family (vs. none)		1.51	1.37–1.66	<0.001	1.4%	
Family member(s) had unmet need for care (did not)		1.56	1.40–1.73	<0.001	–0.6%	
Family member(s) needs ADL help (does not)		0.99	0.97–1.02	0.473	1.4%	
Family size						
<b>Health-related characteristics</b>						
Positive SMI screen (negative)		3.01	2.65–3.42	<0.001	9.1%	
Typical sleep hours/night		0.62	0.58–0.67	<0.001	1.7%	
Typical sleep hours/night <sup>2</sup>		1.02	1.02–1.03	<0.001		
Current smoker (not current)		1.28	1.19–1.39	<0.001	1.9%	
Average number of drinks/drinking day		0.89	0.85–0.94	<0.001	–4.9%	
Average number of drinks/drinking day <sup>2</sup>		1.01	1.00–1.02	0.007		
<b>Body mass index (normal weight)</b>						
Underweight		0.98	0.72–1.35	0.920		–1.0%
Overweight		0.98	0.90–1.07	0.637		

Variable (Reference Group)	Multivariable Analysis			Decomposition	
	Adjusted Prevalence <sup>a</sup>	OR	95% CI	p	% of Difference by Sexual Orientation
Obese		1.12	1.03–1.23	0.011	
4 chronic medical conditions (<4)		2.14	1.87–2.45	<0.001	-1.4%
Total % of higher prevalence among sexual minority men					30.9%

<sup>a</sup>Prevalence of severe headache/migraine in the two sexual orientation groups is adjusted by variables listed in the table, as well as the NHIS survey year. A superscripted 2 next to a variable indicates a quadratic term.

**TABLE 3.** Multivariable Analysis and Decomposition of the Difference in Severe Headache/Migraine Prevalence Between Bisexual Men and Gay Men (United States, 2013–2018)

Variable (Reference Group)	Multivariable Analysis				Decomposition	
	Adjusted Prevalence <sup>a</sup>	OR	95% CI	p	% of Difference by Sexual Orientation	
Sociodemographic characteristics						
Bisexual men	18.2%	1.36	0.94–1.98	0.102	—	
Gay men	14.4%	—	—	—	—	
Age/5		0.98	0.71–1.36	0.920	18.3%	
Age/5 <sup>2</sup>		1.00	0.98–1.01	0.613		
Racial/ethnic minority (non-Hispanic white)		0.79	0.56–1.14	0.208	0.2%	
Highest education in family ( bachelor's degree)		0.81	0.40–1.66	0.565	–1.8%	
<High school degree		0.62	0.35–1.11	0.107		
High school degree		1.21	0.85–1.73	0.290		
Associates degree/some college		1.13	0.97–1.31	0.104	5.5%	
Financial worry score		1.00	0.99–1.00	0.241		
Financial worry score <sup>2</sup>		1.39	0.86–2.26	0.182	3.6%	
Food insecurity in family (vs. none)		1.00	0.59–1.69	0.997	–0.1%	
Family member(s) had unmet need for care (did not)		2.17	1.16–4.04	0.015	–2.2%	
Family member(s) needs ADL help (does not)		1.00	0.85–1.19	0.961	0.3%	
Health-related characteristics						
Positive SMI screen (negative)		4.41	2.64–7.36	<0.001	14.0%	
Typical sleep hours/night		0.45	0.27–0.74	0.002	8.2%	
Typical sleep hours/night <sup>2</sup>		1.05	1.01–1.08	0.008		
Current smoker (not current)		1.18	0.81–1.71	0.397	–0.2%	
Average number of drinks/drinking day		0.85	0.65–1.10	0.214	–0.4%	
Average number of drinks/drinking day <sup>2</sup>		1.01	0.97–1.06	0.475		
Body mass index (normal weight)						
Underweight		0.56	0.16–1.96	0.364		
Overweight		1.16	0.77–1.73	0.476		



Variable (Reference Group)	Multivariable Analysis			Decomposition	
	Adjusted Prevalence <sup>a</sup>	OR	95% CI	<i>p</i>	% of Difference by Sexual Orientation
Obese		1.70	1.08–2.67	0.023	
4 chronic medical conditions (<4)		1.16	0.58–2.28	0.677	–0.2%
Total % of higher prevalence among bisexual men					50.2%

<sup>a</sup>Prevalence of severe headache/migraine in the two sexual orientation groups is adjusted by variables listed in the table, as well as the NHIS survey year. A superscripted 2 next to a variable indicates a quadratic term.

**TABLE 4.** Multivariable Analysis and Decomposition of the Difference in Severe Headache/Migraine Prevalence Between Sexual Minority (Lesbian or Bisexual) Women and Heterosexual Women (United States, 2013–2018)

Variable (Reference Group)	Multivariable Analysis				Decomposition	
	Adjusted Prevalence <sup>a</sup>	OR	95% CI	p	% of Difference by Sexual Orientation	
Sociodemographic characteristics						
Sexual minority women	23.3%	1.25	1.10–1.43	0.001	—	—
Heterosexual women	19.8%	—	—	—	—	—
Age/5		1.20	1.14–1.25	<0.001		42.2%
Age/5 <sup>2</sup>		0.98	0.98–0.99	<0.001		
Racial/ethnic minority (non-Hispanic white)		0.75	0.71–0.78	<0.001		0.6%
Highest education in family ( bachelor's degree)		1.10	1.01–1.21	0.029		0.0%
<High school degree		1.03	0.96–1.11	0.386		
High school degree		1.18	1.12–1.25	<0.001		
Associates degree/some college		1.07	1.05–1.09	<0.001		4.8%
Financial worry score		1.00	1.00–1.00	<0.001		
Financial worry score <sup>2</sup>		1.28	1.21–1.37	<0.001		3.2%
Food insecurity in family (vs. none)		1.38	1.28–1.48	<0.001		3.6%
Family member(s) had unmet need for care (did not)		1.54	1.42–1.67	<0.001		–0.3%
Family member(s) needs ADL help (does not)		1.00	0.98–1.02	0.982		0.0%
Family size						
Health-related characteristics						
Positive SMI screen (negative)		2.37	2.14–2.63	<0.001		6.6%
Typical sleep hours/night		0.62	0.58–0.66	<0.001		3.3%
Typical sleep hours/night <sup>2</sup>		1.03	1.02–1.03	<0.001		
Current smoker (not current)		1.19	1.11–1.27	<0.001		2.4%
Average number of drinks/drinking day		1.06	1.02–1.11	0.004		0.6%
Average number of drinks/drinking day <sup>2</sup>		0.99	0.98–1.00	0.005		
Body mass index (normal weight)						
Underweight		1.00	0.85–1.16	0.956		2.1%
Overweight		1.12	1.05–1.19	<0.001		

Variable (Reference Group)	Multivariable Analysis			Decomposition	
	Adjusted Prevalence <sup>a</sup>	OR	95% CI	p	% of Difference by Sexual Orientation
Obese		1.22	1.15–1.30	<0.001	
4 chronic medical conditions (<4)		1.99	1.82–2.18	<0.001	-1.3%
Total % of higher prevalence among sexual minority women					67.8%

<sup>a</sup>Prevalence of severe headache/migraine in the two sexual orientation groups is adjusted by variables listed in the table, as well as the NHIS survey year. A superscripted 2 next to a variable indicates a quadratic term.

Multivariable Analysis and Decomposition of the Difference in Severe Headache/Migraine Prevalence Between Bisexual Women and Lesbians (United States, 2013–2018)

TABLE 5.

Variable (Reference Group)	Multivariable Analysis				Decomposition	
	Adjusted Prevalence <sup>a</sup>	OR	95% CI	p	% of Difference by Sexual Orientation	
Sociodemographic characteristics						
Bisexual women	25.1%	1.33	1.04–1.70	0.026	—	—
Lesbians	20.7%	—	—	—	—	—
Age/5		1.33	1.01–1.75	0.039		38.5%
Age/5 <sup>2</sup>		0.97	0.96–0.99	0.002		
Racial/ethnic minority (non-Hispanic white)		0.86	0.67–1.12	0.264		1.0%
Highest education in family ( bachelor's degree)						2.2%
<High school degree		1.06	0.58–1.94	0.844		
High school degree		0.75	0.51–1.10	0.138		
Associates degree/some college		1.45	1.08–1.94	0.014		
Financial worry score		1.04	0.93–1.17	0.459		2.3%
Financial worry score <sup>2</sup>		1.00	1.00–1.00	0.613		
Food insecurity in family (vs. none)		1.10	0.80–1.50	0.567		1.2%
Family member(s) had unmet need for care (did not)		1.30	0.97–1.73	0.079		0.4%
Family member(s) needs ADL help (does not)		2.02	1.31–3.12	0.002		0.0%
Family size		1.03	0.93–1.13	0.577		1.1%
Health-related characteristics						
Positive SMI screen (negative)		1.94	1.30–2.91	0.001		7.2%
Typical sleep hours/night		0.64	0.43–0.97	0.036		4.1%
Typical sleep hours/night <sup>2</sup>		1.02	0.99–1.05	0.113		
Current smoker (not current)		1.27	0.96–1.68	0.101		0.3%
Average number of drinks/drinking day		0.89	0.73–1.08	0.241		0.2%
Average number of drinks/drinking day <sup>2</sup>		1.02	0.99–1.05	0.185		
Body mass index (normal weight)						
Underweight		1.16	0.37–3.66	0.795		0.2%
Overweight		0.95	0.71–1.29	0.758		

Variable (Reference Group)	Multivariable Analysis			Decomposition	
	Adjusted Prevalence <sup>a</sup>	OR	95% CI	p	% of Difference by Sexual Orientation
Obese	1.10	0.83-1.46	0.510		
4 chronic medical conditions (<4)	2.24	1.38-3.64	0.001		-2.1%
Total % of higher prevalence among bisexual women					56.7%

<sup>a</sup>Prevalence of severe headache/migraine in the two sexual orientation groups is adjusted by variables listed in the table, as well as the NHIS survey year. A superscripted 2 next to a variable indicates a quadratic term.