



Are sociodemographic, lifestyle, and psychosocial characteristics associated with sexual orientation group differences in mental health disparities? Results from a national population-based study

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Abstract

Purpose Sexual minority mental health disparities are well documented. However, distinct sexual minority subgroups are often collapsed into a single “lesbian, gay, or bisexual” (LGB) analytic group. While limited research has shown sexual minority subgroup differences in mental health, little is known about the factors underlying these differences. This study examines whether sociodemographic, lifestyle, and psychosocial characteristics are associated with sexual orientation subgroup differences in mental health.

Methods Using the National Epidemiologic Survey on Alcohol and Related Conditions, Wave III, differences in various mental health measures, and sociodemographic, lifestyle, and psychosocial characteristics were assessed across three sexual minority subgroups [lesbians/gay men, bisexuals, and heterosexuals reporting same-sex attractions or behaviors (“heterosexual-identified sexual minorities, HSM”)] and heterosexuals reporting only opposite-sex attractions and behaviors (“heterosexuals”). Sequential linear regressions evaluated the degrees to which different factors attenuated mental health (SF-12) disparities between heterosexuals and sexual minority subgroups. Analyses were sex-stratified.

Results Several sociodemographic, lifestyle, and psychosocial characteristic differences existed between sexual orientation groups. Further, all sexual minority subgroups had lower SF-12 scores than heterosexuals, except lesbian women. Sociodemographic factors attenuated the disparity for bisexual men. Sociodemographic, lifestyle, plus psychosocial factors attenuated the disparity for HSM men. However, sociodemographic, lifestyle, and psychosocial factors partially, but did not fully, attenuate the disparity for gay men, bisexual women, or HSM women.

Conclusions Different factors are associated with mental health disparities for sexual minority subgroups. To maximize health intervention efforts, additional research is needed to uncover the specific mechanisms contributing to health disparities across diverse sexual minority populations.

Keywords Sexual orientation · Mental health · Disparities · Social epidemiology

Introduction

Sexual orientation and mental health

Sexual orientation health disparities are well documented, with a large body of work demonstrating such disparities in mental health [1, 2]. For instance, lesbian, gay, and bisexual

(LGB) people report more depressive symptoms and diagnoses than heterosexuals, especially among youth [3–5]. LGBs are also more likely than heterosexuals to experience mental distress and other mood and anxiety disorders [6, 7], and are more likely to attempt suicide [8, 9]. Such health disparities are frequently attributed to increased exposure to minority stress, or stress resulting from one’s presumed minority status (e.g., discrimination or harassment) [10, 11]. However, there is likely a wide range of mechanisms contributing to sexual minority health disparities [12].

Lifestyle characteristics are also strongly associated with health. For instance, those who engage in exercise and who adhere to a healthy diet experience, on average, longer, healthier lives [13, 14], and experience lower rates of

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depression [15]. Conversely, cigarette smoking is negatively associated with both physical [16, 17] and mental health [18], and prior research has shown that sexual minorities are more likely than heterosexuals to smoke [19].

Further, ample research has documented the “social patterning of disease” [20, 21], whereby sociodemographic characteristics, such as race, gender, and socioeconomic status (SES) serve as powerful predictors of population health disparities [22–25]. For example, individuals who are heterosexual, white, educated, more affluent, and male commonly enjoy many physical and mental health benefits, relative to those occupying marginalized social statuses [20, 21, 26–28]. Religiosity, another sociodemographic characteristic, has also been shown to be associated with mental health, though the directionality and causal nature of this relationship is less clear [29–31]. Therefore, given established associations between sociodemographic, lifestyle, and psychosocial factors and health, it is plausible that factors from each of these categories are associated with mental health disparities between heterosexual and sexual minority populations.

Sexual minority subgroups

While, on average, sexual minorities have poorer mental health than heterosexuals [1], growing evidence suggests that mental health differences exist within the larger sexual minority population on the basis of sexual identity, with bisexual people experiencing differential, and often greater health disparities than gay and lesbian-identified people [4, 32–34]. While nationally representative surveys provide valuable population estimates and prevalence rates for health conditions, it is commonly necessary to collapse all sexual minorities into a single analytic category (e.g., LGBs), given the relatively small sizes of each subgroup. Unfortunately, this approach masks variations that might exist between those utilizing different identity labels.

In addition, population studies have shown that similar, or larger, proportions of men and women who report same-sex attractions and behaviors self-identify as heterosexual, rather than as LGB [35, 36]. There is growing interest among researchers in the experiences of heterosexual-identified people who also report same-sex attractions and behaviors, and how meaning is made of their chosen sexual identities. A variety of terms, each with subtly different meanings, are used to describe members of this understudied population (for a recent review, see Hoy and London, 2018) [37]. A few such terms include “discordant heterosexuals” [35, 36, 38, 39], “heteroflexible” people [40–42], and people with “branched” sexual orientations [43, 44]. Each of these terms, however, poses challenges, and may refer to somewhat distinct populations. For instance, while “discordant heterosexual” clearly defines the population, some may find

the term pejorative. However, the term “branched” may be overly inclusive, referring both to heterosexuals with same-sex attractions/behaviors, as well as LGB people with no same-sex attractions/behaviors, while “heteroflexible” might be interpreted to refer to a separate population who consider themselves to be mostly, but not entirely heterosexual. Given these challenges, we use the term “heterosexual-identified sexual minorities” (HSM) to clearly describe the population of interest—sexual minorities, by virtue of their sexual attractions/behaviors, but who identify as heterosexual—while avoiding potentially stigmatizing terminology.

Current study

This study has two aims. First, because much existing research compares self-identified sexual minorities (i.e., LGB-identified) to heterosexuals, relatively little is known about the mental health statuses, or the life experiences of sexual minorities who do not identify as such (i.e., HSM individuals), or about differences that exist between lesbian/gay and bisexual people. Using a nationally representative sample of US adults, we explore differences across a range of sociodemographic, lifestyle, and psychosocial characteristics between heterosexuals reporting only opposite-sex attractions and behaviors (“heterosexuals”) and three sexual minority groups with variations in sexual identification: those identifying as lesbian/gay, as bisexual, or as heterosexual, but with recent same-sex behaviors or attractions (HSM). Second, we assess overall mental health (12-item short form health survey, SF-12) disparities between heterosexuals and each sexual minority group, and the degrees to which underlying differences in sociodemographic, lifestyle, and/or psychosocial characteristics, separately, and in combination, attenuate mental health disparities.

Methods

Study design

The National Epidemiologic Survey on Alcohol and Related Conditions, Wave III (NESARC-III), collected 2012–2013, is a nationally representative cross-sectional survey of 36,309 US adults, and was designed to collect information on a range of substance use, physical, and mental health issues. Using a multi-stage address-based probability sampling design, adults ages 18 and over were selected to participate from over 3100 counties. Data were collected via computer-assisted personal interviewing (CAPI). Hispanic, Black, and Asian respondents were oversampled to ensure diversity within the final sample. Missing demographic characteristics were imputed by the NESARC-III study team in two ways: using the “assignment method”, if the true value

could be deduced from other information in the interview, or using a “hot deck” procedure, in which missing values were replaced with a value from a similar, randomly chosen respondent in the sample [45]. The present study was approved by the University of California, Los Angeles Office of the Human Research Protection Program.

Study variables

Mental health

Mental health status was measured using the 6-item mental health component summary score (MCS), derived from the 12-item short form health survey (SF-12), a well-validated measure of mental distress [46]. Respondents were asked how often, in the past 4 weeks they “had a lot of energy”, “physical health or emotional problems interfered with social activities”, they “accomplished less than [they] would like as a result of emotional problems”, they “did [their] work or other activities less carefully than usual because of emotional problems”, they “felt calm and peaceful”, and they “felt downhearted and depressed”. Response options for each of the questions ranged from “none of the time” to “all of the time” on a five-point Likert scale. A standardized score (range 0–100, mean 50) was calculated utilizing weights empirically derived from the US population. A score of zero represents the lowest, while 100 represents the highest level of health [46, 47]. 17 respondents were missing a mental health score and were excluded from analysis.

In addition, each respondent was coded as meeting Diagnostic and Statistical Manual, version 5 (DSM-V) criteria (or not) for each of several disorders: Major depressive episode (lifetime, MDE), generalized anxiety disorder (lifetime; GAD), and post-traumatic stress disorder (lifetime, PTSD). Respondents were also asked whether they had ever attempted suicide (yes/no).

Sexual orientation group

Three sexual orientation measures were present in the NESARC-III interview (sexual identity, attraction, and behavior). Sexual identity was assessed by asking respondents to choose the “category that best describes your sexual orientation”. Response options were “heterosexual (straight)”, “gay or lesbian”, “bisexual”, “not sure”, and “unknown”. Sexual attraction was assessed by asking respondents to report the “best description of your sexual attraction to other people”. Response options were “only attracted to females”, “mostly attracted to females”, “equally attracted to females and males”, “mostly attracted to males”, “only attracted to males”, and “unknown”. Recent [“during the last 12 months (did you have) sex with

only males, only females, or both?”] and lifetime (“gender of sexual partners in [your] entire life”) sexual behavior was also assessed. Response options for both behavior questions were “only males”, “only females”, “both males and females”, “unknown”, and “never had sex.” Respondents who reported that they were “not sure”, or who selected “unknown” to the sexual identity, attraction, and/or recent and lifetime behavior questions ($N = 513, 335, 16, \text{ and } 365$, respectively), or who reported not having sex ($N = 10,570$ recent; $N = 908$ lifetime) were marked as missing for the respective sexual orientation questions.

Respondents were assigned to one of four sexual orientation groups based on their responses to the identity, attraction, and behavior variables: (1) heterosexual (heterosexual identity plus opposite-sex attractions and lifetime opposite-sex behaviors only; $N = 31,361$), (2) lesbian/gay (lesbian or gay identity, regardless of attractions or behaviors; $N = 586$), (3) bisexual (bisexual identity, regardless of attractions or behaviors; $N = 565$), and (4) HSM (heterosexual identity plus current same/both-sex attractions and/or recent same-sex behaviors; $N = 2074$). The recency of same-sex sexual behavior was taken into account to distinguish heterosexual-identified respondents with only past same-sex experiences from those with ongoing same-sex sexuality (HSM). To serve as an unambiguous comparison group, however, those categorized as “heterosexual” were required to have reported opposite-sex, but no same-sex behaviors in their lifetimes. In total, 1706 respondents were missing the required variables for assignment to a sexual orientation group and were excluded from analysis.

Sociodemographic characteristics

Sex was assessed dichotomously (male or female). Race/ethnicity was assessed categorically (non-Hispanic White, non-Hispanic Black, non-Hispanic American Indian/Alaska Native, non-Hispanic Asian/Native Hawaiian/Other Pacific Islander, or Hispanic). Nativity status was assessed dichotomously (born a US citizen vs. not). Respondents provided a numeric age, ranging from 18 to 89, or over age 90. Education (less than high school, completed high school, technical/trade school, completed college, or more than college) and current income (less than \$25,000, \$25,000–\$49,999, \$50,000–\$79,999, \$80,000–\$99,999, or greater than \$100,000) were coded as ordinal variables. Religious denomination was categorical (non-Catholic Christian, Catholic, Jewish, Muslim, Buddhist, Hindu, Other faith, or Unaffiliated). Religious importance was assessed on a Likert scale (“very important” to “not important”). Urbanicity was dichotomous (Urban or Rural) and Census region was categorical (Northwest, Midwest, South, or West).

Lifestyle characteristics

Respondents' smoking status (current smoker: used at least 1 tobacco product in past 12 months; former smoker: used last tobacco product more than 12 months ago; non-smoker: did not use any tobacco products in lifetime) and drinking status (current drinker: drank at least 1 alcohol product in past 12 months; former drinker: drank last alcohol product more than 12 months ago; lifetime abstainer: did not drink any alcohol products in lifetime) were assessed. Problems sleeping were also assessed ("had problems falling asleep or staying asleep in last 12 months": yes, no). Respondents recorded the moderate (e.g., walking and tennis) and vigorous (e.g., jogging and swimming) physical activities they engaged in, and the amount of time spent engaging in physical exercise each week. They were then categorized based on federal guidelines for physical activity (meets guidelines, exercises but does not meet guidelines, does not exercise) [48]. Finally, body mass index (BMI) was calculated using respondents' reported height and weight (underweight ≤ 18.5 ; healthy weight 18.5–24.9; overweight 25–29.9; obese ≥ 30).

Psychosocial characteristics

Stressful life experiences were assessed as a count of the number of times respondents had experienced one or more of 16 common stressors in the prior 12 months. Questions included whether respondents had "moved or anyone new came to live with them", had been "fired or laid off from a job", or were "unemployed and looking for work for greater than 1 month". All items were dichotomized (occurred vs. did not occur), and a sum score was created (range 0–16, mean 1.71, Std. dev. 1.91). Social support was assessed using the Interpersonal Support Evaluation List, a 12-item validated scale assessing availability of social support [49]. Questions include "[I] feel that there is no one to share [my] worries or fears with", and "[I have] someone to turn to for advice on family problems". All response options ranged from "definitely false" to "definitely true". In accord with scale construction instructions, the scale was created as a mean score (range 1–4, mean 3.47, Std. dev. 0.51), and respondents with more than 25% missing items (three items) were marked as missing for the scale ($N=65$) [50].

Data analysis

Mental health, sociodemographic, lifestyle, and psychosocial differences were assessed across all four sexual orientation groups using Wald and design-based F tests. For tests in which an overall difference was found, post hoc pairwise comparisons assessed differences between each of the subgroups; Bonferroni-adjusted p values were calculated to

adjust for multiple comparisons. Next, sequential multiple linear regression models assessed whether there were disparities in mental health status (SF-12) between heterosexuals and each sexual minority group, and the degrees to which each set of characteristics (i.e., sociodemographic, lifestyle, and psychosocial characteristics), separately, and in combination, attenuated the mental health disparities. Five models were estimated. First, Model 1 estimated the bivariate association between sexual identity and mental health. Next, Model 2 estimated the association between sexual identity and mental health, after including sociodemographic factors. Model 3 then estimated the association between sexual identity and mental health, after including lifestyle factors. Model 4 then estimated the association between sexual identity and mental health, after including psychosocial factors. Finally, Model 5 estimated the association between sexual identity and mental health, after including sociodemographic, lifestyle, and psychosocial factors.

All analyses were performed separately by sex and used survey weights, allowing for generalization to the US population of adults. After excluding those without mental health scores ($N=17$), and subsequently those with missing sexual orientation group assignments ($N=1706$), the final analytic sample size was 34,586 (15,191 men, 19,395 women).

Results

Among men, several mental health, sociodemographic, lifestyle, and psychosocial differences were found by sexual identity group; specific pairwise differences are highlighted below. Please refer to Table 1 for the details of each comparison. All pairwise differences reported are significant at the $p < 0.05$ level.

Compared to all sexual minority groups, heterosexual men had higher ("better") mental health scores. In addition, greater proportions of gay and bisexual men met DSM-V criteria for a lifetime MDE, and were also more likely to have attempted suicide, compared to heterosexual and HSM men. Greater proportions of gay men met criteria for lifetime GAD, compared to both heterosexual and HSM men, and a greater proportion of gay men also met criteria for lifetime PTSD, compared to heterosexual men.

There were also several sociodemographic differences between groups. For instance, gay and bisexual men were younger than heterosexual and HSM men, on average. Compared to heterosexual and HSM men, greater proportions of gay men were born in the United States, and greater proportions also completed more than a college degree. Greater proportions of heterosexuals reported household incomes of \$100,000 or more per year, compared to bisexual and HSM men. Greater proportions of heterosexual and HSM men reported that religion was "very important" to them,

Table 1 Mental health, sociodemographic, lifestyle, and psychosocial characteristics by sexual identity group, males, NESARC-III, 2012–2013

	Heterosexual	Gay	Bisexual	HSM	<i>p</i> value
<i>N</i>	<i>N</i> = 13,946	<i>N</i> = 321	<i>N</i> = 144	<i>N</i> = 780	
Weighted %	92.52%	1.84%	0.84%	4.79%	
Mental health					
SF-12 Mental Health Component Score, range 0–100 (mean)	52.12 (0.12) ^{bcd}	48.51 (0.64) ^{ad}	49.26 (1.09) ^a	50.58 (0.43) ^{ab}	< 0.01
Lifetime DSM-V major depressive episode (%)	15.46 (0.43) ^{bc}	42.13 (3.51) ^{ad}	31.52 (5.36) ^{ad}	17.60 (1.63) ^{bc}	< 0.01
Lifetime DSM-V generalized anxiety disorder (%)	5.48 (0.24) ^b	12.67 (2.55) ^{ad}	11.07 (3.02)	5.06 (1.16) ^b	< 0.01
Lifetime DSM-V post-traumatic stress disorder (%)	3.85 (0.23) ^b	7.85 (1.51) ^a	10.96 (2.93)	5.98 (0.97)	< 0.01
Lifetime suicide attempt (%)	3.16 (0.19) ^{bc}	15.09 (1.99) ^{ad}	17.47 (4.40) ^{ad}	4.45 (0.80) ^{bc}	< 0.01
Sociodemographic characteristics					
Age (mean)	46.46 (0.24) ^{bc}	42.70 (1.06) ^{ad}	39.34 (1.71) ^{ad}	46.94 (0.81) ^{bc}	< 0.01
Race/ethnicity (%)					0.22
White	66.89 (0.83)	74.05 (2.47)	66.90 (5.17)	64.76 (2.15)	
Black	11.07 (0.63)	10.07 (1.66)	11.58 (3.77)	12.36 (1.09)	
American Indian/Alaska Native	1.34 (0.12)	0.59 (0.45)	0.81 (0.47)	1.30 (0.52)	
API/Hawaiian	5.38 (0.48)	3.23 (1.08)	5.86 (2.74)	7.68 (1.26)	
Hispanic	15.33 (0.71)	12.06 (1.92)	14.85 (2.76)	13.90 (1.50)	
Born in US (%)					0.02
Yes	83.64 (0.60) ^b	90.95 (1.63) ^{ad}	86.77 (3.56)	82.09 (1.66) ^b	
No	16.36 (0.60) ^b	9.05 (1.63) ^{ad}	13.23 (3.56)	17.91 (1.66) ^b	
Education (%)					0.01
< High school	13.33 (0.51) ^b	6.25 (1.44) ^{acd}	15.79 (3.90) ^b	13.13 (1.54) ^b	
High school	27.14 (0.60) ^b	19.80 (2.67) ^a	20.91 (4.10)	24.42 (1.88)	
Some college	30.90 (0.66)	32.92 (2.99)	34.63 (4.68)	33.08 (1.93)	
Bachelors	13.80 (0.49)	18.18 (2.61)	13.96 (3.43)	14.54 (1.72)	
More than college	14.83 (0.57) ^b	22.85 (2.79) ^{ad}	14.71 (3.99)	14.84 (1.64) ^b	
Household income (%)					< 0.01
< \$25,000	23.06 (0.62) ^{cd}	27.17 (3.13)	37.48 (4.91) ^a	27.88 (1.98) ^a	
\$25,000–49,999	25.30 (0.48)	25.88 (2.98)	28.13 (5.37)	29.92 (1.95)	
\$50,000–79,999	20.95 (0.49)	21.79 (2.79)	16.21 (0.44)	18.73 (1.79)	
\$80,000–99,999	8.94 (0.31)	7.03 (1.67)	6.90 (2.71)	7.82 (1.14)	
\$100,000 +	21.76 (0.75) ^{cd}	18.13 (2.83)	11.28 (3.62) ^a	15.66 (2.09) ^a	
Religious importance (%)					< 0.01
Not important	10.08 (0.39) ^b	17.01 (2.29) ^a	18.11 (4.30)	10.72 (1.35)	
Not very important	11.09 (0.32) ^b	19.65 (2.91) ^{ad}	10.60 (3.34)	8.84 (1.25) ^b	
Somewhat important	32.33 (0.51)	33.48 (3.60)	36.74 (4.52)	29.90 (1.80)	
Very important	46.51 (0.83) ^{bc}	29.87 (3.08) ^{ad}	34.55 (4.65) ^{ad}	50.54 (2.13) ^{bc}	
Religious denomination (%)					< 0.01
Christian, not Catholic	55.14 (0.99) ^b	38.35 (3.38) ^{ad}	44.33 (4.99)	51.60 (2.17) ^b	
Catholic	26.46 (0.87) ^b	19.22 (2.39) ^a	21.13 (3.97)	26.79 (2.04)	
Jewish	1.52 (0.18) ^b	5.31 (1.47) ^{ac}	0.64 (0.46) ^b	1.80 (0.46)	
Muslim	1.11 (0.12) ^c	0.36 (0.36)	0.00 (0.00) ^{ad}	0.76 (0.30) ^c	
Buddhist	1.20 (0.11)	1.89 (0.97)	0.41 (0.42) ^d	1.97 (0.57) ^c	
Hindu	0.80 (0.09) ^{bd}	0.13 (0.13) ^a	2.61 (1.97)	0.17 (0.12) ^a	
Other faith	2.42 (0.19) ^b	8.82 (1.98) ^{ad}	4.01 (1.57)	2.20 (0.63) ^b	
Unaffiliated	11.34 (0.40) ^{bc}	25.92 (2.89) ^{ad}	26.86 (4.73) ^a	14.71 (1.69) ^b	
Urbanicity (%)					< 0.01
Urban	78.20 (1.49) ^{bd}	87.51 (3.02) ^a	83.64 (5.65)	85.58 (2.06) ^a	
Rural	21.80 (1.49) ^{bd}	12.49 (3.02) ^a	16.36 (5.65)	14.42 (2.06) ^a	
Census region (%)					< 0.01

Table 1 (continued)

	Heterosexual	Gay	Bisexual	HSM	<i>p</i> value
<i>N</i>	<i>N</i> = 13,946	<i>N</i> = 321	<i>N</i> = 144	<i>N</i> = 780	
Weighted %	92.52%	1.84%	0.84%	4.79%	
Northeast	18.00 (0.80) ^b	27.08 (3.06) ^a	22.24 (4.59)	17.55 (1.86)	
Midwest	21.74 (0.60)	15.65 (2.56)	22.20 (3.85)	21.20 (1.86)	
South	37.24 (0.95) ^d	30.08 (2.87)	29.95 (5.09)	31.00 (1.96) ^a	
West	23.02 (0.87) ^d	27.19 (3.61)	25.60 (4.30)	30.25 (2.03) ^a	
Lifestyle characteristics					
Smoking status (%)					< 0.01
Current smoker	33.80 (0.59) ^{cd}	37.03 (3.38) ^d	50.00 (5.33) ^{ad}	27.29 (1.79) ^{abc}	
Former smoker	21.69 (0.56) ^c	18.28 (2.83)	10.41 (2.85) ^a	18.34 (1.84)	
Non-smoker	44.50 (0.80) ^d	44.69 (3.61)	39.60 (5.21)	54.38 (2.50) ^a	
Drinking status (%)					< 0.01
Current drinker	77.34 (0.63) ^b	87.88 (1.83) ^{ad}	80.22 (4.09)	76.54 (1.92) ^b	
Former drinker	15.86 (0.47) ^{bc}	9.24 (1.63) ^{ad}	7.33 (2.51) ^a	14.48 (1.51) ^b	
Lifetime abstainer	6.80 (0.38) ^b	2.88 (0.75) ^{acd}	12.45 (3.58) ^b	8.98 (1.24) ^b	
Problems sleeping (%)					< 0.01
No	77.45 (0.60) ^b	62.63 (3.19) ^{ad}	71.59 (5.38)	76.57 (1.82) ^b	
Yes	22.55 (0.60) ^b	37.37 (3.19) ^{ad}	28.41 (5.38)	23.43 (1.82) ^b	
Physical activity (%)					0.10
Does not exercise	9.06 (0.39)	6.54 (1.49)	10.26 (2.73)	11.96 (1.21)	
Meets guidelines	72.93 (0.59)	71.94 (3.59)	70.57 (4.89)	67.69 (2.01)	
Exercises, but does not meet guidelines	18.02 (0.43)	21.53 (3.15)	19.17 (4.98)	20.35 (1.84)	
BMI (%)					< 0.01
Underweight (≤ 18.5)	0.66 (0.08)	0.67 (0.40)	3.25 (1.64)	2.06 (0.61)	
Healthy weight (18.5–24.9)	28.04 (0.56) ^{bc}	38.68 (3.45) ^a	42.21 (4.64) ^a	32.21 (1.91)	
Overweight (25–29.9)	41.29 (0.48) ^{cd}	42.48 (3.53) ^c	27.62 (5.20) ^{ab}	35.57 (1.77) ^a	
Obese (≥ 30)	30.00 (0.53) ^b	18.17 (2.69) ^{ad}	26.92 (4.52)	30.17 (2.11) ^b	
Psychosocial characteristics					
Stressful life experiences, range 0–16 (mean)	1.59 (0.24) ^{bc}	2.17 (0.15) ^{ad}	2.75 (0.31) ^{ad}	1.63 (0.07) ^{bc}	< 0.01
Social support, range 1–4 (mean)	3.52 (0.01) ^{bcd}	3.42 (0.03) ^{ac}	3.27 (0.06) ^{ab}	3.39 (0.02) ^a	< 0.01

Table presents weighted means and percentages. Adjusted Wald tests were performed to calculate *p* values for continuous variables, and design-based *F* tests were performed to calculate *p* values for categorical variables. For tests in which an overall difference was found, post hoc comparisons assessed whether (a) heterosexual, (b) gay, (c) bisexual, and (d) HSM men different significant from one another (Bonferroni-adjusted $p < 0.05$), reported as subscripts

compared to gay or bisexual men. Smaller proportions of heterosexual men lived in urban areas of the US than both gay and HSM men.

Several lifestyle differences were also present between sexual identity groups among men. For instance, smaller proportions of HSM men were current smokers, compared to all other groups. Meanwhile, greater proportions of gay men were current drinkers and reported problems sleeping, compared to both heterosexual and HSM men. While there were no significant differences in physical activity between groups ($p = 0.10$), smaller proportions of heterosexuals were a healthy weight, compared to both gay and bisexual men.

Finally, psychosocial differences were present between sexual identity groups among men. Gay and bisexual men

reported more stressful life experiences in the prior year, on average, than heterosexual or HSM men. In addition, while perceived social support was high among all groups, heterosexual men reported more support than all other sexual minority groups.

Several mental health, sociodemographic, lifestyle, and psychosocial differences were also found by sexual identity group among women; specific pairwise differences are highlighted below. Please refer to Table 2 for the details of each comparison. All pairwise differences reported are significant at the $p < 0.05$ level.

Bisexual women had the lowest (“worst”) mental health of all sexual orientation groups, and heterosexual women had higher (“better”) scores than both bisexual and HSM

Table 2 Mental health, sociodemographic, lifestyle, and psychosocial characteristics by sexual identity group, females, NESARC-III, 2012–2013

	Heterosexual	Lesbian	Bisexual	HSM	<i>p</i> value
<i>N</i>	<i>N</i> = 17,415	<i>N</i> = 265	<i>N</i> = 421	<i>N</i> = 1294	
Weighted %	90.24%	1.24%	1.94%	6.58%	
Mental health					
SF-12 Mental Health Component Score, range 0–100 (mean)	50.26 (0.10) ^{cd}	48.87 (0.80) ^c	44.11 (0.79) ^{abd}	47.89 (0.35) ^{ac}	<0.01
Lifetime DSM-V major depressive episode (%)	26.71 (0.56) ^{bcd}	42.50 (3.61) ^{ad}	48.94 (2.90) ^{ad}	32.30 (1.77) ^{abc}	<0.01
Lifetime DSM-V generalized anxiety disorder (%)	9.10 (0.33) ^{cd}	12.24 (2.38)	18.69 (2.40) ^a	12.46 (1.14) ^a	<0.01
Lifetime DSM-V Post-traumatic stress disorder (%)	7.22 (0.31) ^{cd}	12.15 (2.33) ^c	23.22 (3.05) ^{abd}	11.27 (0.94) ^{ac}	<0.01
Lifetime suicide attempt (%)	5.71 (0.28) ^{bcd}	13.08 (2.38) ^{ac}	24.63 (2.54) ^{abd}	9.18 (0.87) ^{ac}	<0.01
Sociodemographic characteristics					
Age (mean)	48.37 (0.23) ^{bcd}	39.50 (1.05) ^{acd}	31.22 (0.79) ^{abd}	45.21 (0.79) ^{abc}	<0.01
Race/ethnicity (%)					<0.01
White	66.11 (0.87)	58.63 (3.78)	64.19 (2.70)	65.78 (1.77)	
Black	12.37 (0.77) ^c	17.23 (2.82)	17.29 (2.12) ^{ad}	11.64 (1.07) ^c	
American Indian/Alaska Native	1.70 (0.18)	2.48 (1.16)	3.84 (1.32)	1.39 (0.34)	
API/Hawaiian	5.57 (0.52) ^{bc}	1.69 (0.84) ^{ad}	1.44 (0.67) ^{ad}	7.19 (0.85) ^{bc}	
Hispanic	14.25 (0.72)	19.98 (2.64)	13.24 (1.74)	14.00 (1.21)	
Born in US (%)					<0.01
Yes	84.08 (0.52) ^{bc}	93.36 (1.62) ^{ad}	93.25 (1.77) ^{ad}	84.47 (1.25) ^{bc}	
No	15.92 (0.52) ^{bc}	6.64 (1.62) ^{ad}	6.75 (1.77) ^{ad}	15.53 (1.25) ^{bc}	
Education (%)					<0.01
<High school	12.53 (0.46) ^b	5.85 (1.53) ^{acd}	14.52 (1.91) ^b	12.80 (1.31) ^b	
High school	24.71 (0.67)	25.09 (3.55)	26.76 (2.73)	25.30 (1.65)	
Some college	34.48 (0.53) ^c	35.77 (3.69)	42.24 (3.16) ^a	34.10 (1.74)	
Bachelors	14.24 (0.55) ^c	12.81 (2.28)	6.93 (1.48) ^{ad}	15.01 (1.33) ^c	
More than college	14.04 (0.51) ^c	20.48 (2.88) ^{cd}	9.55 (1.78) ^{ab}	12.79 (1.18) ^b	
Household income (%)					<0.01
< \$25,000	29.30 (0.68) ^c	27.24 (3.29) ^c	43.85 (2.53) ^{abd}	33.14 (1.62) ^c	
\$25,000–49,999	26.09 (0.51)	24.03 (3.15)	25.55 (2.53)	26.50 (1.50)	
\$50,000–79,999	19.03 (0.45)	20.15 (3.18)	14.25 (2.19)	18.58 (1.32)	
\$80,000–99,999	8.80 (0.30)	10.96 (2.39)	6.57 (1.71)	7.17 (0.96)	
\$100,000 +	16.78 (0.63) ^c	17.62 (2.64)	9.78 (2.34) ^a	14.59 (1.41)	
Religious importance (%)					<0.01
Not important	4.69 (0.21) ^{bcd}	13.01 (2.58) ^a	15.84 (2.31) ^a	11.03 (1.22) ^a	
Not very important	6.58 (0.32) ^{cd}	11.86 (2.23)	12.61 (1.87) ^a	10.23 (0.99) ^a	
Somewhat important	26.91 (0.56)	31.15 (3.25)	32.51 (3.18)	29.88 (1.60)	
Very important	61.82 (0.74) ^{bcd}	43.98 (3.76) ^a	39.04 (3.05) ^a	48.85 (1.89) ^a	
Religious denomination (%)					<0.01
Christian, not Catholic	62.56 (0.96) ^{bcd}	46.24 (3.85) ^a	54.00 (3.24) ^a	54.35 (1.95) ^a	
Catholic	24.85 (0.87) ^{cd}	24.00 (3.43) ^c	12.67 (1.94) ^{abd}	20.06 (1.58) ^{ac}	
Jewish	1.36 (0.12)	1.65 (0.99)	1.43 (0.72)	1.51 (0.41)	
Muslim	0.84 (0.09) ^b	0.18 (0.18) ^a	0.33 (0.20)	0.87 (0.31)	
Buddhist	1.03 (0.11)	2.09 (1.26)	1.62 (0.67)	1.98 (0.39)	
Hindu	0.53 (0.09) ^b	0.00 (0.00) ^a	0.47 (0.47)	0.59 (0.26)	
Other faith	2.19 (0.14) ^{bcd}	7.42 (2.11) ^a	8.12 (1.21) ^{ad}	5.26 (0.74) ^{ac}	
Unaffiliated	6.64 (0.28) ^{bcd}	18.42 (2.91) ^a	21.37 (2.78) ^a	15.38 (1.49) ^a	
Urbanicity (%)					<0.01
Urban	77.68 (1.72) ^{bcd}	90.11 (2.85) ^a	86.28 (2.24) ^a	83.06 (2.32) ^a	
Rural	22.32 (1.72) ^{bcd}	9.89 (2.85) ^a	13.72 (2.24) ^a	16.94 (2.32) ^a	
Census region (%)					0.01

Table 2 (continued)

	Heterosexual <i>N</i> = 17,415	Lesbian <i>N</i> = 265	Bisexual <i>N</i> = 421	HSM <i>N</i> = 1294	<i>p</i> value
<i>N</i>					
Weighted %	90.24%	1.24%	1.94%	6.58%	
Northeast	18.36 (0.55)	22.96 (3.58)	20.81 (2.51)	17.96 (1.64)	
Midwest	21.50 (0.59) ^b	14.81 (2.45) ^a	22.65 (2.87)	20.62 (1.86)	
South	37.89 (1.08) ^d	34.07 (3.68)	33.31 (3.19)	33.21 (1.86) ^a	
West	22.25 (1.08) ^d	28.17 (3.77)	23.24 (2.74)	28.21 (1.90) ^a	
Lifestyle characteristics					
Smoking status (%)					< 0.01
Current smoker	20.57 (0.52) ^{bcd}	36.66 (3.72) ^a	45.65 (3.17) ^{ad}	28.47 (1.63) ^{ac}	
Former smoker	17.04 (0.45) ^c	19.97 (3.29) ^c	8.75 (2.12) ^{abd}	18.38 (1.29) ^c	
Non-smoker	62.33 (0.64) ^{bcd}	43.37 (3.83) ^a	45.6 (3.21) ^a	53.15 (1.66) ^a	
Drinking status (%)					< 0.01
Current drinker	68.86 (0.77) ^{bcd}	84.87 (2.36) ^{ad}	86.41 (1.79) ^{ad}	73.25 (1.81) ^{abc}	
Former drinker	17.40 (0.45) ^{bc}	10.93 (2.03) ^{ad}	8.73 (1.38) ^{ad}	17.00 (1.32) ^{bc}	
Lifetime abstainer	13.74 (0.58) ^{bcd}	4.20 (1.50) ^{ad}	4.86 (1.32) ^{ad}	9.74 (1.07) ^{abc}	
Problems sleeping (%)					< 0.01
No	68.95 (0.62) ^c	63.72 (3.56)	58.74 (3.11) ^{ad}	67.46 (1.82) ^c	
Yes	31.05 (0.62) ^c	36.28 (3.56)	41.26 (3.11) ^{ad}	32.54 (1.82) ^c	
Physical activity (%)					< 0.01
Does not exercise	13.40 (0.50) ^{bc}	4.77 (1.33) ^{ad}	6.64 (1.56) ^{ad}	12.86 (1.07) ^{bc}	
Meets guidelines	61.56 (0.58) ^{bc}	75.50 (3.10) ^{ad}	72.16 (2.52) ^{ad}	63.3 (1.59) ^{bc}	
Exercises, but does not meet guidelines	25.03 (0.41)	19.73 (3.11)	21.20 (2.41)	23.84 (1.52)	
BMI (%)					0.05
Underweight (≤ 18.5)	2.11 (0.14) ^b	0.27 (0.27) ^{acd}	3.64 (1.08) ^b	3.05 (0.66) ^b	
Healthy weight (18.5–24.9)	37.65 (0.58)	30.73 (3.46)	39.01 (3.21)	35.51 (1.37)	
Overweight (25–29.9)	30.24 (0.45)	31.35 (3.50)	27.79 (2.34)	30.68 (1.43)	
Obese (≥ 30)	30.01 (0.60)	37.65 (3.71)	29.56 (2.94)	30.77 (1.59)	
Psychosocial characteristics					
Stressful life experiences, range 0–16 (mean)	1.54 (0.02) ^{bcd}	2.50 (0.13) ^{acd}	3.20 (0.16) ^{abd}	2.04 (0.07) ^{abc}	< 0.01
Social support, range 1–4 (mean)	3.53 (0.01) ^{bcd}	3.60 (0.3) ^{acd}	3.36 (0.03) ^{ab}	3.40 (0.02) ^{ab}	< 0.01

Table presents weighted means and percentages. Adjusted Wald tests were performed to calculate *p* values for continuous variables, and design-based *F* tests were performed to calculate *p* values for categorical variables. For tests in which an overall difference was found, post hoc comparisons assessed whether (a) heterosexual, (b) lesbian, (c) bisexual, and (d) HSM women different significant from one another (Bonferroni-adjusted $p < 0.05$), reported as subscripts

women. Compared to heterosexual women, greater proportions of all sexual minority groups met lifetime criteria for an MDE and were also more likely to have attempted suicide. Greater proportions of bisexual and HSM women met criteria for a lifetime GAD, compared to heterosexual women. Finally, greater proportions of bisexual women met criteria for PTSD in their lifetime, compared to all other groups.

Several sociodemographic differences also existed between sexual identity groups. For instance, bisexuals were the youngest, and heterosexuals were the oldest, on average. Greater proportions of bisexual women were black, compared to heterosexual and HSM women. Furthermore, smaller proportions of lesbian and bisexual women

were API/Hawaiian, compared to heterosexual and HSM women. Greater proportions of lesbian and bisexual women were born in the U.S., compared to heterosexual and HSM women. Compared to other groups, a greater proportion of lesbian women completed more than high school. However, compared to all other groups, greater proportions of bisexual women had household incomes of less than \$25,000 per year. Compared to all other groups, greater proportions of heterosexual women reported that religion was “very important” to them, were Christian, and lived in rural areas of the US.

Several lifestyle differences were also present between sexual identity groups among women. Smaller proportions of heterosexual women were current smokers or drinkers,

compared to all other groups. A greater proportion of bisexual women reported problems sleeping than heterosexual or HSM women. Compared to heterosexual and HSM women, greater proportions of lesbian and bisexual women met guidelines for exercise, and smaller proportions of lesbian women were underweight, compared to other groups.

Finally, psychosocial differences were present between sexual identity groups among women. Heterosexuals reported the fewest and bisexuals reported the most number of past-year stressful life experiences. In addition, lesbian women reported more social support than all other groups.

Table 3 presents results from a series of sequential regression analyses, assessing the roles of sociodemographic, lifestyle, and psychosocial factors in attenuating the association between sexual identity group and mental health status, among men. Model 1 presents the bivariate association between sexual identity and mental health. Sociodemographic, lifestyle, and psychosocial characteristics were added sequentially in Models 2, 3, and 4, respectively. All covariates were included in Model 5. Below, we describe how the addition of the covariates attenuated the associations between sexual identity and mental health.

All sexual minority groups had lower (“worse”) mental health scores, compared to heterosexuals (Model 1, all $p < 0.05$), with gay men having the greatest disparity, and HSM men having the smallest (though still significant) disparity. The mental health disparity between bisexual and heterosexual men was attenuated after accounting for sociodemographic differences (Model 1: $B = -2.86$, CI $-5.06, -0.66$, $p < 0.05$; Model 2: $B = -1.99$, CI $-4.18, 0.20$, $p > 0.05$). Neither lifestyle (Model 3) nor psychosocial (Model 4) characteristics alone fully attenuated the mental health disparities between gay, HSM, and heterosexual men. However, the disparity between heterosexual and HSM men was attenuated after accounting for sociodemographic, lifestyle, and psychosocial characteristics in combination (Model 1: $B = -1.54$, CI $-2.38, -0.69$, $p < 0.001$; Model 5: $B = -0.73$, CI $-1.51, 0.06$, $p > 0.05$). Despite the wide range of sociodemographic, lifestyle, and psychosocial differences present between gay men and heterosexual men, none of these groups of factors could fully attenuate the disparity among gay men. However, the full range of factors attenuated the disparity approximately 45% (Model 1: $B = -3.60$, CI $-4.84, -2.37$, $p < 0.001$; Model 5: $B = -2.00$, CI $-3.00, -0.99$, $p < 0.001$).

Table 4 presents results from a series of sequential regression analyses, assessing the roles of sociodemographic, lifestyle, and psychosocial factors in attenuating the association between sexual identity group and mental health score, among women. Model 1 presents the bivariate association between sexual identity and mental health. Sociodemographic, lifestyle, and psychosocial characteristics were added sequentially in Models 2, 3, and 4, respectively. All

covariates were included in Model 5. Below, we describe how the addition of the covariates attenuated the associations between sexual identity and mental health.

Bisexual and HSM women had lower mental health scores than heterosexuals (Model 1, both $p < 0.001$). However, mental health scores were not significantly different between lesbian and heterosexual women. Despite the wide range of sociodemographic, lifestyle, and psychosocial differences present between bisexual and HSM women, and heterosexual women, none of these groups of factors fully attenuated the mental health disparities for these groups, separately (Models 2–4) or in combination (Model 5). However, the full range of factors attenuated the disparity nearly 75% for bisexual women (Model 1: $B = -6.16$, CI $-7.72, -4.59$, $p < 0.001$; Model 5: $B = -1.59$, CI $-3.09, -0.10$, $p < 0.05$) and roughly 70% for HSM women (Model 1: $B = -2.37$, CI $-3.06, -1.68$, $p < 0.001$; Model 5: $B = -0.69$, CI $-1.28, -0.10$, $p < 0.05$).

Discussion

Sexual minorities are commonly studied as a singular population (e.g., LGBs), and indeed, many sexual minorities share common experiences and concerns with regard to stigma and discrimination, and also experience reduced mental health, on average, compared to heterosexuals [1]. However, this study highlights the importance of examining subgroup differences within the diverse and heterogeneous sexual minority population. When examined separately, subgroup differences in mental health were evident, with, for instance, bisexual women having the lowest mental health (SF-12) scores, and lesbian women having no statistical disparity, compared to heterosexual women. Had lesbian and bisexual women been combined into a single analytic group, as is commonly done, these differences would have been obscured. By disaggregating LGB-identified sexual minorities into monosexual (lesbian/gay) and bisexual subgroups, researchers and practitioners will be better able to understand, and ultimately address the unique health and social challenges faced by sexual minority people.

Furthermore, current recommendations stress the importance of including multiple dimensions of sexual orientation (i.e., identity, attraction, and behavior) on surveys when possible, allowing for greater specificity of research findings, as well as greater consistency across studies [51]. Sexual identity, attraction, and behavior intersect in ways that create “hidden,” and sizeable, subpopulations of sexual minorities. For instance, results from this study show that the HSM population is roughly 60% larger than the combined gay/bisexual population among men, and roughly 80% larger than the combined population of lesbian and bisexual women. However, despite their relatively large sizes, HSM

Table 3 Assessing the roles of sociodemographic, lifestyle, and psychosocial factors in attenuating the association between sexual identity group and mental health, males, sequential multiple linear regression models, NESARC-III (2012–2013)

	Model 1: Gross effects, B (95% CI)	Model 2: Sociodemographic-ics, B (95% CI)	Model 3: Lifestyle, B (95% CI)	Model 4: Psychosocial, B (95% CI)	Model 5: Sociodemographics + lifestyle + psychosocial, B (95% CI)
Sexual identity (ref = heterosexual)					
Gay	-3.60 (-4.84, -2.37)***	-3.13 (-4.28, -1.98)***	-2.83 (-4.00, -1.66)***	2.50 (-3.55, -1.44)***	-2.00 (-3.00, -0.99)***
Bisexual	-2.86 (-5.06, -0.66)*	-1.99 (-4.18, 0.20)	-2.07 (-4.07, -0.08)*	-0.31 (-2.29, 1.67)	-0.01 (-1.90, 1.87)
HSM	-1.54 (-2.38, -0.69)***	-1.25 (-2.10, -0.40)**	-1.45 (-2.26, -0.63)**	-0.83 (-1.63, -0.04)*	-0.73 (-1.51, 0.06)
Sociodemographic characteristics					
Age		0.00 (-0.01, 0.02)			0.01 (0.00, 0.03)**
Race/ethnicity (ref = white)					
Black		-0.04 (-0.59, 0.51)			0.07 (-0.46, 0.60)
American Indian/Alaska Native		0.10 (-1.49, 1.68)			0.82 (-0.66, 2.30)
API/Hawaiian		-0.61 (-1.41, 0.18)			-0.45 (-1.17, 0.28)
Hispanic		0.77 (0.09, 1.46)*			0.93 (0.32, 1.53)**
Born in US (ref = yes)					
No		1.67 (1.07, 2.27)***			0.82 (0.28, 1.36)**
Education (ref = less than high school)					
High school		0.82 (0.10, 1.54)*			0.38 (-0.32, 1.08)
Some college		1.05 (0.32, 1.78)**			0.45 (-0.22, 1.12)
Bachelors		1.76 (0.98, 2.55)***			0.95 (0.23, 1.68)*
More than college		1.86 (1.06, 2.66)***			0.95 (0.24, 1.66)**
Household income (ref = less than \$25,000)					
\$25,000–49,999		2.03 (1.54, 2.52)***			0.80 (0.36, 1.23)***
\$50,000–79,999		2.87 (2.31, 3.42)***			1.17 (0.65, 1.70)***
\$80,000–99,999		3.53 (2.90, 4.15)***			1.48 (0.89, 2.07)***
\$100,000 +		3.38 (2.77, 3.98)***			1.07 (0.52, 1.63)***
Religious importance (ref = not important)					
Not very important		0.77 (-0.01, 1.54)			0.57 (-0.14, 1.29)
Somewhat important		0.10 (-0.80, 1.00)			0.01 (-0.76, 0.78)
Very important		0.49 (-0.37, 1.34)			0.05 (-0.68, 0.78)
Religious denomination (ref = Christian, not Catholic)					
Catholic		-0.10 (-0.55, 0.34)			-0.31 (-0.73, 0.11)
Other faith		-1.38 (-2.11, -0.65)***			-0.87 (-1.51, -0.24)**
Unaffiliated		-0.96 (-1.64, -0.28)**			-0.12 (-0.79, 0.54)
Urbanicity (ref = urban)					
Rural		0.62 (0.03, 1.21)*			0.28 (-0.28, 0.84)

Table 3 (continued)

	Model 1: Gross effects, B (95% CI)	Model 2: Sociodemographics, B (95% CI)	Model 3: Lifestyle, B (95% CI)	Model 4: Psychosocial, B (95% CI)	Model 5: Sociodemographics + lifestyle + psychosocial, B (95% CI)
Census region (ref = Northeast)					
Midwest		0.01 (−0.72, 0.73)			−0.20 (−0.88, 0.48)
South		0.21 (−0.51, 0.92)			0.00 (−0.65, 0.66)
West		0.00 (−0.74, 0.73)			−0.18 (−0.89, 0.53)
Lifestyle characteristics					
Smoking status (ref = non-smoker)					
Current smoker			−2.09 (−2.51, −1.67)***		−0.81 (−1.21, −0.42)***
Former smoker			0.84 (0.42, 1.26)***		0.79 (0.35, 1.22)***
Drinking status (ref = lifetime abstainer)					
Current drinker			−0.20 (−0.76, 0.37)		−0.41 (−0.99, 0.16)
Former drinker			−1.06 (−1.77, −0.35)**		−1.19 (−1.91, −0.48)**
Problems sleeping (ref = no)					
Yes			−5.20 (−5.72, −4.67)***		−4.11 (−4.59, −3.63)***
Physical activity (ref = does not exercise)					
Meets guidelines			3.47 (2.72, 4.22)***		3.05 (2.31, 3.79)***
Exercises, but does not meet guidelines			2.05 (1.20, 2.90)***		1.65 (0.84, 2.47)***
BMI (ref = underweight)					
Healthy weight (18.5–24.9)			0.17 (−2.17, 2.52)		−0.52 (−2.72, 1.68)
Overweight (25–29.9)			0.71 (−1.67, 3.09)		−0.49 (−2.72, 1.74)
Obese (> 30)			0.16 (−2.25, 2.56)		−0.90 (−3.16, 1.35)
Psychosocial characteristics					
Stressful life experiences				−1.05 (−1.15, −0.96)***	−0.83 (−0.94, −0.72)***
Social support				5.35 (4.89, 5.81)***	4.53 (4.06, 5.00)***

Table 4 Assessing the roles of sociodemographic, lifestyle, and psychosocial factors in attenuating the association between sexual identity group and mental health, females, sequential multiple linear regression models, NESARC-III (2012–2013)

	Model 1: Gross effects, B (95% CI)	Model 2: Sociodemographics, B (95% CI)	Model 3: Lifestyle, B (95% CI)	Model 4: Psychosocial, B (95% CI)	Model 5: Sociodemographics + lifestyle + psychosocial, B (95% CI)
Sexual identity (ref = heterosexual)					
Lesbian/gay	-1.39 (-2.95, 0.17)	-0.83 (-2.34, 0.69)	-0.60 (-2.03, 0.84)	-0.30 (-1.72, 1.12)	0.11 (-1.22, 1.44)
Bisexual	-6.16 (-7.72, -4.59)***	-4.27 (-5.78, -2.75)***	-4.74 (-6.17, -3.32)***	-2.58 (-4.14, -1.03)**	-1.59 (-3.09, -0.10)*
HSM	-2.37 (-3.06, -1.68)***	-1.95 (-2.64, -1.26)***	-1.95 (-2.56, -1.33)***	-0.83 (-1.46, -0.21)**	-0.69 (-1.28, -0.10)*
Sociodemographic characteristics					
Age		0.06 (0.04, 0.07)***			0.05 (0.04, 0.06)***
Race/ethnicity (ref = white)					
Black		0.54 (0.04, 1.05)*			0.39 (-0.09, 0.88)
American Indian/Alaska Native		-0.05 (-1.39, 1.29)			1.94 (0.75, 3.14)***
API/Hawaiian		0.66 (-0.19, 1.51)			0.02 (-0.69, 0.74)
Hispanic		0.76 (0.09, 1.43)*			0.56 (-0.08, 1.21)
Born in US (ref = yes)					
No		1.83 (1.23, 2.43)***			0.74 (0.23, 1.24)**
Education (ref = less than high school)					
High school		2.17 (1.44, 2.89)***			1.31 (0.71, 1.91)***
Some college		2.32 (1.54, 3.10)***			1.46 (0.82, 2.09)***
Bachelors		3.18 (2.40, 3.95)***			1.44 (0.79, 2.09)***
More than college		2.90 (2.09, 3.71)***			1.31 (0.55, 2.06)**
Household income (ref = less than \$25,000)					
\$25,000–49,999		1.58 (1.09, 2.07)***			0.68 (0.23, 1.12)**
\$50,000–79,999		2.27 (1.68, 2.86)***			0.73 (0.19, 1.27)**
\$80,000–99,999		2.71 (2.03, 3.39)***			0.60 (-0.02, 1.22)
\$100,000 +		3.16 (2.46, 3.86)***			0.96 (0.38, 1.55)**
Religious importance (ref = not important)					
Not very important		0.56 (-0.39, 1.51)			0.58 (-0.15, 1.31)
Somewhat important		-0.03 (-0.98, 0.93)			-0.39 (-1.17, 0.40)
Very important		0.30 (-0.61, 1.22)			-0.49 (-1.24, 0.25)
Religious denomination (ref = Christian, not Catholic)					
Catholic		0.28 (-0.16, 0.73)			-0.16 (-0.57, 0.25)
Other faith		-0.82 (-1.50, -0.13)*			-0.56 (-1.21, 0.09)
Unaffiliated		-0.32 (-1.10, 0.47)			-0.21 (-0.87, 0.45)
Urbanicity (ref = urban)					
Rural		0.48 (-0.04, 1.01)			0.11 (-0.42, 0.63)

Table 4 (continued)

	Model 1: Gross effects, B (95% CI)	Model 2: Sociodemographics, B (95% CI)	Model 3: Lifestyle, B (95% CI)	Model 4: Psychosocial, B (95% CI)	Model 5: Sociodemographics + lifestyle + psychosocial, B (95% CI)
Census region (ref = Northeast)					
Midwest		0.53 (−0.13, 1.20)			0.10 (−0.43, 0.62)
South		0.08 (−0.57, 0.73)			−0.35 (−0.85, 0.15)
West		0.28 (−0.36, 0.92)			−0.07 (−0.56, 0.43)
Lifestyle characteristics					
Smoking status (ref = non-smoker)					
Current smoker			−4.21 (−4.67, −3.76)***		−2.29 (−2.69, −1.88)***
Former smoker			0.17 (−0.33, 0.66)		−0.21 (−0.71, 0.29)
Drinking status (ref = lifetime abstainer)					
Current drinker			−0.54 (−1.04, −0.03)*		−0.34 (−0.86, 0.18)
Former drinker			−0.88 (−1.53, −0.24)**		−0.82 (−1.45, −0.18)*
Problems sleeping (ref = no)					
Yes			−4.91 (−5.37, −4.45)***		−3.90 (−4.32, −3.48)***
Physical activity (ref = does not exercise)					
Meets guidelines			2.23 (1.67, 2.78)***		2.14 (1.58, 2.70)***
Exercises, but does not meet guidelines			1.30 (0.66, 1.94)***		1.18 (0.54, 1.83)***
BMI (ref = underweight)					
Healthy weight (18.5–24.9)			1.36 (−0.01, 2.73)		0.66 (−0.58, 1.90)
Overweight (25–29.9)			1.07 (−0.31, 2.45)		0.38 (−0.89, 1.64)
Obese (> 30)			0.05 (−1.37, 1.46)		−0.31 (−1.63, 1.01)
Psychosocial characteristics					
Stressful life experiences				−1.56 (−1.68, −1.45)***	−1.20 (−1.32, −1.08)***
Social support				5.86 (5.48, 6.24)***	5.22 (4.82, 5.62)***

people are frequently miscategorized or excluded altogether from relevant research on the basis of their heterosexual identities [52, 53]. Reliance on single-indicator measures of sexual orientation ultimately masks the true extent of sexual minority health disparities. This point also has clinical relevance; it may be especially important for practitioners to assess clients' sexual identities, attractions, and behaviors to identify those most at risk for (as well as the unique factors associated with) reduced mental health.

Factors associated with mental health

Using nationally representative data, we found that, while most sexual minority subgroups had poorer mental health, compared to heterosexuals, there were wide-ranging subgroup differences across several sociodemographic, lifestyle, and psychosocial characteristics. While this study did not assess the specific causal mechanisms contributing to disparities in mental health, our findings do suggest that different factors may be associated with the mental health disparities that exist between different subgroups. For instance, the disparity between bisexual and heterosexual men was fully attenuated after accounting for sociodemographic characteristics alone. This suggests that underlying differences in social placement may be associated with, at least in part, bisexual men's lower mental health statuses, compared to heterosexual men. However, while many such differences were present between heterosexual, gay, and HSM men, they were not able to attenuate the mental health disparities experienced by HSM or gay men alone.

Alternately, accounting for sociodemographic, lifestyle, and psychosocial characteristics fully attenuated the disparity between HSM and heterosexual men, suggesting that the disparity may be driven via a different mechanism. Specifically, while HSM men did not report more stressful life experiences than heterosexual men, they did report less perceived social support, possibly limiting their ability cope with stress when it arises [54]. Finally, despite the existence of several sociodemographic, lifestyle, and psychosocial characteristic differences between heterosexuals and gay men, bisexual women, and HSM women, we were unable to fully attenuate the observed disparities after controlling for the wide range of characteristics included in this study. While the included factors likely contribute to disparities in mental health among these groups, as evidenced by partial reductions in the magnitudes of the disparities between Model 1 and Model 5 (Table 3), they are incomplete. For example, ample research has demonstrated that minority stress is an important factor underlying sexual minority mental health disparities [10, 58], but no such measures were available for these comparative analyses. Additional research should explore the unique factors and mechanisms by which

mental health disparities are reinforced for diverse sexual minority subgroups.

Finally, sociodemographic, lifestyle, and psychosocial factors are not associated with mental health independently of one another [55]. Individual risk factors may interact in unique combinations, and through different mechanisms of action, to influence mental health differently for sexual minority subgroups, and further, for individual sexual minorities. As such, it is possible that competing risk and resilience factors “offset” one another within groups, to a degree. For example, we did not find significantly differently mental health scores between lesbian and heterosexual women, which was unexpected, especially because lesbian women had higher rates of lifetime MDE, and more suicide attempts, compared to heterosexuals. While lesbian women reported several risk factors for poor mental health (compared to heterosexual women, greater proportions of lesbian women were current smokers, drinkers, and reported problems sleeping), they also reported several resilience factors (greater proportions of lesbian women completed high school, and reported greater social support, compared to heterosexuals), possibly compensating for, to a degree, increased risk for mental health problems. To maximize population health intervention efforts, more research is needed to understand the specific mechanisms by which sexual identity-based mental health disparities emerge, and the potentially unique resilience factors that help to offset them.

Limitations

While this paper advocates for comprehensively assessing sexual orientation, the variables available in the data set were limiting in certain ways. For example, the measure of sexual identity included response options for “gay or lesbian”, “bisexual”, and “heterosexual (straight)”, but did not include alternate sexual minority identity labels (e.g., queer and pansexual). Recent research suggests the use of such “emerging” identity labels has increased in recent years, especially among youths [56, 57]. Future surveys should consider including a greater diversity of sexual minority identities as response options on their sexual identity questions. Furthermore, transgender identity was not assessed. Similar to sexual identity, important subgroup distinctions likely exist by gender identity (e.g., between cisgender, genderqueer/non-binary, and transgender people). Finally, this study showed underlying sociodemographic, lifestyle, and psychosocial factors were associated with sexual minority subgroup mental health disparities. However, these data are cross-sectional, and this study was not designed to assess the specific causal mechanisms by which individual factors account for mental health disparities across groups, and so should be

interpreted with caution. This is an area requiring further investigation, ideally using longitudinal data.

Conclusions

This study showed that, when examined separately, there are wide-ranging sexual orientation group differences across sociodemographic, lifestyle, and psychosocial characteristics. Underlying subgroup differences across each of these factors may contribute to mental health in unique ways for sexual minority subgroups. Further research should assess the specific social and behavioral mechanisms underlying sexual minority mental health disparities.

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