Prevalence of Self-Reported Diabetes by Sexual Orientation: Results from the 2014 Behavioral Risk Factor Surveillance System

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Abstract

Purpose: This study aimed to compare the prevalence of self-reported diabetes and diabetes risk factors among adult sexual minority and heterosexual populations in the United States.

Methods: Data from the 2014 Behavioral Risk Factor Surveillance System for 3776 lesbian, gay, and bisexual (LGB) adults and 142,852 heterosexual adults aged 18 years and older were used to estimate the prevalence of diabetes. Binomial logistic regression models were used to compare the odds of diabetes by sexual orientation.

Results: Sexual minorities were younger and more racially diverse than heterosexuals. Gay men less often and lesbian and bisexual women more often reported a body mass index of 30 kg/m² or higher than heterosexuals. Overall, 14.2% of bisexual men, 11.4% of gay men, and 10.8% of heterosexual men reported a lifetime diabetes diagnosis, as did 8.5% of lesbian women, 5.7% of bisexual women, and 10.2% of heterosexual women. After controlling for multiple factors, gay (odds ratio [OR] = 1.50; confidence interval [95% CI] = 1.09–2.07) and bisexual men [OR = 1.55; 95% CI = 1.00–2.07] were more likely to report a lifetime diabetes diagnosis than heterosexual men. Similar differences were not found for lesbian [OR = 1.22; 95% CI = 0.76–1.95] or bisexual women [OR = 0.88; 95% CI = 0.62–1.26].

Conclusion: Sexual minorities may be at increased risk for diabetes than their heterosexual peers. This may be due partly to the chronic stressors associated with being a member of a marginalized population. Future research should explore the underlying causes and consequences of LGB diabetes disparities and elucidate best practices to improve diabetes screening and care for these vulnerable patient populations.

Keywords: Behavioral Risk Factor Surveillance System, bisexual, diabetes, gay, health disparities, lesbian

Introduction

HEALTH DISPARITIES FOR lesbian, gay, and bisexual (LGB) people have been targeted for elimination by the Institute of Medicine (IOM)¹ and *Healthy People 2020* goals.² According to a growing body of public health research, LGB people experience worse health outcomes compared with their heterosexual peers partly as a result of “minority stress,” the chronic stress associated with being a member of a marginalized minority group.^{1,3} Discriminatory environments and public policies can contribute to minority stress by stigmatizing LGB people and engendering feelings of rejection, shame, and low self-esteem, which can negatively shape their mental health outcomes and health-related behaviors.^{4,5} Chronic psychological stress and depression, both of which are higher in LGB individuals,^{6,7} have been linked to hypothalamic-pituitary-adrenal (HPA) axis dysregulation, autonomic nervous system

activation, and increases in the inflammatory proteins interleukin 6 and C-reactive protein.^{8–10} These physiological changes, in turn, are associated with increases in blood sugar and insulin resistance, which lead to type 2 diabetes.⁹ Physically and psychologically, then, minority stress is hypothesized to be associated with higher rates of diabetes and other chronic conditions in LGB populations.⁵ Minority stress has also been hypothesized to contribute to the observed racial/ethnic and socioeconomic diabetes disparities.^{11–13}

Although many studies have documented mental health and substance use disparities among LGB populations,^{14–16} comparatively few studies have investigated chronic physical health conditions in LGB individuals.⁵ Much of the previous diabetes research on LGB people has relied on nonrandom convenience samples or on population-based studies isolated to individual states.^{17–25} Furthermore, few LGB health studies have focused on diabetes outcomes or diabetes care.²⁶

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There are reasons to believe that LGB populations may be at increased risk for diabetes based on their health risk profiles. For instance, LGB adults are more likely to engage in heavy cigarette smoking and alcohol consumption than their heterosexual peers,^{14,18,27,28} with some research suggesting that bisexual people have elevated disparities in these health habits.^{14,18,29} Moreover, the use of medications to treat hypertension,³⁰ HIV,³¹ and certain mental health³² conditions, all of which have been reported to be more prevalent in sexual minorities,^{33–36} have also been linked to higher diabetes prevalence.^{30–32}

Some studies have reported mixed findings about the relative prevalence of diabetes among sexual minorities compared with heterosexuals.^{18,37} In a study utilizing data from 10 states in the 2010 Behavioral Risk Factor Surveillance System (BRFSS), heterosexual men (8.2%) and heterosexual women (10.2%) had higher adjusted diabetes prevalence than gay men (6.4%), lesbian women (6.8%), or bisexual men (5.1%) and bisexual women (6.1%).²² Except for bisexual women, however, none of these estimates were statistically different. In contrast, data from the 2013 National Health Interview Survey (NHIS) indicated that bisexual men had the highest diabetes prevalence (13.5%), followed by heterosexual men (9.2%), gay men (8.6%), heterosexual women (8.3%), and lesbian women (4.5%) (reliable statistical estimates for bisexual women could not be calculated).²³ None of these differences in the NHIS, however, were significant.²³ Similar trends showing heightened prevalence of diabetes among bisexual men were found using data from the 2001–2010 National Health and Nutrition Examination Surveys (NHANES).³⁸ The present study builds on previous LGB diabetes research by using the largest multistate sample from the 2014 BRFSS to compare the prevalence of diabetes by sexual orientation. Moreover, this is one of the first articles, to the best of our knowledge, dedicated to an in-depth analysis of diabetes risk factors and the prevalence of diabetes among sexual minorities using a nationally representative data set.

Data and Methods

Data source

Data for this study come from the 2014 BRFSS, a cross-sectional, nationally representative survey of the civilian, noninstitutionalized population aged 18 years and older. The BRFSS is conducted annually by the Centers for Disease Control and Prevention (CDC) in conjunction with state health departments in all 50 states plus the District of Columbia. The BRFSS has been administered since 1984, and to better reflect the changing demographic structure of the United States, cell phone only households were added to the sampling frame in 2011.³⁹ Approximately 450,000 adults are randomly selected for the survey every year and are asked a standard core set of questions, including information about socio-demographic characteristics, health conditions, and healthcare access. In addition, states have the option to add BRFSS-supported modules on specific topics, or states can develop and include their own questions in their statewide BRFSS.

Study sample

Currently, the BRFSS core questionnaire does not ask participants to identify their sexual orientation, but several states

have independently added sexual orientation questions to their own BRFSS surveys in previous years.^{17,18,40} State-added questions are not submitted to the CDC, so analyzing BRFSS data on sexual minority populations across state borders previously required permission from each individual state. Starting in 2014, the BRFSS offered states an optional and unified sexual orientation module, and the following 19 states added sexual orientation questions to their statewide BRFSS surveys: Delaware, Hawaii, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Minnesota, Montana, Nevada, New York, Ohio, Pennsylvania, Vermont, Virginia, Wisconsin, and Wyoming.

In the BRFSS sexual orientation module, respondents were asked, “Do you consider yourself to be: straight, lesbian or gay, bisexual.” Our final sample included 3776 adults who identified as lesbian, gay, or bisexual and 142,852 adults who identified as straight or heterosexual. Our analysis excluded respondents who indicated their sexual orientation as something other than the response options ($n=441$), respondents who did not know the answer ($n=1161$), or respondents who refused to answer ($n=2556$). The nonresponse rate for the BRFSS sexual orientation question was similar to the nonresponse rate for other sensitive questions (i.e., race/ethnicity).⁴¹ The median state-level response rate for the BRFSS was 47% in 2014 (ranging from 25.1% in California to 60.1% in South Dakota).⁴²

Diabetes measures and covariates

We classified respondents as having diagnosed diabetes if they answered “yes” to the question, “Has a doctor, nurse, or other health professional ever told you that you have diabetes?” Women indicating gestational diabetes during pregnancy and adults indicating they were told they had prediabetes were not considered to have diabetes. We excluded respondents who indicated they did not know ($n=160$) or refused to answer ($n=60$). No participants in our study sample had missing information regarding diabetes diagnosis. Other demographic, socioeconomic, health behavior, and healthcare categorical variables used in this study were sexual orientation (lesbian, gay, bisexual, or heterosexual); age in years (18–29, 30–39, 40–49, 50–64, 65 or older, missing); race and ethnicity (White, Black, Hispanic, other/multiple races, and missing); relationship status (married or living with an unmarried partner, formerly married [divorced, separated, or widowed]), never married, refused/do not know; reporting any exercise in the past 30 days (yes, no, and missing); being a current smoker, former smoker, or lifetime nonsmoker; having consumed ≥ 7 drinks (women) or ≥ 14 drinks (men) per week (yes, no, and missing); educational attainment (less than high school, high school graduate, some college, college graduate, and missing); employment status (employed, unemployed, not in paid work force, do not know/not sure, and missing); household income in U.S. dollars (<\$10,000, \$10,000–24,999, \$25,000–34,999, \$35,000–49,999, \$50,000–74,999, \$75,000 or greater, and missing); body mass index (BMI) measured in kg/m^2 (<25, ≥ 25 –<30, ≥ 30 , and missing); self-reported health status (excellent/very good/good, poor/fair, and missing); having health insurance (insured, uninsured, and missing); having a usual source of care (has usual care, no usual care, and refused/missing); having a routine checkup in the prior 12 months (yes, no, and missing);

and having an unmet care need because of cost (yes, no, and missing) in the prior 12 months.

Analytic methods

We used descriptive statistics to characterize the study sample; weighting was used for all analyses. Then, we examined the prevalence of having been diagnosed with diabetes by sex and sexual orientation, first for the entire sample and then for select characteristics. We also estimated a series of logistic regression models to compare the prevalence of diabetes between lesbian/gay, bisexual, and heterosexual adults while incrementally adjusting for sociodemographic characteristics, health behaviors, and access to care measures. Results from the logistic regression models are presented as adjusted odds ratios (AORs) with 95% confidence intervals (CIs). With the exception of sexual orientation where respondents with missing data were excluded a priori, respondents' missing data for one or more predictor variables were retained in our regression analyses; missing data retained in analyses were coded as their own category. We conducted all analyses in R 3.3.1⁴³ using the survey package version 3.31-2,⁴⁴ to weight the data to account for the complex survey design of the BRFSS according to the technical instructions provided by CDC.⁴⁵ The Vanderbilt Institutional Review Board designated that this study did not involve human subjects research and granted exempt approval for this study.

Results

Demographic, socioeconomic, and health characteristics

Table 1 presents the demographic, socioeconomic, and health characteristics of adults in the study sample by sex and sexual orientation. Gay and bisexual men were younger and more racially and ethnically diverse than heterosexual men. A comparatively lower percentage of gay and bisexual men reported being married or living with a partner. Gay men more often reported a BMI of $<25 \text{ kg/m}^2$ compared with heterosexual men. Gay men most often reported and bisexual men least often reported having completed a college education. Compared with both gay and heterosexual men, bisexual men had lower incomes, more often lacked health insurance, and more often had an unmet healthcare need because of cost. Bisexual men also less frequently reported visiting a doctor for a routine checkup in the past 12 months and reported overall poor or fair health more often.

Similar to sexual minority men, lesbian and bisexual women were also younger and more racially and ethnically diverse than their heterosexual counterparts, with these trends being particularly pronounced for bisexual women. Lesbian and bisexual women reported being married or partnered less often than heterosexual women, with this trend strongest for bisexual women. Both lesbian and bisexual women reported higher BMIs than heterosexual women. Lesbian women more commonly reported that they had completed some college or hold college degrees than either heterosexual women or bisexual women. Bisexual women often indicated that they did not complete high school—nearly 1 in 5 bisexual women did not have a high school diploma, compared with ~1 in 10 heterosexual women and 1 in 20 lesbian women.

Lesbian women more often reported incomes at the high and low extremes of the income scale, with more les-

bian women reporting household incomes of $<\$10,000$ and $\$75,000$ or more per year than heterosexual women, respectively. Bisexual women had the lowest incomes of all sexual minority groups, with nearly 50% reporting household incomes $<\$35,000$; $>10\%$ of bisexual women reported that they earned $<\$10,000$ per year. Compared with heterosexual women, a lower percentage of lesbian and bisexual women had health insurance. Lesbian and bisexual women also more often reported having an unmet healthcare need because of cost, and less frequently reported visiting a doctor for a routine checkup in the past 12 months. Bisexual women more often reported fair or poor health than either lesbian or heterosexual women.

Prevalence of diabetes by sex and sexual orientation

Tables 2 and 3 present the prevalence of diabetes by sexual orientation and for select characteristics for men and women, respectively. Overall, 14.2% (95% CI 9.7–18.8) of bisexual men, 11.4% (95% CI 8.6–14.2) of gay men, and 10.8% (95% CI 10.4–11.2) of heterosexual men had an unadjusted self-reported diabetes diagnosis, as did 8.5% (95% CI 5.2–11.8) of lesbian women, 5.7% (95% CI 4.0–7.3) of bisexual women, and 10.2% (95% CI 9.8–10.5) of heterosexual women. Age-stratified analyses revealed that gay men and lesbian women had higher diabetes prevalence estimates than their heterosexual counterparts in every age category; bisexual men and women had the highest overall diabetes prevalence estimate for groups in the two oldest age categories, although none of these findings were significant. Among heterosexual men and women, Black adults were found to have a statistically higher prevalence of diabetes than did White adults. In contrast, among sexual minorities, no significant differences in diabetes prevalence among racial/ethnic minorities were found.

Odds of diabetes prevalence

Next, we performed a series of binomial logistic regression models to generate AORs to compare the prevalence of diabetes by sexual orientation. After adjusting for age, race/ethnicity, and BMI (Table 4, Model 3), both gay men (OR = 1.72; 95% CI 1.29–2.31) and bisexual men (OR = 1.69, 95% CI 1.12–2.56) had increased odds of a lifetime diabetes diagnosis. In contrast, lesbian women had slightly increased odds (OR = 1.11, 95% CI 0.72–1.72), whereas bisexual women had slightly decreased odds (OR = 0.93, 95% CI 0.66–1.33) of diabetes compared with heterosexual women, although these findings were not significant.

After adjusting for socioeconomic characteristics, health behaviors, and healthcare access variables (Table 4, Model 7), the heightened diabetes prevalence remained for gay men (OR = 1.50, 95% CI 1.09–2.07) and bisexual men (OR = 1.55, 95% CI 1.00–2.07). After performing the same analysis among women, lesbian women still had increased odds (OR = 1.22, 95% CI 0.76–1.95), whereas bisexual women had lower odds (OR = 0.88, 95% CI 0.62–1.26) of having diabetes than heterosexual women, although again these findings were not significant.

Discussion

Our study used data from 19 states that ascertained sexual orientation using the unified CDC module in their 2014

TABLE 1. DEMOGRAPHIC, SOCIOECONOMIC, AND HEALTH CHARACTERISTICS BY SEX AND SEXUAL ORIENTATION

Variable	Men				Women			
	Sample size	Heterosexual	Gay	Bisexual	Sample size	Heterosexual	Lesbian	Bisexual
Total	60,689	96.7	2.0	1.3	85,939	96.5	1.1	2.4
Age, years								
18–29	6319	20.6	30.4	37.2	6323	17.6	29.9	50.5
30–39	6261	16.2	15.3	10.6	8531	15.3	18.7	20.6
40–49	8399	16.5	18.6	12.3	11,313	16.2	17.9	11.6
50–64	20,487	27.7	26.8	22.8	27,983	27.6	24.7	10.7
65 or older	18,834	18.4	8.5	17.0	30,884	22.3	8.5	6.6
Missing	389	0.6	0.3	0.1	905	0.9	0.3	1.1
Race/ethnicity								
White	49,730	73.2	71.4	64.6	70,335	73.6	69.8	63.7
Black	3550	11.2	10.8	12.1	6975	12.5	16.1	17.1
Hispanic	2091	7.5	11.3	6.8	2687	6.8	8.4	8.1
Other/multiple races	4413	6.4	4.9	14.5	5130	5.9	5.1	9.7
Missing	905	1.7	1.6	2	812	1.1	0.6	1.4
Education								
Less than high school	3987	12.9	8.5	13.2	5433	10.9	5.7	18.3
High school graduate	18,223	32.7	24.7	35.5	25,467	29.8	22.8	28
Some college	15,601	28.3	29.9	28.6	24,846	32.3	39.1	35.2
College graduate	22,775	25.9	36.9	22.6	30,013	26.7	32.4	18.4
Missing	103	0.3	0	0	180	0.2	0	0.1
Relationship status								
Married or partnered	37,743	59.3	31.4	31.9	45,556	54.6	42.3	32.1
Formerly married	12,285	15.5	6.7	19.8	29,661	24.5	11.8	16.1
Never married	10,425	24.8	61.6	47.8	10,348	20.6	44.8	50.8
Refused/do not know	236	0.5	0.3	0.5	374	0.4	1.0	1.0
BMI, kg/m ²								
BMI <25	15,663	27.9	38.4	33.2	31,099	37.8	34.6	35.2
BMI 25 to <30	25,587	40	35.2	33.2	24,911	27.4	25.1	21.1
BMI 30 or higher	18,738	30.7	25.5	29.8	24,024	27.5	36.9	35.4
Missing	701	1.4	0.8	3.9	5905	7.4	3.4	8.3
Exercise in past 30 days								
Yes	47,425	77.9	76.3	74.2	63,490	74.7	80.5	80.2
No	13,151	21.9	23.6	25.8	22,350	25.2	19.4	19.8
Missing	113	0.2	0.1	0	99	0.1	0.1	0
Smoking status								
Current smoker	10,208	20.2	31.3	25.7	83,903	16.6	32.5	29.2
Former smoker	20,517	28.2	22.1	23.0	779	22.1	24.4	18.8
Lifetime nonsmoker	29,964	50.9	46.6	51.3	1257	61.3	43.1	52
Heavy drinker								
Yes	55,719	6.1	8.3	7.0	80,548	4.9	14.1	13.8
No	3768	91.7	90.0	89.3	4227	93.5	83.7	84.6
Missing	1202	2.2	1.8	3.7	1164	1.6	2.2	1.6
Household income								
<10,000	1912	3.8	4.9	6.0	3769	5.0	8.4	10.7
10,000–24,999	9793	17.0	21.2	21.4	18,126	20.4	21.7	28.9
25,000–34,999	5692	9.1	7.0	8.3	8944	9.6	9.5	8.3
35,000–49,999	8439	12.3	12.5	17.5	10,871	12.3	12.9	11.5
50,000–74,999	9660	15.4	13.3	13.8	11,599	13.2	12.5	8.3
75,000 or greater	19,013	30.6	29.7	19.7	20,068	25.5	28.7	14.9
Missing	6180	10.9	11.4	13.3	12,562	14.0	6.2	17.3
Employment								
Employed	35,137	63.9	63.7	51.8	39,798	51.8	66.6	50.6
Unemployed	2646	6.4	9.3	5.4	3363	5.4	6.2	10.8
Not in paid work force	22,699	29.4	27.0	42.4	42,487	42.4	27.2	38.5
Do not know/not sure	207	0.4	0.1	0.4	291	0.4	0	0.1
Missing	0	0	0	0	0	0	0	0

(continued)

TABLE 1. (CONTINUED)

Variable	Men				Women			
	Sample size	Heterosexual	Gay	Bisexual	Sample size	Heterosexual	Lesbian	Bisexual
Health insurance status								
Insured	55,589	87.2	86.7	80.3	80,373	90.6	83.7	86.5
Uninsured	4854	12.1	13.2	16.3	5357	9.1	16	13
Missing	246	0.7	0.1	3.4	209	0.3	0.3	0.4
Usual source of care								
Has usual care	48,866	75.3	74.4	73.4	76,906	86.3	80.3	78.1
No usual care	11,525	23.9	25.4	25.8	8757	13.2	19.4	21.3
Refused/missing	298	0.8	0.2	0.7	276	0.5	0.3	0.6
Unmet care need because of cost								
Yes	4961	11.0	13.8	16.7	9106	13.7	18.1	23.4
No	55,598	88.8	86.2	83.3	76,653	86	81.6	76.6
Missing	130	0.3	0	0	180	0.2	0.3	0
Checkup in past year								
Yes	42,211	66.3	68.5	61.3	66,105	75.3	71.1	68.3
No	17,816	32.6	29.6	36.3	18,849	23.6	28.6	30.4
Missing	662	1.1	1.9	2.4	985	1.1	0.3	1.3
Health status								
Excellent to good	50,172	83.6	82.6	74.8	70,005	82.6	81.8	73.7
Poor or fair	10,317	16	16.9	24.6	15,674	17.1	17.2	26.2
Missing	200	0	0.2	0.4	260	0.4	1.0	0

Estimates are from adults aged 18 years or older from the 19 states that included the optional sexual orientation and gender identity question module in the 2014 BRFSS. All data were weighted. Current smokers were defined as respondents who currently smoked every day or some days; former smokers were defined as respondents who had smoked at least 100 cigarettes in their lifetime but who now report no cigarette use; lifetime nonsmokers were defined as those respondents who had not smoked 100 cigarettes in their lifetime. Heavy drinking was defined for men as at least 14 drinks per week and for women as at least 7 drinks per week. Source: 2014 BRFSS.

BMI, body mass index; BRFSS, Behavioral Risk Factor Surveillance System.

BRFSS surveys to compare the prevalence of diabetes by sexual orientation. After adjusting for demographics, socioeconomic status, health behaviors, and access to healthcare, we found that both gay and bisexual men were more likely to have diabetes than heterosexual men. This finding was particularly striking because compared with heterosexual men, with the exception of current smoking status, sexual minority men in this study had similar or lower risk profiles for diabetes. In particular, sexual minority men in the 2014 BRFSS tended to be younger and had lower or similar BMI levels compared with heterosexual men.

In contrast, after adjusting for multiple factors, we found that the prevalence of diabetes among lesbian and bisexual women did not differ from that among heterosexual women. Indeed, in our unadjusted analyses, we found that bisexual women were statistically *less* likely than heterosexual women to be living with diabetes despite their elevated risk of smoking, heavy alcohol consumption, and obesity. Adjusting for age category, however, resulted in the elimination of this statistical difference, which was due to the fact that 30% of lesbian women and 50% of bisexual women fell into the youngest age category, compared with only 18% of heterosexual women. Age is the single strongest risk factor for diabetes; respondents in the oldest age category in this study (65 years or older) were >30 times more likely than those in the youngest age category (18–29 years) to report living with diabetes.

Our results are in agreement with recent analyses of NHIS and NHANES data, showing that sexual minority men are

more likely than heterosexual men to be living with diabetes,^{23,38} but stand in contrast to a study by Blossnich et al. using 2010 BRFSS data compiled from 10 states.²² Blossnich et al. found that gay and bisexual men each had a lower prevalence of diabetes than heterosexual men, although these results were not significant. Blossnich et al. did not perform adjusted analyses comparing diabetes prevalence between sexual minority versus heterosexual men, making our results difficult to compare. Blossnich et al., however, did calculate the adjusted odds of diabetes prevalence for bisexual versus heterosexual women. Even after adjusting for age, race/ethnicity, education, and income, Blossnich et al. found that bisexual women were still statistically less likely than heterosexual women to be living with diabetes.²² An increasing number of reports demonstrate the existence of diabetes “hot spots”; these articles reveal that diabetes prevalence, mortality, and disparities vary greatly not only by state but also by county.⁴⁶ Depending upon the diabetes prevalence in the states analyzed, then, the estimates for diabetes prevalence and disparities may vary year to year. Additional studies are needed to explore the reasons contributing to these variations.

Limitations

There were several limitations to using the 2014 BRFSS for this study. First, all responses to the BRFSS were self-reported, which can lead to recall and response bias when describing height, weight, access to care, sociodemographic characteristics, and health conditions, including diagnoses

TABLE 2. PREVALENCE OF DIABETES BY SEXUAL ORIENTATION FOR SELECT CHARACTERISTICS OF MEN IN THE 2014 BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM

Variable	N	Heterosexual (N=58,949)		Gay (N=1061)		Bisexual (N=679)	
		%	95% CI	%	95% CI	%	95% CI
Overall	60,689	10.8	10.4–11.2	11.4	8.6–14.2	14.2	9.7–18.8
Age, years							
18–29	6319	1.2	0.1–1.5	1.3	–0.3 to 3.0	2.3	0.0–4.6
30–39	6261	3.3	2.7–3.8	6.5	1.3–11.8	1.7	–0.2 to 3.6
40–49	8399	7.4	6.6–8.2	10.0	4.4–15.7	14.9	4.4–25.5
50–64	20,487	15.5	14.8–16.1	18.7	12.9–24.6	23.3	15.2–31.4
65 or older	18,834	22.6	21.9–23.4	28.1	18.8–37.5	29.8	20.2–39.4
Race/ethnicity							
White	49,730	10.7	10.2–11.1	13.0	9.6–16.4	15.6	10.0–21.2
Black	3550	14.2	12.5–15.8	9.6	0.8–18.3	10.5	–0.9 to 22.0
Hispanic	2091	7.8	5.9–9.7	6.2	–1.0 to 13.4	9.6	–3.0 to 22.2
Other/multiple races	4413	9.2	7.6–10.8	8.3	–1.5 to 18.2	13.7	–0.8 to 28.2
Education							
Less than high school	3987	13.6	11.9–15.3	10.4	1.8–18.9	16.3	–0.1 to 32.7
High school graduate	18,223	11.8	11.0–12.5	8.2	3.2–13.2	16.9	8.4–25.3
Some college	15,601	10.5	9.8–11.3	15.0	8.8–21.2	11.0	3.1–19.0
College graduate	22,775	8.5	7.9–9.0	10.9	6.9–15.0	12.8	7.3–18.4
BMI, kg/m ²							
BMI <25	15,663	4.3	4.0–4.7	4.5	1.9–7.0	2.7	0.5–4.8
BMI 25 to <30	25,587	8.9	8.3–9.5	11.0	6.5–15.6	13.5	5.9–21.2
BMI 30 or higher	18,738	19.0	18.1–19.9	23.1	15.7–30.5	25.7	15.5–35.8
Exercise past 30 days							
Yes	47,425	9.1	8.7–9.5	9.4	6.5–12.4	11.3	6.4–16.1
No	13,151	16.8	15.7–17.9	17.6	10.5–24.7	22.6	12.0–33.3
Heavy drinker							
Yes	55,719	11.3	10.9–11.7	12.6	9.5–15.6	14.6	9.9–19.3
No	3768	5.1	3.9–6.2	1.4	–0.4 to 3.2	15.4	–8.9 to 39.6
Smoking status							
Current smoker	10,208	7.9	7.1–8.8	7.2	2.8–11.5	11.2	4.6–17.8
Former smoker	20,517	16.6	15.7–17.5	18.6	11.8–25.5	21.4	12.3–30.4
Lifetime nonsmoker	29,964	8.7	8.2–9.3	10.9	6.9–14.9	12.5	5.5–19.6
Health status							
Excellent to good	50,172	8.0	7.8–8.3	7.7	5.7–9.7	6.7	4.5–8.8
Poor or fair	10,317	27.7	26.4–29.0	26.1	16.8–35.3	25.5	16.3–34.8
Household income							
<\$10,000	1912	12.2	9.7–14.7	13.2	0.5–25.9	12.9	–1.1 to 27
\$10,000 to \$24,999	9793	15.3	14.1–16.4	15.9	8.7–23.0	15.5	6.9–24.1
\$25,000 to \$34,999	5692	12.6	11–14.2	13.9	1.9–25.8	14.8	1.1–28.5
\$35,000 to \$49,999	8439	11.7	10.5–12.9	18.9	9.2–28.5	22.5	8.7–36.3
\$50,000 to \$74,999	9660	10.7	9.7–11.8	10.6	3.7–17.6	20.3	2.9–37.8
\$75,000 or greater	19,013	7.7	7.1–8.3	6.9	2.5–11.3	10.1	2.4–17.8

The prevalence of diabetes overall (top row) or by select bivariate characteristics is presented for men. Results were stratified by sexual orientation. All data were weighted according to CDC instructions to adjust for the complex survey design of the BRFSS.

CDC, Centers for Disease Control and Prevention; CI, confidence interval.

for diabetes. In addition, reporting sexual orientation may suffer from selection bias. Our sample of LGB adults only includes noninstitutionalized adults randomly selected among landline and cell phone users who were comfortable disclosing their sexual orientation to BRFSS surveyors. Missing from our analysis were homeless adults and adults residing in institutionalized settings, including nursing homes, institutionalized medical facilities, incarceration facilities, and homeless shelters. Thus, our study may be missing LGB individuals from the lower end of the socioeconomic spectrum who were not cap-

tured by the BRFSS and who are over-represented in these populations.⁴⁷

Our results may not be generalizable to the entire U.S. sexual minority population, as our study only included data from 19 states. However, these states were geographically diverse. Nevertheless, our study would have benefited if the optional sexual orientation and gender identity module had been added to the core BRFSS questionnaire.

Our study would have also benefited from additional data missing in the BRFSS. For example, the BRFSS does not measure other dimensions of sexual orientation, including

TABLE 3. PREVALENCE OF DIABETES BY SEXUAL ORIENTATION FOR SELECT CHARACTERISTICS OF WOMEN IN THE 2014 BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM

Variable	N	Heterosexual (N=83,903)		Lesbian (N=779)		Bisexual (N=1257)	
		%	95% CI	%	95% CI	%	95% CI
Overall	85,939	10.2	9.8–10.5	8.5	5.2–11.8	5.7	4.0–7.3
Age, years							
18–29	6323	1.5	0–1.9	3.1	0–6.2	2.5	0–4.4
30–39	8531	3.4	2.8–3.9	7.7	1.7–13.7	2.4	0.3–4.5
40–49	11,313	7.9	7.1–8.6	11.1	4.8–17.4	8.4	2.9–13.9
50–64	27,983	14.8	14.2–15.5	15.5	9.9–21.1	23.7	15.3–32.1
65 or older	30,884	22.0	21.2–22.7	23.3	15.0–31.7	27.6	17.9–37.2
Race/ethnicity							
White	70,335	9.4	9.0–9.7	6.6	3.4–9.8	5.4 ^a	3.6–7.2
Black	6975	16.0	14.6–17.4	12.5	2.3–22.6	5.8	1.7–10.0
Hispanic	2687	8.3	6.7–10.0	19.0	–1.1 to 39.1	7.9	–1.3 to 17.1
Other/multiple races	5130	10.0	8.1–11.9	1.3 ^a	0–2.6	6.0	1.3–10.8
Education							
Less than high school	5433	16.3	14.8–18.0	9.2	–2.5 to 20.9	4.8 ^a	0.4–9.1
High school graduate	25,467	12.6	11.9–13.3	10.5	2.3–18.8	6.7 ^a	3.2–10.2
Some college	24,846	9.7	9.1–10.3	9.3	3.3–15.2	5.6 ^a	3.2–7.9
College graduate	30,013	5.4	5.1–5.8	6.0	2.4–9.7	5.2	1.8–8.5
BMI, kg/m ²							
BMI <25	31,099	4.3	4.0–4.6	4.5	1.9–7.1	2.6	0.4–4.7
BMI 25 to <30	24,911	8.9	8.3–9.4	3.2 ^a	0.6–5.8	6.4	3.3–9.4
BMI 30 or higher	24,024	19.9	19.0–20.7	16.5	9.0–24.0	10.8 ^a	6.7–15.0
Exercise past 30 days							
Yes	63,490	7.9	7.5–8.2	7.1	3.5–10.7	4.6 ^a	3.0–6.2
No	22,350	17.0	16.1–17.8	14.3	6.3–22.4	10.0	5.0–15.0
Heavy drinker							
Yes	80,548	10.6	10.2–10.9	8.9	5.2–12.5	6.3 ^a	4.4–8.2
No	4227	3.3	2.3–4.2	3.6	–0.8 to 8.0	2.1	–0.8 to 5.0
Smoking status							
Current smoker	12,855	10.3	9.4–11.2	6.7	2.3–11.1	6.4	3.0–9.9
Former smoker	22,404	13.0	12.2–13.8	12.3	3.6–21	9.2	2.3–13.6
Lifetime nonsmoker	50,680	9.1	8.7–9.6	7.7	3.1–12.4	4.0 ^a	2.1–5.9
Health status							
Excellent to good	70,005	7.9	7.6–8.2	8.1	6.0–10.3	6.4	4.4–8.5
Poor or fair	15,674	27.5	26.3–28.7	28.7	17.2–40.1	13.2 ^a	8.3–18.1
Household income							
<\$10,000	3769	18.5	16.1–20.8	7.1	–5.4 to 19.7	9.1	1.7–16.5
\$10,000 to \$24,999	18,126	15.6	14.7–16.6	8.1 ^a	3.5–12.6	7.7 ^a	4.0–11.5
\$25,000 to \$34,999	8944	12.9	11.6–14.1	15.4	–1.8 to 32.7	4.3 ^a	1.5–7.1
\$35,000 to \$49,999	10,871	9.4	8.6–10.3	12.1	1.4–22.8	2.3 ^a	0.2–4.3
\$50,000 to \$74,999	11,599	7.0	7.2–8.7	8.0	0–16.1	5.0	1–9.1
\$75,000 or greater	20,068	4.3	3.8–4.7	6.2	0.5–11.9	5.1	1.2–9.1

The prevalence of diabetes overall (top row) or by select bivariate characteristics is presented for women. Results were stratified by sexual orientation. All data were weighted according to CDC instructions to adjust for the complex survey design of the BRFSS.

^aIndicates nonoverlapping 95% CIs of lesbian and/or bisexual women compared with heterosexual women.

sexual behavior or sexual attraction. Thus, our study does not consider individuals who are sexually active with or attracted to people of the same gender but who do not identify as LGB. BRFSS also does not measure variables that could contribute to the higher diabetes prevalence observed, in particular, for sexual minority men, such as the use of HIV antiretroviral medications, nor does the BRFSS include objective measures of diabetes (e.g., study-assessed biometrics such as blood glucose levels or glycated hemoglobin tests for HbA1c levels) and diabetes risk factors (e.g., study-assessed body weight and waist measurements). Finally, the BRFSS is a

cross-sectional survey and cannot definitively establish the causal directions of the observed associations between sexual orientation and diabetes, as cross-sectional studies are prone to omitted variable bias. Missing and unmeasured variables—such as structural stigma and dysregulation of the HPA axis due to minority stress and depression⁴⁸—may provide alternative explanations for the relationship between sexual orientation and health outcomes.⁴⁹

Notwithstanding these limitations, we use data from a large population-based survey to analyze the prevalence of diabetes and diabetes risk factors by sexual orientation—

TABLE 4. ADJUSTED ODDS RATIOS OF DIABETES PREVALENCE BY SEX AND SEXUAL ORIENTATION IN THE 2014 BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM

<i>Model</i>	<i>Comparator groups</i>	<i>Men AOR</i>	<i>Men 95% CI</i>	<i>Women AOR</i>	<i>Women 95% CI</i>	<i>Variables in model</i>
1	Gay/lesbian	1.07	0.81–1.41	0.82	0.54–1.25	Sexual orientation
	Bisexual	1.37	0.94–2.00	0.53 ^a	0.39–0.72	
2	Gay/lesbian	1.45 ^a	1.09–1.94	1.18	0.76–1.84	Model 1+age
	Bisexual	1.72 ^a	1.17–2.54	1.13	0.82–1.56	
3	Gay/lesbian	1.72 ^a	1.29–2.31	1.11	0.72–1.72	Model 2+race/ethnicity, BMI
	Bisexual	1.69 ^a	1.12–2.56	0.93	0.66–1.33	
4	Gay/lesbian	1.65 ^a	1.22–2.23	1.08	0.70–1.69	Model 3+relationship status
	Bisexual	1.63 ^a	1.07–2.47	0.92	0.65–1.30	
5	Gay/lesbian	1.64 ^a	1.21–2.21	1.11	0.71–1.75	Model 4+health behaviors—exercise, smoking, alcohol use
	Bisexual	1.62 ^a	1.06–2.49	0.97	0.69–1.37	
6	Gay/lesbian	1.66 ^a	1.22–2.25	1.21	0.76–1.92	Model 5+socioeconomic status—income, education, employment
	Bisexual	1.58 ^a	1.02–2.42	0.90	0.63–1.27	
7	Gay/lesbian	1.50 ^a	1.09–2.07	1.22	0.76–1.95	Model 6+healthcare access—health insurance, usual source of care, unmet care need because of cost, routine checkup in past 12 months
	Bisexual	1.55 ^a	1.00–2.07	0.88	0.62–1.26	

AORs stratified by sex and sexual orientation were calculated using binomial logistic regression; heterosexuals are the reference group. Each consecutively numbered model retains the variables from the previous model and adds the additional variables listed in the far right hand column. All model variables were analyzed according to the variable categories presented in Table 1.

^aIndicates nonoverlapping 95% CIs. All data were weighted according to CDC instructions to adjust for the complex survey design of the BRFSS.

AORs, adjusted odds ratios.

making this one of the first studies to focus in depth on diabetes among sexual minorities. We found that both gay and bisexual men were more likely to be living with diabetes than heterosexual men. Our results serve as a reminder that not only are LGB adults more likely to have mental health conditions and substance use disorders, but increasingly, LGB adults have been shown to have higher prevalence of physical health chronic conditions, such as diabetes. Healthcare providers should consider the higher burden of mental health conditions, substance use, and stress levels among sexual minorities and be mindful of how these factors, including any medications used to address them, may contribute to the physical health disparities increasingly described among sexual minority populations, including diabetes,^{23,38} cardiovascular disease,^{38,50} and cerebrovascular disease.⁵¹ Healthcare providers should also continue their efforts to build welcoming and safe clinical environments for their sexual minority patients. Building trust between providers and sexual minority patients will help facilitate discussions on recommended screenings and best practices for reducing risk factors for diabetes. Meanwhile, future studies should investigate whether the development of enhanced screening guidelines for physical health conditions, such as diabetes, among sexual minority populations, is warranted.

Conclusion

Future research should continue to explore the underlying causes and consequences of LGB health disparities, including diabetes disparities, and monitor these over time. Meanwhile, researchers and clinicians should identify best

practices for treating and managing diabetes among LGB patients, as such approaches may be helpful toward achieving health equity for LGB people.

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