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Disparities in chronic physical health conditions in sexual and gender minority people using the United States Behavioral Risk Factor Surveillance System

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ABSTRACT

This study analyzed the physical health status of adults who belong to a sexual or gender minority (SGM) population, and whether health inequities correlate with access to quality healthcare. The Centers for Disease Control and Prevention (CDC) 2014–2020 Behavioral Risk Factor Surveillance System (BRFSS) included data for 64,696 adults who identified as gay, lesbian, bisexual, other, and/or transgender and 1,369,681 adults who identified as cisgender and straight. Multivariable logistic regressions of the weighted sample were conducted to examine associations between demographics and health and access outcomes. After accounting for demographic variables, drinking, and smoking behavior, SGM respondents reported poorer physical and mental health, which worsened after the start of the COVID-19 pandemic. SGM respondents had higher odds than non-SGM of having asthma, arthritis, diabetes, kidney disease, hypertension, cardiovascular disease, heart attack, stroke, and chronic obstructive pulmonary disease (COPD), as well as difficulties "see[ing] the doctor because of cost," particularly after the start of the COVID pandemic. SGM respondents had higher odds of lack of access to healthcare provider, delayed medical care, and issues taking medications due to cost and fewer routine checkups. Thus, the SGM group faced worse health and higher rates of some chronic conditions. This study found a significant relationship with cost barriers attributable to larger societal discrimination regarding SGM individuals, particularly in the workplace. Further research exploring these results is critical, but these findings have identified areas of healthcare inequity to be addressed via preventative health efforts in both public health and primary care settings.

1. Introduction

Sexual and gender minority (SGM) populations include diverse people "whose sexual orientation, gender identity or expression, or reproductive development is characterized by non-binary constructs of sexual orientation, gender, and/or sex" (National Institutes of Health: Sexual and Gender Minority Research Office., 2021), such as lesbian, gay, bisexual, transgender, and gender non-conforming individuals. Numerous studies have found that individuals who report being part of the SGM population are more likely to report worse mental and sexual health and higher levels of substance use (Hoffman et al., 2018; Streed et al., 2018; Denson et al., 2017; Gonzales and Henning-Smith, 2017). Research has shown that SGM individuals, who commonly face systemic discrimination, have lower access to healthcare than heterosexual, cisgender individuals living in the United States (Gonzales and Henning-Smith, 2017; Institute of Medicine (US) Committee on Lesbian, Gay, Bisexual, and Transgender Health Issues and Research Gaps and Opportunities, 2011). Transgender and gender nonconforming adults are more likely to be uninsured with no consistent source of care and face more cost-related barriers than cisgender women (Gonzales and Henning-Smith, 2017). However, there is less information on chronic physical health conditions affecting individuals that are SGM.

Previous studies have demonstrated that SGM individuals in the United States experience different levels of health access and outcomes in certain measures. Women identifying as gay, lesbian, or bisexual are more likely to experience adverse health outcomes and healthcare access issues, with disparities varying by racial and ethnic identification (Trinh et al., 2017). Lesbian and bisexual women consistently report

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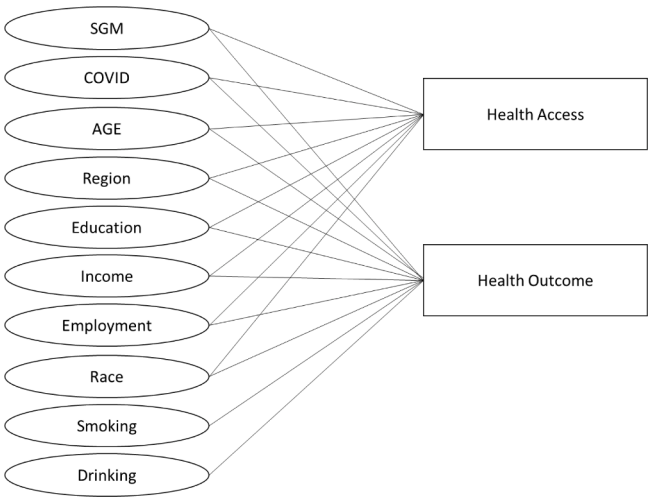

Fig. 1. The directed acyclic graph for models proposed.

greater activity restrictions, arthritis, asthma, and chronic obstructive pulmonary disease (COPD) than straight women, as well as higher rates of obesity, smoking, and binge drinking (Gonzales and Henning-Smith, 2017). These analyses did not include transgender individuals. Other studies focused on transgender individuals using data from the Behavioral Risk Factor Surveillance System (BRFSS) survey created by the Centers for Disease Control and Prevention (CDC), which includes an optional module for Sexual Orientation and Gender Identity (SOGI) that some states use. According to this data, transgender men more often faced myocardial infarction than cisgender individuals, and transgender women compared to cisgender women (Alzahrani et al., 2019). Transgender adults were found more likely to have disabilities and poor mental health (Downing and Przedworski, 2018). Gender nonconforming adults, excluding sexual minorities, had higher odds of multiple chronic conditions, poorer quality of life, and disabilities than cisgender individuals (Downing and Przedworski, 2018).

Proposed explanations for these disparities lie in social determinants of health: social stressors, health disparities, socioeconomic marginalization, stigma, and minority stress (Alzahrani et al., 2019; Downing and Przedworski, 2018; Al Rifai et al., 2020; Fredriksen-Goldsen et al., 2013). Few studies additionally considered health access (for an exception, see Trinh et al., 2017). One study analyzed six health access variables for respondents identifying as transgender; all subgroups of transgender respondents had higher odds of reporting delaying accessing medical care because of cost when compared to cisgender males. Only some groups had higher odds of having no dental visit in the past year and of having no primary care provider. Overall, the study found few differences in preventive care utilization between transgender and cisgender respondents (Downing and Przedworski, 2018).

Since 2014, the CDC's BRFSS survey has included the SOGI module that can provide insight into discrimination in the healthcare system and its consequences. With the use of cross-sectional analysis, this study aimed to analyze the chronic physical health status of adults aged 18 or older in the United States that are SGM and evaluate whether any disparities identified were associated with access to quality healthcare (Fig. 1). Current literature on chronic physical health conditions among SGM people provides some insight and has limitations. Some research looks at health outcomes and factors often considered "risks," especially for chronic diseases, such as smoking, drinking, obesity, activity, and sleep; this analysis does not specifically address how SGM individuals are affected by chronic diseases (Gonzales and Henning-Smith, 2017). One study, using data from a 2014–2015 BRFSS survey, found that various subgroups of respondents who identified as lesbian, gay, or bisexual (LGB) had higher odds of having cancer, arthritis, asthma, and COPD, and self-reported "poor health days" as well as higher odds of smoking, drinking, and obesity (Gonzales and Henning-Smith, 2017). While this study covers some of the same variables in our current study, it does not address transgender and gender nonconforming individuals.

Our study categorizes SOGI responses into a single binary variable, SGM. As recent research demonstrates (Parkinson et al., 2021), access barriers and discrimination impacting SGM intersect with gender discrimination broadly. Although different gender and sexual minority groups have unique challenges and needs, SGM individuals face universal discrimination and barriers to care. While much of the prior research cited above has studied sexual minority and gender minority people separately, sometimes excluding some groups, other studies demonstrate the utility of a binary variable like SGM. This binary method has been utilized in previous studies to examine how general victimization and minority stressors contribute to overall substance use (Phillips, et al., 2020; Dyar et al., 2019). Furthermore, the Kaiser Family Foundation (KFF) Survey on LGBT+ communities used this approach to analyze differences between LGBT+ and non-LGBT+ people with respect to healthcare experiences, including negative provider experiences, medical bill burden, and COVID-era challenges. KFF justified this single variable given LGBT+ people's common experiences with stigma, discrimination, and violence in a range of environments (Dawson and Frederiksen, 2021). We hope to expand this research in two ways, focusing specifically on the chronic health conditions, as well as comparing health outcomes between pre-COVID-19 and post-COVID-19 conditions, all in hopes to provide better policy, equity, and access to the LGBTQ+ population.

This study addresses three different outcome variables: chronic health conditions, access to healthcare, and substance use. We focused on the top chronic health conditions in the United States (U.S.) that were also assessed in the BRFSS survey results: hypertension, heart attack, angina and/or coronary heart disease, stroke, asthma (past and current), COPD, arthritis, diabetes, and pre-diabetes (Boersma et al., 2020). Access to healthcare includes survey items regarding insurance, availability of providers, healthcare costs, and similar. Finally, substance use is used as a risk factor to account for differences in health outcomes, rather than as an outcome measure itself, as previous studies have done. While tobacco use can account for differences in conditions like COPD, this study hypothesizes that SGM populations would be at greater risk for chronic health conditions even while controlling for substance use.

Lastly, this study addresses the possible interaction of the COVID-19 pandemic on health access and outcomes for SGM individuals. During the COVID-19 pandemic, many LGBTQ+ youths faced various mental health issues, such as psychological distress and depression, due to isolation and confinment in locations where they felt unsafe (Gonzales et al., 2020). Additionally, as a consequence of the COVID-19 recession, there is increased workforce discrimination against SGM individuals (Mattei et al., 2021). This discrimination leads to a more significant social environment impact, impacting individuals' physical and mental health by denying them access to resources, dignity, and high quality of life.

2. Methods

2.1. Data

The data used for this study are from the 2014–2020 CDC BRFSS surveys, cross-sectional telephone surveys conducted by state health departments using instruments provided by the CDC. Respondents were individuals in the U.S. who were asked about their chronic health conditions, socioeconomic status, and various risk factors. Data for this study are limited to publicly available, de-identified BRFSS information and therefore did not require institutional review board review.

This study analyzed three categories of variables: demographics, health variables, and access variables. The primary demographic of interest is sexual and gender minority (SGM) responses. This variable, labeled SGM, was created by coding the BRFSS SOGI questions into a

single binary variable. Responses to "Which of the following best represents how you think of yourself" were coded as binary (1 if "gay," "lesbian or gay," "bisexual," "other," or "something else"; 0 if "straight," "straight, that is, not gay," "don't know/not sure", "I don't know the answer," or "refused").[1] Responses to "Do you consider yourself to be transgender" were also coded into a binary (1 for all "yes" responses; 0 for "no," "don't know/not sure," or "refused"). The two binary variables were then combined with an if-statement. If either one of the responses were 1, SGM was coded as 1 for being in the SGM group. If neither variable was 1, then SGM was coded as 0. There are 64,696 individuals in SGM group and 1,369,682 in non-SGM group during 2014–2020.

Other demographic variables of interest included imputed age in six groups, state Federal Information Processing System (FIPS) code, level of education completed categories, income categories, employment status, and five-level race/ethnicity categories. We included two substance-use variables: smoking (currently smokes every day, currently smokes some days, formerly smoked, or never smoked) and binge drinking (one or more in the past 30 days or none of the past 30 days). Smoking and drinking were included because these factors may impact the investigated health outcomes.

Health variables included poor physical or mental health, as well as if the participant was ever told their blood pressure was high, ever diagnosed with angina or coronary heart disease, ever diagnosed with asthma, if they still have asthma, if they were ever told they have arthritis, and if they have ever had diabetes, pre-diabetes or borderline diabetes. Additional variables include participants' self-reported general health, number of days where their physical health was not good, number of days where their mental health was not good, if they were ever diagnosed with heart attack, stroke, chronic obstructive pulmonary disease, emphysema or chronic bronchitis, or kidney disease.

Access variables included "have any health care coverage", "could not see doctor because of cost", "delayed getting medical care", "could not get medicine due to cost", "multiple health care professionals", "length of time since last routine checkup", "satisfied with care received", and doctor visits past 12 months ("last visited a doctor for routine checkup").

To study whether the associations between SGM and health access/outcomes change during the COVID-19 pandemic, we created a variable "COVID" defined as "Yes" for data from 2020 and "No" for 2014 to 2019. While the information for most variables is available during 2014–2020, some variables are not, such as delayed medical care (2015, 2019, 2020), lack of medication (2015, 2019, 2020), hypertension (2014, 2016, 2018, 2020), satisfied with care received (2015, 2019, 2020), doctor visit past 12 months (2015, 2019, 2020). Therefore, the interaction effect between COVID and those variables is not available.

The response of don't know/not sure, not applicable, and refused were coded as missing. The variables evaluating poor health, physical health condition, number of doctor visits, mental health and healthcare provider were dichotomized coding the response of any number of days/times/providers as 1 and a response of none as 0. The variables of delayed medical care, satisfaction with care received, hypertension, diabetes and prediabetes status were also dichotomized, coding the response with the trait as 1 and without the trait as 0. The variable of general health was dichotomized coding the response of excellent/very good/good as 1 and fair/poor as 0. The variable of length of time since last routine checkup was dichotomized coding the response of <5 years as 1 and more than 5 years/Never as 0. Gestational conditions were

[1] We have included "other" and "something else" in the SGM group, following researchers, e.g. (Boersma et al., 2020), who interpret the response "Other" to mean "Another Sexual Orientation." We recognize that respondents may interpret these response options in a variety of ways, and have chosen to include them so as not to exclude respondents who select it because they "are not straight but use another label" (Gonzales et al., 2020).

Table 1
Description of individuals in each of the two group (SGM versus non-SGM) strata. Data are presented as weighted percentage for categorical variables while the sample size listed for SGM and Non-SGM are unweighted. The p-values are based on Rao-Scott Chi-square tests.

	SGM (n = 64,696)	Non-SGM (n = 1,369,681)	Test (p-value)
Age			Rao-Scott = 5,550 (<0.0001)*
18–24	26.9%	10.8%	
25–34	23.6%	15.3%	
35–44	14.5%	16.2%	
45–54	12.7%	17.3%	
55–64	11.3%	17.9%	
65+	11.0%	22.5%	
Region			Rao-Scott = 35 (<0.0001)*
West	17.7%	17.6%	
Midwest	23.0%	24.3%	
Southwest	12.5%	12.1%	
Southeast	23.1%	21.3%	
Northeast	23.7%	24.8%	
Education			Rao-Scott = 86 (<0.0001)*
Not High School Grad	15.2%	13.5%	
Graduated High School	27.5%	28.5%	
Attended College/Tech	32.7%	30.8%	
College/Tech Grad	24.6%	27.3%	
Income			Rao-Scott = 749 (<0.0001)*
<15,000	14.3%	9.9%	
15,000 to <25,000	21.4%	15.9%	
25,000 to <35,000	11.3%	10.1%	
35,000 to <50,000	12.9%	13.3%	
50,000+	40.1%	50.9%	
Employment			Rao-Scott = 2,087 (<0.0001)*
Employed for wages	48.2%	47.5%	
Self-employed	8.5%	9.0%	
Out of work for 1 yr+	3.7%	2.5%	
Out of work for < 1 yr	5.3%	3.2%	
Homemaker	4.5%	6.1%	
Student	11.1%	4.9%	
Retired	10.2%	20.0%	
Unable to work	8.6%	6.9%	
Race			Rao-Scott = 286 (<0.0001)*
White	58.3%	64.2%	
Black	12.5%	11.9%	
Other Race	7.4%	6.7%	
Multiracial	2.5%	1.3%	
Hispanic	19.3%	15.9%	
Smoking Status (%)			Rao-Scott = 527 (<0.0001)*
Current Smoker			
-Smokes everyday	14.9%	10.7%	
-Smokes some days	6.9%	4.7%	
Former smoker	20.5%	24.9%	
Never smoked	57.7%	59.7%	
Binge Drinking (Yes)	39.7%	30.2%	Rao-Scott = 359 (<0.0001)*

Note: *: significant at level of 0.05.
Acronyms & Abbreviations:
COPD = chronic obstructive pulmonary disease.
SGM = sexual and gender minority respondents.
Non-GSM = individuals other than sexual or gender minority respondents.

Table 2
Logistic regression models estimates based on weighted/adjusted, Unweighted/adjusted and weighted/unadjusted for health access variables with Bonferroni adjustment. Odds ratio with 95% confidence interval are listed.

	HLTHPLN	PERSDOC	CHECKUP	MEDCOST	DELAYMED	MEDSCOS	CARERCVD	DRVISITS
SGM (Ref = Yes)	¥1.02 (0.95, 1.08)	¥0.95 (0.91, 1.00)*	¥0.88 (0.82, 0.95)*	¥0.71 (0.67, 0.75)* when COVID = No				
¥0.58 (0.51, 0.66)* when COVID = Yes	¥0.74 (0.65, 0.85)*	¥0.85 (0.73, 1.00)*	¥1.13 (0.90, 1.43)	¥0.85 (0.72, 1.00)				
	ϕ1.07 (1.03, 1.11)* when COVID = No							
ϕ0.94 (0.88, 1.01) when COVID = Yes	ϕ0.91 (0.87, 0.94)* when COVID = No							
ϕ0.85 (0.79, 0.91)* when COVID = Yes	ϕ0.91 (0.88, 0.95)*	ϕ0.74 (0.72, 0.76)* when COVID = No						
ϕ0.63 (0.59, 0.67)* when COVID = Yes	ϕ0.75 (0.70, 0.81)*	ϕ0.84 (0.77, 0.91)*	ϕ1.23 (1.08, 1.39)*	ϕ0.87 (0.79, 0.95)*				
	ψ1.40 (1.32, 1.48)*	ψ1.39 (1.33, 1.45)*	ψ1.04 (0.97, 1.12)	ψ0.55 (0.53, 0.58)*	ψ0.59 (0.52, 0.67)*	ψ0.69 (0.60, 0.80)*	ψ0.82 (0.75, 0.91)*	ψ0.97 (0.83, 1.13)
COVID (Ref = Yes)	¥1.08 (1.03, 1.13)*	¥1.05 (1.02, 1.09)*	¥0.72 (0.68, 0.75)*	¥1.31 (1.25, 1.36)* when SGM = No				
¥1.06 (0.93, 1.21) when SGM = Yes								
	ϕ1.08 (1.06, 1.11)* when SGM = No							
ϕ0.95 (0.88, 1.03) when SGM = Yes	ϕ1.11 (1.09, 1.13)* when SGM = No							
ϕ1.04 (0.97, 1.12) when SGM = Yes	ϕ0.77 (0.75, 0.79)*	ϕ1.23 (1.21, 1.25)* when SGM = No						
ϕ1.05 (0.99, 1.12) when SGM = Yes								
	ψ1.05 (1.01, 1.10)*	ψ1.07 (1.04, 1.10)*	ψ0.72 (0.69, 0.76)*	ψ1.30 (1.25, 1.35)*				
Age (Ref = 25–34)								
35–44	¥1.21 (1.14, 1.29)*	¥1.68 (1.61, 1.75)*	¥1.23 (1.15, 1.31)*	¥0.94 (0.89, 0.99)*	¥0.93 (0.82, 1.05)	¥1.14 (0.96, 1.34)	¥1.16 (0.94, 1.44)	¥1.05 (0.92, 1.20)
	ϕ1.17 (1.13, 1.21)*	ϕ1.72 (1.67, 1.78)*	ϕ1.24 (1.20, 1.28)*	ϕ0.93 (0.90, 0.95)*	ϕ1.00 (0.92, 1.07)	ϕ1.19 (1.08, 1.30)*	ϕ1.01 (0.89, 1.15)	ϕ1.10 (1.02, 1.19)*
45–54	¥1.52 (1.43, 1.63)*	¥2.68 (2.55, 2.80)*	¥1.85 (1.73, 1.97)*	¥0.87 (0.83, 0.92)*	¥0.81 (0.72, 0.92)*	¥1.08 (0.93, 1.26)	¥1.27 (1.03, 1.57)*	¥1.37 (1.20, 1.56)*
	ϕ1.43 (1.38, 1.48)*	ϕ2.76 (2.68, 2.85)*	ϕ1.76 (1.70, 1.82)*	ϕ0.85 (0.82, 0.87)*	ϕ0.85 (0.79, 0.91)*	ϕ1.10 (1.00, 1.20)*	ϕ1.16 (1.02, 1.32)*	ϕ1.33 (1.24, 1.43)*
55–64	¥2.09 (1.95, 2.23)*	¥4.02 (3.82, 4.23)*	¥2.47 (2.30, 2.64)*	¥0.66 (0.62, 0.70)*	¥0.66 (0.58, 0.76)*	¥0.93 (0.79, 1.08)	¥1.35 (1.08, 1.68)*	¥1.87 (1.63, 2.13)*
	ϕ1.92 (1.86, 1.98)*	ϕ4.03 (3.89, 4.16)*	ϕ2.27 (2.19, 2.35)*	ϕ0.64 (0.62, 0.66)*	ϕ0.65 (0.61, 0.70)*	ϕ0.88 (0.80, 0.96)*	ϕ1.44 (1.27, 1.64)*	ϕ1.78 (1.65, 1.92)*
65+	¥10.57 (9.36, 11.93)*	¥7.83 (7.28, 8.43)*	¥5.03 (4.57, 5.54)*	¥0.30 (0.27, 0.32)*	¥0.45 (0.38, 0.52)*	¥0.53 (0.43, 0.64)*	¥3.73 (2.80, 4.96)*	¥4.19 (3.49, 5.03)*
	ϕ10.51 (9.99, 11.07)*	ϕ7.21 (6.88, 7.56)*	ϕ4.46 (4.26, 4.66)*	ϕ0.28 (0.27, 0.29)*	ϕ0.46 (0.42, 0.50)*	ϕ0.49 (0.44, 0.54)*	ϕ3.27 (2.77, 3.87)*	ϕ3.69 (3.34, 4.07)*
18–24	¥1.26 (1.17, 1.37)*	¥1.06 (1.00, 1.12)	¥1.70 (1.54, 1.87)*	¥0.74 (0.68, 0.80)*	¥1.05 (0.88, 1.24)	¥0.65 (0.52, 0.83)*	¥1.72 (1.27, 2.34)*	¥1.29 (1.07, 1.56)*
	ϕ1.28 (1.23, 1.34)*	ϕ1.02 (0.98, 1.06)	ϕ1.79 (1.70, 1.89)*	ϕ0.70 (0.67, 0.73)*	ϕ0.98 (0.88, 1.08)	ϕ0.59 (0.51, 0.69)*	ϕ1.72 (1.41, 2.10)*	ϕ1.26 (1.13, 1.40)*
Region (Ref = Northeast)								
Southeast	¥1.76 (1.66, 1.86)*	¥1.67 (1.60, 1.73)*	¥1.42 (1.34, 1.51)*	¥0.71 (0.68, 0.75)*	¥1.19 (1.09, 1.30)*	¥0.93 (0.83, 1.04)	¥1.03 (0.88, 1.22)	¥1.12 (1.00, 1.24)*
	ϕ1.70 (1.65, 1.75)*	ϕ1.57 (1.52, 1.62)*	ϕ1.35 (1.31, 1.40)	ϕ0.70 (0.69, 0.72)*	ϕ1.01 (0.95, 1.06)	ϕ0.79 (0.73, 0.84)*	ϕ1.16 (1.05, 1.29)*	ϕ1.00 (0.94, 1.07)
Southwest	¥0.72 (0.67, 0.78)*	¥0.82 (0.77, 0.87)*	¥0.72 (0.66, 0.78)*	¥1.12 (1.04, 1.19)*				
	ϕ0.78 (0.75, 0.81)*	ϕ0.81 (0.77, 0.84)*	ϕ0.74 (0.71, 0.78)*	ϕ1.11 (1.08, 1.15)*				
West	¥1.76 (1.65, 1.88)*	¥1.05 (1.00, 1.10)*	¥0.85 (0.80, 0.91)*	¥0.70 (0.66, 0.74)*	¥1.19 (1.05, 1.35)*	¥0.75 (0.63, 0.90)*	¥0.95 (0.74, 1.51)	¥0.67 (0.59, 0.77)*
	ϕ1.25 (1.21, 1.29)*	ϕ0.82 (0.79, 0.84)*	ϕ0.70 (0.68, 0.72)*	ϕ0.82 (0.80, 0.84)*	ϕ1.04 (0.98, 1.12)	ϕ0.66 (0.60, 0.73)*	ϕ1.00 (0.89, 1.13)	ϕ0.64 (0.60, 0.69)*
Midwest	¥1.48 (1.41, 1.55)*	¥1.25 (1.21, 1.29)*	¥0.94 (0.89, 0.98)*	¥0.74 (0.71, 0.77)*	¥0.90 (0.83, 0.97)*	¥0.79 (0.72, 0.87)*	¥1.31 (1.13, 1.51)*	¥0.88 (0.81, 0.96)*
	ϕ1.33 (1.29, 1.36)*	ϕ1.06 (1.03, 1.09)*	ϕ0.88 (0.86, 0.91)*	ϕ0.76 (0.74, 0.78)*	ϕ0.79 (0.76, 0.83)*	ϕ0.68 (0.64, 0.72)*	ϕ1.32 (1.21, 1.44)*	ϕ0.82 (0.78, 0.86)*
Education (ref = Not High School Grad)								
Graduated High School	¥1.76 (1.66, 1.87)*	¥1.45 (1.37, 1.53)*		¥0.77 (0.73, 0.82)*				

(*continued on next page*)

Table 2 (*continued*)

	HLTHPLN	PERSDOC	CHECKUP	MEDCOST	DELAYMED	MEDSCOS	CARERCVD	DRVISITS
			¥1.43 (1.33, 1.53)*		¥0.80 (0.71, 0.91)*	¥0.87 (0.75, 1.01)	¥1.29 (1.03, 1.60)*	¥1.46 (1.27, 1.68)*
	ϕ1.74 (1.69, 1.79)*	ϕ1.50 (1.43, 1.56)*	ϕ1.37 (1.32, 1.42)*	ϕ0.79 (0.76, 0.81)*	ϕ0.89 (0.83, 0.96)*	ϕ0.89 (0.83, 0.97)*	ϕ1.14 (1.02, 1.29)*	ϕ1.43 (1.32, 1.54)*
Graduated College/ Tech	¥4.16 (3.87, 4.46)*	¥2.14 (2.03, 2.26)*	¥2.39 (2.22, 2.58)*	¥0.62 (0.59, 0.66)*	¥0.95 (0.82, 1.08)	¥0.77 (0.66, 0.92)*	¥2.13 (1.64, 2.75)*	¥2.33 (2.00, 2.72)*
	ϕ3.81 (3.68, 3.95)*	ϕ2.07 (1.98, 2.17)*	ϕ2.06 (1.98, 2.14)*	ϕ0.67 (0.65, 0.69)*	ϕ0.98 (0.92, 1.06)	ϕ0.86 (0.78, 0.94)*	ϕ1.68 (1.47, 1.92)*	ϕ2.16 (1.98, 2.35)*
Attended College/Tech	¥2.42 (2.27, 2.58)*	¥1.84 (1.75, 1.95)*	¥1.80 (1.67, 1.94)*	¥0.87 (0.82, 0.93)*	¥0.97 (0.85, 1.10)	¥1.10 (0.95, 1.29)	¥1.36 (1.08, 1.72)*	¥1.89 (1.64, 2.19)*
	ϕ2.32 (2.25, 2.39)*	ϕ1.80 (1.72, 1.88)*	ϕ1.67 (1.61, 1.74)*	ϕ0.89 (0.86, 0.91)*	ϕ1.05 (0.98, 1.13)	ϕ1.11 (1.03, 1.21)*	ϕ1.15 (1.02, 1.30)*	ϕ1.81 (1.67, 1.97)*
Income (ref = 25,000 to <35,000)								
35,000 to <50,000	¥1.33 (1.24, 1.43)*	¥1.17 (1.11, 1.24)*	¥1.11 (1.02, 1.20)*	¥0.80 (0.75, 0.85)*	¥0.80 (0.69, 0.93)*	¥0.71 (0.60, 0.85)*	¥1.28 (0.97, 1.69)	¥1.17 (1.00, 1.37)
	ϕ1.34 (1.30, 1.39)*	ϕ1.15 (1.11, 1.20)*	ϕ1.13 (1.09, 1.18)*	ϕ0.76 (0.74, 0.79)*	ϕ0.85 (0.79, 0.92)*	ϕ0.72 (0.66, 0.78)*	ϕ1.24 (1.07, 1.42)*	ϕ1.13 (1.04, 1.23)*
50000+	¥3.16 (2.95, 3.40)*	¥1.69 (1.60, 1.78)*	¥1.65 (1.54, 1.78)*	¥0.35 (0.33, 0.38)*	¥0.62 (0.55, 0.71)*	¥0.36 (0.31, 0.43)*	¥2.04 (1.61, 2.57)*	¥1.56 (1.36, 1.79)*
	ϕ3.27 (3.16, 3.38)*	ϕ1.60 (1.55, 1.66)*	ϕ1.71 (1.66, 1.77)*	ϕ0.33 (0.32, 0.34)*	ϕ0.67 (0.62, 0.71)*	ϕ0.33 (0.31, 0.36)*	ϕ2.09 (1.84, 2.37)*	ϕ1.42 (1.32, 1.53)*
<15,000	¥0.78 (0.72, 0.85)*	¥0.82 (0.77, 0.88)*	¥0.89 (0.81, 0.98)*	¥1.34 (1.26, 1.44)*	¥1.55 (1.33, 1.80)*	¥1.21 (1.02, 1.45)*	¥0.81 (0.62, 1.06)	¥1.03 (0.86, 1.23)
	ϕ0.75 (0.72, 0.78)*	ϕ0.79 (0.75, 0.82)*	ϕ0.82 (0.78, 0.85)*	ϕ1.36 (1.32, 1.41)*	ϕ1.74 (1.62, 1.88)*	ϕ1.28 (1.18, 1.40)*	ϕ0.68 (0.60, 0.78)*	ϕ0.83 (0.76, 0.91)*
15,000 to <25,000	¥0.78 (0.73, 0.84)*	¥0.89 (0.84, 0.94)*	¥0.97 (0.90, 1.05)	¥1.26 (1.19, 1.34)*	¥1.23 (1.07, 1.40)*	¥1.21 (1.03, 1.42)*	¥0.88 (0.70, 1.11)	¥1.04 (0.89, 1.21)
	ϕ0.78 (0.75, 0.80)*	ϕ0.86 (0.83, 0.89)*	ϕ0.95 (0.91, 0.98)	ϕ1.31 (1.28, 1.35)*	ϕ1.34 (1.25, 1.43)*	ϕ1.33 (1.23, 1.44)*	ϕ0.77 (0.68, 0.87)*	ϕ0.94 (0.86, 1.01)
Employment (ref = A homemaker)								
A student	¥1.69 (1.46, 1.96)*	¥0.92 (0.82, 1.03)	¥1.41 (1.16, 1.70)*	¥0.68 (0.59, 0.78)*	¥0.92 (0.69, 1.22)	¥0.83 (0.56, 1.24)	¥1.23 (0.64, 2.37)	¥1.15 (0.82, 1.63)
	ϕ1.58 (1.47, 1.70)*	ϕ0.89 (0.82, 0.97)*	ϕ1.34 (1.22, 1.47)*	ϕ0.80 (0.74, 0.85)*	ϕ0.85 (0.73, 1.00)	ϕ0.97 (0.78, 1.21)	ϕ1.05 (0.75, 1.47)	ϕ1.18 (0.98, 1.43)
Employed for wages	¥1.31 (1.20, 1.43)*	¥0.68 (0.63, 0.74)*	¥0.68 (0.61, 0.76)*	¥0.95 (0.88, 1.04)	¥0.86 (0.73, 1.02)	¥0.99 (0.81, 1.22)	¥0.85 (0.60, 1.20)	¥0.71 (0.58, 0.86)*
	ϕ1.30 (1.25, 1.36)*	ϕ0.69 (0.65, 0.74)*	ϕ0.76 (0.72, 0.79)*	ϕ1.08, 1.151.01 (0.97, 1.05)	ϕ0.83 (0.75, 0.91)*	ϕ0.99 (0.88, 1.12)	ϕ0.80 (0.66, 0.97)*	ϕ0.80 (0.72, 0.88)*
Out of work for 1 year or more	¥0.81 (0.71, 0.92)*	¥0.67 (0.59, 0.76)*	¥0.65 (0.55, 0.76)*	¥1.37 (1.21, 1.54)*	¥1.51 (1.17, 1.94)*	¥1.80 (1.35, 2.39)*	¥0.59 (0.38, 0.93)*	¥0.76 (0.56, 1.03)
	ϕ0.79 (0.74, 0.84)*	ϕ0.67 (0.61, 0.74)*	ϕ0.69 (0.64, 0.75)*	ϕ1.53 (1.44, 1.62)*	ϕ1.38 (1.20, 1.59)*	ϕ1.92 (1.63, 2.26)*	ϕ0.47 (0.37, 0.60)*	ϕ0.84 (0.71, 1.00)*
Out of work for <1 year	¥0.63 (0.56, 0.72)*	¥0.61 (0.54, 0.68)*	¥0.65 (0.56, 0.76)*	¥1.55 (1.38, 1.74)*	¥1.23 (0.94, 1.61)	¥2.03 (1.51, 2.73)*	¥0.58 (0.36, 0.94)*	¥0.77 (0.57, 1.05)
	ϕ0.53 (0.50, 0.56)*	ϕ0.57 (0.53, 0.62)*	ϕ0.70 (0.65, 0.76)*	ϕ1.74 (1.65, 1.84)*	ϕ1.14 (0.99, 1.33)	ϕ1.82 (1.53, 2.16)*	ϕ0.57 (0.43, 0.74)*	ϕ0.86 (0.73, 1.02)
Retired	¥1.87 (1.62, 2.16)*	¥1.16 (1.05, 1.28)	¥1.12 (0.97, 1.29)*	¥0.60 (0.55, 0.67)*	¥0.81 (0.66, 0.98)*	¥0.89 (0.69, 1.13)	¥1.02 (0.68, 1.53)	¥0.96 (0.75, 1.23)
	ϕ1.85 (1.74, 1.96)*	ϕ1.06 (0.99, 1.14)	ϕ1.24 (1.17, 1.32)*	ϕ0.66 (0.63, 0.69)*	ϕ0.84 (0.75, 0.93)*	ϕ0.88 (0.77, 1.01)	ϕ1.02 (0.82, 1.28)	ϕ1.17 (1.03, 1.33)*
Self-employed	¥0.49 (0.44, 0.54)*	¥0.50 (0.45, 0.54)*	¥0.41 (0.36, 0.46)*	¥1.20 (1.09, 1.32)*	¥0.84 (0.68, 1.04)	¥0.96 (0.74, 1.25)	¥0.45 (0.30, 0.66)*	¥0.44 (0.35, 0.56)*
	ϕ0.51 (0.48, 0.53)*	ϕ0.49 (0.46, 0.53)*	ϕ0.45 (0.42, 0.47)*	ϕ1.21 (1.16, 1.27)*	ϕ0.76 (0.68, 0.85)*	ϕ0.92 (0.79, 1.07)	ϕ0.50 (0.40, 0.61)*	ϕ0.49 (0.43, 0.55)*
Unable to work	¥2.87 (2.54, 3.23)*	¥1.88 (1.70, 2.09)	¥1.60 (1.37, 1.86)*	¥1.16 (1.05, 1.27)*	¥1.99 (1.64, 2.42)*	¥2.03 (1.61, 2.56)*	¥0.73 (0.50, 1.07)	¥2.84 (2.05, 3.94)*
	ϕ3.03 (2.86, 3.20)*	ϕ1.73 (1.59, 1.88)*	ϕ1.90 (1.77, 2.04)*	ϕ1.30 (1.24, 1.36)*	ϕ2.17 (1.95, 2.41)*	ϕ2.03 (1.78, 2.31)*	ϕ0.63 (0.51, 0.77)*	ϕ3.65 (3.08, 4.31)*
Race (ref = Black only, Non-Hispanic)								
Hispanic	¥0.52 (0.48, 0.56)*	¥0.64 (0.60, 0.68)*	¥0.60 (0.54, 0.67)*	¥1.15 (1.07, 1.23)*	¥1.18 (1.00, 1.40)*	¥1.21 (0.97, 1.50)	¥0.77 (0.58, 1.03)	¥0.64 (0.52, 0.78)*
	ϕ0.52 (0.50, 0.54)*	ϕ0.63 (0.60, 0.67)*	ϕ0.54 (0.51, 0.57)*	ϕ1.24 (1.19, 1.28)*	ϕ1.16 (1.03, 1.31)*	ϕ1.01 (0.91, 1.12)	ϕ0.83 (0.70, 0.99)*	ϕ0.56 (0.50, 0.63)*
Multiracial, Non-Hispanic	¥1.02 (0.90, 1.17)	¥0.87 (0.79, 0.96)*	¥0.38 (0.32, 0.44)*	¥1.29 (1.16, 1.44)*	¥1.07 (0.81, 1.42)	¥1.69 (1.23, 2.34)*	¥0.61 (0.38, 0.98)*	¥0.90 (0.61, 1.34)
	ϕ1.16 (1.08, 1.23)*	ϕ0.99 (0.93, 1.06)	ϕ0.39 (0.36, 0.42)*	ϕ1.14 (1.08, 1.20)*	ϕ1.53 (1.29, 1.80)*	ϕ1.17 (1.01, 1.36)*	ϕ0.61 (0.48, 0.78)*	ϕ0.85 (0.70, 1.03)
Other race only, Non-Hispanic	¥0.98 (0.88, 1.09)	¥0.85 (0.79, 0.92)*	¥0.52 (0.45, 0.59)*	¥1.02 (0.93, 1.11)	¥1.12 (0.89, 1.41)	¥1.05 (0.76, 1.43)	¥0.63 (0.43, 0.93)*	¥0.53 (0.43, 0.67)*
	ϕ1.00 (0.95, 1.05)	ϕ0.86 (0.81, 0.91)*	ϕ0.47 (0.44, 0.51)*	ϕ1.03 (0.99, 1.08)	ϕ1.03 (0.89, 1.19)	ϕ0.92 (0.82, 1.04)	ϕ0.49 (0.41, 0.59)*	ϕ0.59 (0.52, 0.67)*
White	¥1.10 (1.04, 1.17)*	¥0.91 (0.87, 0.96)*		¥0.98 (0.93, 1.04)				

(*continued on next page*)

Table 2 (*continued*)

	HLTHPLN	PERSDOC	CHECKUP	MEDCOST	DELAYMED	MEDSCOS	CARERCVD	DRVISITS
			¥0.37 (0.34, 0.41)*		¥0.80 (0.72, 0.88)*	¥1.08 (0.95, 1.22)	¥0.91 (0.76, 1.10)	¥0.84 (0.74, 0.96)*
	ϕ1.12 (1.08, 1.15)*	ϕ0.86 (0.83, 0.89)*	ϕ0.35 (0.34, 0.37)*	ϕ0.96 (0.93, 0.99)*	ϕ1.02 (0.95, 1.09)	ϕ1.00 (0.94, 1.06)	ϕ0.97 (0.87, 1.08)	ϕ0.79 (0.73, 0.85)*

Note: *: significant at level of 0.05; ¥:Weighted adjusted estimates; ϕ:Unweighted adjusted estimates; ψ:weighted unadjusted estimates.
Abbreviations: HLTHPLN(ref = No) = Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare, or Indian Health Service. PERSDOC2(ref = No) = Do you have one person you think of as your personal doctor or health care provider?;
CHECKUP1(ref = 5 + years ago/Never) = About how long has it been since you last visited a doctor for a routine checkup?;
MEDCOST(ref = No) = Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?;
DELAYMED(ref = No) = Have you delayed getting needed medical care for any of the following reasons in the past 12 months?;
MEDSCOS(ref = No/No Medication prescribed) = Not including over-the-counter (OTC) medications, was there a time in the past 12 months when you did not take your medication as prescribed because of cost?;
CARERCVD(ref = Not at all satisfied) = In general, how satisfied are you with the health care you received?;
DRVISITS(ref = No) = How many times have you been to a doctor, nurse, or other health professional in the past 12 months?

coded as not having the condition, as the gestational conditions were transient changes that resolved to normal postpartum rather than chronic health conditions that this study was evaluating.

2.2. Statistical analysis

SAS 9.4 (SAS Institute Inc, Cary, NC) was used to account for weights in the statistical analyses process for the stratified survey design. Weights were considered in the estimating process by incorporating design stratification variables, final weight: landline and cell-phone data, and primary sampling unit. The unweighted estimates as suggested by Cicero et al. (Flatt et al., 2021) are also provided for comparison. Descriptive statistics, count (percentage), are provided for categorical variables. The Rao-Scott design-adjusted chi-square test, which takes the stratified survey design into account, examines the association between variables of interest and SGM group. Multivariable logistics regressions were adopted to examine the association between health access and health outcome variables, and demographic variables, respectively. The interaction between SGM and COVID are included in the models when feasible to examine whether the associations between SGM and health access/outcome changed before and after the COVID pandemic. The adjusted odds ratio with a 95% confidence interval are reported. There were no multicollinearity issues among independent variables. An unadjusted odds ratio with 95% confidence interval is provided for comparison. Bonferroni adjustments have been applied to obtain the 95% confidence intervals of odds ratio. All analytical results are considered significant when p-values are less than or equal to 0.05 or the 95% confidence interval of odds ratio doesn't contain 1.

3. Results

The 2014–2020 BRFSS surveys included responses from 64,696 individuals who self-reported being gay, lesbian, bisexual, other, and/or transgender (Table 1). Compared to the non-SGM group, SGM respondents were more likely to be 18 to 24 than other age groups included; more likely to be from the Southeast than from the Northeast; more likely to attend college or technical school; more likely to have an income from $15,000-$25,000 than an incoming over $35,000, more likely to be unable to work or out of work than to be a homemaker; more likely to be multiracial, non-Hispanic than to be white, non-Hispanic; and more likely to currently smoke than to never have smoked.

Multivariable logistic regression (Table 2) suggests that the odds of not seeing a doctor because of cost for the SGM group was 29% higher than the odds for the non-SGM group before the COVID-19 pandemic and increased to 42% after the start of the COVID-19 pandemic ($p < 0.05$). There were also significant differences between SGM and non-SGM respondents regarding the healthcare provider, last routine checkup, delayed getting medical care, and could not get medicine due to cost. The SGM group had 5% higher odds of not having at least one provider, 12% higher odds of not having a routine check-up in the last five years, 26% higher odds of delaying medical care due to cost, and 15% higher odds of reporting being unable to get medicine due to cost. There were no significant differences between the SGM and non-SGM groups concerning having a health plan, satisfaction with care received, or number of doctor visits, including age, region, education, income, employment, and race.

Multivariable logistic regression identified significant differences between the SGM and non-SGM groups in several health outcomes while factoring age, region, education, income, employment, race, smoking, and drinking. Compared to the non-SGM group, the odds of having poor physical or mental health were 39% higher for SGM respondents before the COVID-19 pandemic, and increased to 54% after the start of the COVID-19 pandemic ($p < 0.05$); the odds of having poor physical health was 33% ($p < 0.05$) higher for the SGM group (Table 3). The odds of having "not good" mental health were 41% higher for the SGM group before the COVID pandemic and increased to 51% after the pandemic started ($p < 0.05$). The odds of a respondent in the SGM group reporting having ever been told they have asthma was 27% higher, and the odds of still having asthma was 24% higher than the non-SGM group. The odds of respondents in the SGM group reporting having ever been told they have arthritis were 21% higher, diabetes 17% higher, pre-diabetes 27% higher, and kidney disease 31% higher. The odds of a respondent having ever been told they have chronic obstructive pulmonary disease, emphysema, or chronic bronchitis was 30% higher for respondents in the SGM group. Differences between the SGM and non-SGM groups related to hypertension, cardiovascular disease, heart attack, and stroke were also significant after considering other demographic factors. The odds of SGM respondents having hypertension are 8% higher, cardiovascular disease 14% higher, heart attack 33% higher, and stroke 24% higher (Table 3a).

4. Discussion

These results reinforce other studies' findings that SGM people face poorer health outcomes than non-SGM people across all chronic health domains. After the start of the COVID-19 pandemic, SGM respondents' mental and physical health worsened, and was significantly worse than respondents in the non-SGM group, although this difference could also reflect other time-related changes beyond the pandemic. Current research shows that the SGM population has a higher rate of tobacco use, which has been proposed as contributing to this increased prevalence (Hoffman et al., 2018; Al Rifai et al., 2020; Morgan et al., 2020). However, our study identified differences between SGM and non-SGM respondents that are not explained by tobacco use, suggesting other social determinants of health impact these disparities.

This study also sought to identify barriers to care. While insurance coverage did not differ significantly between groups, the odds of seeing a doctor because of cost, not taking medicine because of cost, and delaying

Table 3
Logistic regression models estimates based on weighted/adjusted, Unweighted/adjusted and weighted/unadjusted for health outcome variables with Bonferroni adjustment. Odds ratio with 95% confidence interval are listed.

	BPHIGH4	CVDCRHD4	GENHLTH	ASTHMA3	ASTHNOW	HAVARTH3	DIABETE3	PREDIAB1
SGM (Ref = Yes)	¥0.92 (0.84, 1.00)*	¥0.86 (0.75, 0.99)*	¥1.41 (1.31, 1.52)*	¥0.73 (0.68, 0.77)*	¥0.76 (0.68, 0.86)*	¥0.79 (0.74, 0.84)*	¥0.83 (0.75, 0.91)*	¥0.73 (0.65, 0.82)*
	ϕ0.91 (0.87, 0.95)*	ϕ0.89 (0.84, 0.95)*	ϕ1.33 (1.27, 1.38)* when COVID = No					
ϕ1.52 (1.39, 1.66)* when COVID = Yes	ϕ0.74 (0.72, 0.76)*	ϕ0.80 (0.75, 0.85)*	ϕ0.87 (0.84, 0.89)*	ϕ0.83 (0.79, 0.86)*	ϕ0.79 (0.75, 0.83)*			
	ψ1.35 (1.25, 1.45)*	ψ1.35 (1.19, 1.55)*	ψ1.47 (1.38, 1.56)*	ψ0.61 (0.58, 0.65)*	ψ0.86 (0.77, 0.97)*	ψ1.24 (1.18, 1.32)*	ψ1.23 (1.12, 1.35)*	ψ0.92 (0.82, 1.03)
COVID (Ref = Yes)	¥1.02 (0.94, 1.11)	¥0.75 (0.71, 0.80)*	¥0.94 (0.90, 0.98)*	¥0.89 (0.81, 0.98)*	¥1.04 (1.00, 1.08)*	¥0.96 (0.91, 1.02)	¥0.79 (0.73, 0.84)*	
		ϕ0.98 (0.95, 1.02)	ϕ0.80 (0.78, 0.82)* when SGM = No					
ϕ0.92 (0.84, 1.00) when SGM = Yes	ϕ0.99 (0.97, 1.01)	ϕ0.81 (0.78, 0.85)*	ϕ1.07 (1.05, 1.09)*	ϕ0.95 (0.93, 0.98)*	ϕ0.83 (0.81, 0.86)*			
		ψ1.03 (0.95, 1.12)	ψ0.79 (0.75, 0.83)*	ψ0.93 (0.89, 0.97)*	ψ0.92 (0.83, 1.01)	ψ1.06 (1.02, 1.10)*	ψ0.96 (0.90, 1.02)	ψ0.78 (0.73, 0.84)*
Age (Ref = 25–34)								
35–44	¥1.64 (1.48, 1.81)*	¥1.50 (1.08, 2.08)*	¥0.79 (0.72, 0.87)*	¥0.84 (0.79, 0.90)*	¥1.32 (1.15, 1.50)*	¥2.04 (1.88, 2.22)*	¥2.55 (2.18, 2.98)*	¥1.75 (1.52, 2.02)*
	ϕ1.60 (1.51, 1.70)*	ϕ1.60 (1.33, 1.92)*	ϕ0.80 (0.76, 0.84)*	ϕ0.87 (0.84, 0.90)*	ϕ1.33 (1.24, 1.43)*	ϕ2.07 (1.97, 2.17)*	ϕ2.34 (2.14, 2.56)*	ϕ1.59 (1.48, 1.71)*
45–54	¥3.14 (2.85, 3.45)*	¥3.99 (3.03, 5.25)*	¥0.64 (0.59, 0.70)*	¥0.74 (0.69, 0.80)*	¥1.68 (1.46, 1.93)*	¥4.10 (3.80, 4.42)*	¥5.68 (4.91, 6.56)*	¥2.39 (2.10, 2.71)*
	ϕ2.90 (2.75, 3.06)*	ϕ4.20 (3.57, 4.94)*	ϕ0.66 (0.63, 0.70)*	ϕ0.76 (0.73, 0.79)*	ϕ1.77 (1.64, 1.90)*	ϕ3.98 (3.81, 4.15)*	ϕ4.85 (4.47, 5.27)*	ϕ2.28 (2.13, 2.44)*
55–64	¥5.31 (4.83, 5.83)*	¥7.83 (6.04, 10.15)*	¥0.60 (0.54, 0.65)*	¥0.66 (0.62, 0.71)*	¥1.75 (1.51, 2.02)*	¥6.79 (6.30, 7.33)*	¥8.34 (7.24, 9.59)*	¥3.45 (3.03, 3.93)*
	ϕ4.95 (4.70, 5.22)*	ϕ8.30 (7.10, 9.70)*	ϕ0.64 (0.61, 0.67)*	ϕ0.67 (0.64, 0.69)*	ϕ1.74 (1.62, 1.87)*	ϕ6.74 (6.46, 7.03)*	ϕ7.10 (6.55, 7.69)*	ϕ3.14 (2.94, 3.36)*
65+	¥8.66 (7.78, 9.64)*	¥15.70 (12.09, 20.40)*	¥0.59 (0.53, 0.66)*	¥0.58 (0.52, 0.63)*	¥1.62 (1.34, 1.96)*	¥10.06 (9.25, 10.94)*	¥10.54 (9.07, 12.25)*	¥3.79 (3.28, 4.39)*
	ϕ8.33 (7.87, 8.81)*	ϕ17.03 (14.55, 19.94)*	ϕ0.62 (0.59, 0.65)*	ϕ0.60 (0.58, 0.63)*	ϕ1.63 (1.50, 1.78)*	ϕ10.05 (9.61, 10.51)*	ϕ9.07 (8.34, 9.87)*	ϕ3.45 (3.20, 3.71)*
18–24	¥0.58 (0.49, 0.68)*	¥0.63 (0.34, 1.16)	¥1.05 (0.92, 1.20)	¥1.30 (1.20, 1.42)*	¥0.92 (0.79, 1.08)	¥0.57 (0.49, 0.67)*	¥0.64 (0.49, 0.83)*	¥0.85 (0.68, 1.06)
	ϕ0.56 (0.51, 0.62)*	ϕ0.73 (0.53, 1.01)	ϕ1.14 (1.06, 1.22)*	ϕ1.25 (1.19, 1.32)*	ϕ0.86 (0.79, 0.95)*	ϕ0.54 (0.50, 0.59)*	ϕ0.59 (0.50, 0.70)*	ϕ0.72 (0.64, 0.81)*
Region (Ref = Northeast)								
Southeast	¥0.80 (0.76, 0.86)*	¥0.92 (0.84, 1.01)	¥1.10 (1.04, 1.17)*	¥1.22 (1.16, 1.29)*	¥1.41 (1.27, 1.56)*	¥0.99 (0.95, 1.03)	¥0.90 (0.84, 0.95)*	¥0.90 (0.83, 0.98)*
	ϕ0.81 (0.78, 0.84)*	ϕ0.89 (0.84, 0.93)*	ϕ1.17 (1.13, 1.21)*	ϕ1.23 (1.19, 1.26)*	ϕ1.28 (1.20, 1.35)*	ϕ0.96 (0.94, 0.98)*	ϕ0.86 (0.83, 0.89)*	ϕ0.86 (0.82, 0.90)*
Southwest	¥1.00 (0.90, 1.10)	¥0.96 (0.81, 1.13)	¥0.90 (0.81, 1.00)	¥1.10 (1.00, 1.21)	¥1.01 (0.84, 1.22)	¥0.91 (0.84, 0.99)*	¥1.10 (0.98, 1.24)	¥1.14 (0.97, 1.34)
	ϕ1.06 (1.01, 1.11)*	ϕ1.01 (0.94, 1.09)	ϕ0.92 (0.88, 0.97)*	ϕ1.07 (1.02, 1.12)*	ϕ0.99 (0.90, 1.08)	ϕ0.88 (0.85, 0.92)*	ϕ1.06 (1.00, 1.11)*	ϕ1.08 (1.01, 1.15)*
West	¥0.87 (0.80, 0.94)*	¥0.82 (0.72, 0.93)*	¥1.05 (0.97, 1.14)	¥1.32 (1.23, 1.42)*	¥1.16 (1.01, 1.32)*	¥0.91 (0.86, 0.97)*	¥0.82 (0.75, 0.90)*	¥1.14 (1.02, 1.27)*
	ϕ0.80 (0.77, 0.83)*	ϕ0.76 (0.73, 0.81)*	ϕ1.08 (1.04, 1.11)*	ϕ1.19 (1.16, 1.23)*	ϕ1.11 (1.05, 1.18)*	ϕ0.89 (0.87, 0.92)*	ϕ0.78 (0.75, 0.81)*	ϕ1.03 (0.98, 1.07)
Midwest	¥0.90 (0.85, 0.95)*	¥0.90 (0.83, 0.98)*	¥1.03 (0.98, 1.09)	¥1.03 (0.98, 1.08)	¥1.38 (1.25, 1.52)*	¥0.99 (0.96, 1.03)	¥0.97 (0.91, 1.03)	¥0.90 (0.83, 0.97)*
	ϕ0.88 (0.85, 0.91)*	ϕ0.93 (0.89, 0.98)*	ϕ1.09 (1.06, 1.13)*	ϕ0.95 (0.93, 0.98)*	ϕ1.29 (1.22, 1.37)*	ϕ0.90 (0.88, 0.91)*	ϕ0.96 (0.93, 0.99)*	ϕ0.92 (0.89, 0.96)*
Education (ref = Not High School Grad)								
Graduated High School	¥0.99 (0.88, 1.11)	¥0.85 (0.73, 1.00)*	¥1.53 (1.40, 1.67)*	¥0.98 (0.89, 1.09)	¥0.84 (0.69, 1.03)	¥1.02 (0.93, 1.11)	¥0.91 (0.82, 1.02)	¥1.12 (0.95, 1.34)
	ϕ1.00 (0.94, 1.06)	ϕ0.84 (0.78, 0.91)*	ϕ1.59 (1.52, 1.66)*	ϕ0.91 (0.87, 0.96)*	ϕ0.90 (0.80, 1.00)	ϕ1.00 (0.96, 1.05)	ϕ0.89 (0.84, 0.94)*	ϕ1.08 (0.99, 1.17)
Graduated College/Tech	¥0.71 (0.63, 0.80)*	¥0.71 (0.60, 0.83)*	¥2.73 (2.49, 3.00)*	¥1.12 (1.01, 1.24)*	¥0.80 (0.66, 0.99)*	¥0.84 (0.77, 0.91)*	¥0.65 (0.58, 0.73)*	¥1.06 (0.90, 1.26)
	ϕ0.73 (0.68, 0.77)*	ϕ0.71 (0.66, 0.77)*	ϕ2.66 (2.54, 2.79)*	ϕ1.08 (1.03, 1.14)*	ϕ0.79 (0.71, 0.88)*	ϕ0.85 (0.82, 0.89)*	ϕ0.65 (0.61, 0.69)*	ϕ1.00 (0.92, 1.08)
Attended College/Tech	¥0.92 (0.81, 1.03)	¥0.86 (0.73, 1.02)	¥1.80 (1.65, 1.97)*	¥1.18 (1.07, 1.31)*	¥0.87 (0.71, 1.07)	¥1.11 (1.02, 1.22)*	¥0.92 (0.82, 1.03)	¥1.25 (1.05, 1.48)*
	ϕ0.91 (0.86, 0.97)*	ϕ0.82 (0.76, 0.89)*	ϕ1.85 (1.77, 1.93)*	ϕ1.10 (1.04, 1.16)*	ϕ0.85 (0.76, 0.95)*	ϕ1.07 (1.03, 1.12)*	ϕ0.87 (0.82, 0.92)*	ϕ1.14 (1.05, 1.23)*
Income (ref = 25,000 to <35,000)								
35,000 to <50,000	¥1.05 (0.95, 1.17)	¥1.10 (0.95, 1.27)	¥1.28 (1.17, 1.40)*	¥0.99 (0.91, 1.09)	¥0.93 (0.78, 1.11)	¥1.02 (0.95, 1.10)	¥1.00 (0.90, 1.11)	¥0.92 (0.79, 1.06)
			ϕ1.24 (1.19, 1.29)					

(*continued on next page*)

Table 3 (*continued*)

	BPHIGH4	CVDCRHD4	GENHLTH	ASTHMA3	ASTHNOW	HAVARTH3	DIABETE3	PREDIAB1
	ϕ1.01 (0.96, 1.06)	ϕ1.02 (0.96, 1.09)		ϕ0.95 (0.91, 0.99)*	ϕ0.92 (0.84, 1.00)*	ϕ0.96 (0.93, 1.00)*	ϕ0.96 (0.91, 1.00)	ϕ1.00 (0.94, 1.07)
50,000+	¥0.92 (0.84, 1.01)	¥0.95 (0.84, 1.06)	¥1.98 (1.82, 2.15)*	¥0.96 (0.89, 1.04)	¥0.92 (0.79, 1.08)	¥0.86 (0.81, 0.92)*	¥0.83 (0.76, 0.91)*	¥0.89 (0.78, 1.01)
	ϕ0.89 (0.85, 0.93)*	ϕ0.94 (0.89, 1.00)*	ϕ1.97 (1.90, 2.04)*	ϕ0.89 (0.86, 0.93)*	ϕ0.87 (0.81, 0.94)*	ϕ0.81 (0.79, 0.83)*	ϕ0.81 (0.78, 0.84)*	ϕ0.95 (0.90, 1.00)*
<15,000	¥1.09 (0.94, 1.26)	¥1.26 (1.06, 1.50)*	¥0.69 (0.62, 0.77)*	¥1.18 (1.06, 1.31)*	¥1.26 (1.02, 1.55)*	¥1.14 (1.04, 1.26)*	¥1.07 (0.94, 1.23)	¥0.89 (0.73, 1.10)
	ϕ1.06 (0.99, 1.13)	ϕ1.12 (1.03, 1.21)*	ϕ0.68 (0.65, 0.71)*	ϕ1.24 (1.18, 1.30)*	ϕ1.31 (1.17, 1.45)*	ϕ1.11 (1.07, 1.16)*	ϕ1.04 (0.98, 1.11)	ϕ0.95 (0.88, 1.04)
15,000 to <25,000	¥1.11 (0.99, 1.24)	¥1.19 (1.03, 1.37)*	¥0.81 (0.74, 0.89)*	¥1.14 (1.04, 1.24)*	¥1.14 (0.95, 1.36)	¥1.06 (0.99, 1.14)	¥1.10 (0.99, 1.22)	¥0.98 (0.83, 1.15)
	ϕ1.05 (0.99, 1.10)	ϕ1.13 (1.06, 1.20)*	ϕ0.79 (0.76, 0.82)*	ϕ1.09 (1.05, 1.14)*	ϕ1.14 (1.04, 1.24)*	ϕ1.06 (1.02, 1.09)*	ϕ1.07 (1.02, 1.12)*	ϕ1.00 (0.93, 1.06)
Employment (ref = A homemaker)								
A student	¥0.99 (0.76, 1.29)	¥1.06 (0.46, 2.48)	¥1.57 (1.25, 1.97)*	¥0.93 (0.78, 1.10)	¥0.96 (0.69, 1.33)	¥0.69 (0.56, 0.86)*	¥1.09 (0.76, 1.57)	¥0.85 (0.58, 1.27)
	ϕ1.06 (0.91, 1.23)	ϕ1.01 (0.68, 1.50)	ϕ1.36 (1.21, 1.54)*	ϕ0.91 (0.83, 0.99)*	ϕ0.91 (0.76, 1.08)	ϕ0.71 (0.64, 0.80)*	ϕ1.13 (0.92, 1.39)	ϕ0.91 (0.76, 1.09)
Employed for wages	¥1.35 (1.18, 1.56)*	¥1.18 (0.89, 1.55)	¥1.32 (1.15, 1.52)*	¥0.89 (0.79, 1.00)*	¥0.80 (0.63, 1.01)	¥0.77 (0.70, 0.85)*	¥1.17 (0.97, 1.41)	¥0.85 (0.68, 1.08)
	ϕ1.26 (1.17, 1.35)*	ϕ1.09 (0.96, 1.25)	ϕ1.30 (1.22, 1.39)*	ϕ0.89 (0.84, 0.94)*	ϕ0.84 (0.74, 0.94)*	ϕ0.73 (0.70, 0.77)*	ϕ1.20 (1.11, 1.31)*	ϕ0.96 (0.88, 1.05)
Out of work for 1 year or more	¥1.78 (1.40, 2.26)*	¥2.44 (1.69, 3.51)*	¥0.66 (0.53, 0.81)*	¥1.23 (1.02, 1.47)*	¥1.14 (0.78, 1.65)	¥1.19 (1.02, 1.39)*	¥1.69 (1.30, 2.19)*	¥0.93 (0.63, 1.38)
	ϕ1.67 (1.49, 1.87)*	ϕ2.04 (1.70, 2.44)*	ϕ0.57 (0.52, 0.63)*	ϕ1.16 (1.05, 1.27)*	ϕ0.95 (0.79, 1.16)	ϕ1.11 (1.03, 1.20)*	ϕ1.73 (1.53, 1.95)*	ϕ1.13 (0.98, 1.31)
Out of work for<1 year	¥1.54 (1.24, 1.91)*	¥1.57 (1.06, 2.34)*	¥0.95 (0.78, 1.14)	¥0.95 (0.80, 1.12)	¥0.88 (0.63, 1.21)	¥0.94 (0.81, 1.09)	¥1.37 (1.06, 1.78)*	¥1.00 (0.73, 1.39)
	ϕ1.45 (1.29, 1.62)*	ϕ1.45 (1.19, 1.77)*	ϕ0.88 (0.80, 0.96)*	ϕ1.02 (0.93, 1.11)	ϕ0.84 (0.71, 0.99)*	ϕ0.93 (0.87, 1.01)	ϕ1.47 (1.30, 1.66)*	ϕ1.15 (1.01, 1.31)*
Retired	¥1.70 (1.47, 1.98)*	¥2.00 (1.52, 2.62)*	¥0.84 (0.72, 0.98)*	¥1.01 (0.87, 1.16)	¥0.99 (0.74, 1.32)	¥1.14 (1.03, 1.25)*	¥1.64 (1.35, 1.98)*	¥0.87 (0.69, 1.10)
	ϕ1.60 (1.48, 1.72)*	ϕ1.85 (1.63, 2.11)*	ϕ0.80 (0.75, 0.86)*	ϕ0.93 (0.87, 0.99)*	ϕ0.93 (0.81, 1.06)	ϕ1.04 (0.99, 1.10)	ϕ1.56 (1.44, 1.70)*	ϕ1.00 (0.91, 1.10)
Self-employed	¥1.15 (0.98, 1.35)	¥1.56 (1.16, 2.09)*	¥1.33 (1.13, 1.57)*	¥0.82 (0.72, 0.93)*	¥0.69 (0.52, 0.90)	¥0.73 (0.66, 0.81)*	¥1.00 (0.82, 1.23)	¥0.75 (0.58, 0.97)*
	ϕ1.08 (1.00, 1.17)	ϕ1.37 (1.20, 1.57)*	ϕ1.39 (1.29, 1.49)*	ϕ0.79 (0.74, 0.84)*	ϕ0.70 (0.62, 0.81)*	ϕ0.70 (0.67, 0.74)*	ϕ1.03 (0.94, 1.13)	ϕ0.81 (0.74, 0.90)*
Unable to work	¥2.91 (2.40, 3.52)*	¥4.53 (3.37, 6.10)*	¥0.19 (0.16, 0.22)*	¥2.08 (1.80, 2.41)*	¥1.55 (1.14, 2.10)*	¥3.03 (2.67, 3.43)*	¥2.73 (2.22, 3.36)*	¥1.19 (0.90, 1.58)
	ϕ2.56 (2.33, 2.81)*	ϕ4.20 (3.65, 4.84)*	ϕ0.16 (0.14, 0.17)*	ϕ2.09 (1.94, 2.24)*	ϕ1.41 (1.21, 1.64)*	ϕ2.89 (2.72, 3.08)*	ϕ2.85 (2.59, 3.13)*	ϕ1.41 (1.25, 1.58)*
Race (ref = Black only, Non-Hispanic)								
Hispanic	¥0.53 (0.47, 0.60)*	¥1.01 (0.77, 1.33)	¥0.76 (0.68, 0.85)*	¥0.70 (0.63, 0.78)*	¥0.69 (0.57, 0.84)*	¥0.70 (0.63, 0.78)*	¥0.95 (0.83, 1.07)	¥0.90 (0.76, 1.07)
	ϕ0.49 (0.46, 0.52)*	ϕ1.19 (1.05, 1.34)*	ϕ0.82 (0.78, 0.87)*	ϕ0.78 (0.74, 0.83)*	ϕ0.77 (0.70, 0.86)*	ϕ0.72 (0.69, 0.76)*	ϕ0.87 (0.82, 0.93)*	ϕ0.94 (0.86, 1.01)
Multiracial, Non-Hispanic	¥0.75 (0.63, 0.90)*	¥1.74 (1.24, 2.43)*	¥0.87 (0.75, 1.01)	¥1.24 (1.07, 1.42)*	¥0.91 (0.69, 1.20)	¥1.33 (1.17, 1.51)*	¥0.83 (0.67, 1.02)	¥0.79 (0.64, 0.99)*
	ϕ0.66 (0.60, 0.72)*	ϕ1.58 (1.37, 1.82)*	ϕ0.86 (0.80, 0.93)*	ϕ1.27 (1.19, 1.36)*	ϕ0.78 (0.69, 0.89)*	ϕ1.24 (1.16, 1.32)*	ϕ0.79 (0.72, 0.86)*	ϕ0.96 (0.87, 1.06)
Other race only, Non-Hispanic	¥0.60 (0.51, 0.70)*	¥1.24 (0.94, 1.63)	¥1.00 (0.85, 1.17)	¥0.65 (0.56, 0.74)*	¥0.79 (0.61, 1.02)	¥0.78 (0.68, 0.90)*	¥0.88 (0.75, 1.05)	¥0.86 (0.70, 1.05)
	ϕ0.63 (0.59, 0.68)*	ϕ1.45 (1.28, 1.63)*	ϕ0.91 (0.86, 0.97)*	ϕ0.81 (0.76, 0.86)*	ϕ0.70 (0.62, 0.79)*	ϕ0.86 (0.81, 0.91)*	ϕ0.94 (0.88, 1.00)	ϕ1.05 (0.97, 1.14)
White	¥0.58 (0.53, 0.63)*	¥1.34 (1.17, 1.55)*	¥1.28 (1.19, 1.39)*	¥0.84 (0.78, 0.90)*	¥0.90 (0.79, 1.04)	¥1.10 (1.03, 1.17)*	¥0.53 (0.49, 0.58)*	¥0.52 (0.47, 0.58)*
	ϕ0.52 (0.50, 0.55)*	ϕ1.31 (1.21, 1.42)*	ϕ1.31 (1.26, 1.37)*	ϕ0.85 (0.82, 0.89)*	ϕ0.88 (0.81, 0.95)*	ϕ1.05 (1.02, 1.09)*	ϕ0.50 (0.48, 0.52)*	ϕ0.56 (0.53, 0.59)*
Smoking (ref = Current smoker-Smokes everyday)								
Current smoker-Smokes some days	¥0.93 (0.83, 1.06)	¥1.04 (0.87, 1.26)	¥1.27 (1.14, 1.41)*	¥0.87 (0.80, 0.96)*	¥0.96 (0.80, 1.16)	¥0.88 (0.81, 0.96)*	¥0.91 (0.79, 1.06)	¥0.94 (0.79, 1.12)
	ϕ0.97 (0.92, 1.03)	ϕ0.93 (0.85, 1.02)	ϕ1.22 (1.16, 1.28)*	ϕ0.97 (0.92, 1.01)	ϕ0.92 (0.84, 1.02)	ϕ0.93 (0.89, 0.97)*	ϕ0.93 (0.87, 1.00)*	ϕ0.98 (0.90, 1.06)
Former smoker	¥1.10 (1.01, 1.19)*	¥1.15 (1.02, 1.30)*	¥1.36 (1.27, 1.45)*	¥0.96 (0.89, 1.02)	¥0.97 (0.84, 1.11)	¥0.91 (0.86, 0.96)*	¥1.31 (1.20, 1.42)*	¥1.11 (0.99, 1.24)
	ϕ1.11 (1.07, 1.16)*	ϕ1.10 (1.04, 1.16)*	ϕ1.34 (1.30, 1.39)*	ϕ1.01 (0.98, 1.05)	ϕ0.92 (0.85, 0.98)*	ϕ0.98 (0.96, 1.01)	ϕ1.29 (1.24, 1.34)*	ϕ1.15 (1.09, 1.21)*
Never Smoked	¥0.92 (0.85, 1.00)*	¥0.69 (0.61, 0.79)*	¥1.81 (1.70, 1.94)*	¥0.87 (0.82, 0.93)*	¥1.06 (0.93, 1.20)	¥0.71 (0.67, 0.75)*	¥1.05 (0.97, 1.15)*	¥0.95 (0.84, 1.07)
			ϕ1.94 (1.88, 2.00)*					

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Table 3 (*continued*)

	BPHIGH4	CVDCRHD4	GENHLTH	ASTHMA3	ASTHNOW	HAVARTH3	DIABETE3	PREDIAB1
	ϕ0.90 (0.87, 0.94)*	ϕ0.65 (0.62, 0.69)*		ϕ0.92 (0.89, 0.95)*	ϕ0.99 (0.93, 1.06)	ϕ0.77 (0.75, 0.79)*	ϕ1.03 (0.99, 1.07)	ϕ0.98 (0.93, 1.03)
Drink (ref = Yes)	¥0.79 (0.76, 0.83)*	¥1.12 (1.04, 1.21)*	¥1.02 (0.98, 1.07)	¥1.08 (1.04, 1.12)*	¥1.11 (1.04, 1.19)*	¥1.07 (1.03, 1.10)*	¥1.29 (1.22, 1.36)*	¥1.07 (1.00, 1.14)*
	ϕ0.80 (0.78, 0.82)*	ϕ1.12 (1.09, 1.16)*	ϕ1.01 (0.99, 1.03)*	ϕ1.08 (1.06, 1.10)*	ϕ1.12 (1.08, 1.16)*	ϕ1.04 (1.02, 1.05)*	ϕ1.28 (1.25, 1.31)*	ϕ1.05 (1.02, 1.08)*

Note: *: significant at level of 0.05; ¥:Weighted adjusted estimates; ϕ:Unweighted adjusted estimates; ψ:weighted unadjusted estimates.
Abbreviations: BPHIGH4(ref = No) = Have you EVER been told by a doctor, nurse or other health professional that you have high blood pressure?;
CVDCRHD4(ref = NO)= (Ever told) you had angina or coronary heart disease?;
GENHLTH(ref = Fair/Poor) = Would you say that in general your health is?;
ASTHMA3(ref = NO)= (Ever told) you had asthma?;
ASTHNOW(ref = NO) = Do you still have asthma?;
HAVARTH3(ref = NO)= (Ever told) you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?;
DIABETE3(ref = NO)= (Ever told) you have diabetes;
PREDIAB1(ref = NO) = Have you ever been told by a doctor or other health professional that you have pre-diabetes or borderline diabetes?.

medical care because of cost were higher for the SGM group. This finding parallels an older study comparing access variables between transgender and cisgender respondents only, which found that all transgender groups analyzed were less likely to have health insurance, but fewer differences between groups concerning health access variables (Downing and Przedworski, 2018). The authors propose that this difference may be attributable to more healthcare utilization by transgender than cisgender respondents.

However, the present study's findings demonstrate that this difference is not limited to transgender respondents, but SGM respondents overall. This finding may relate to specific spending choices not captured by income variable alone. Some SGM youth lack a financial safety net due to family rejection, affecting disposable income and the likelihood of spending funds on healthcare (Cicero et al., 2020). Moreover, previous literature has shown that SGM individuals report being hesitant to seek healthcare due to negative experiences despite access to care (Newcomb et al., 2019); making seeing a doctor not worth the cost. The BRFSS survey does not include this metric, which might shed light on this relationship.

Previous research found that SGM populations experience a disproportionate burden of poor physical health and multiple chronic conditions (Streed et al., 2018; Morgan et al., 2020). Our results support these findings, demonstrating that the SGM group had higher rates of common chronic conditions. Previous research has not combined gender identity, instead only evaluating lesbian, gay, and bisexual (LBG) individuals (Streed et al., 2018; Morgan et al., 2020). Previous research has also indicated that the gaps in care may be due to SGM individuals not performing preventative health care practices (Gonzales and Henning-Smith, 2017; Trinh et al., 2017). However, this study's findings suggest that other factors that affect the likelihood of receiving care, notably cost barriers, have a significant impact. This agrees with prior literature finding that SGM individuals have poorer healthcare access that affects outcomes (Trinh et al., 2017).

While previous research has broken down LGB individuals' healthcare access and risks into more specific categories, i.e., comparing lesbian women to gay men, this study did not. Future research may wish to compare the outcomes of SGM individuals of different sexes or separately analyze the experience of transgender individuals who may face different healthcare barriers. Indeed, previous research has shown the benefits of doing so at various levels of disaggregation (Downing and Przedworski, 2018; Fredriksen-Goldsen et al., 2013; Gonzales et al., 2016; Newcomb et al., 2019).

Several limitations come with using BRFSS survey data. Information is self-reported, leading to recall and response bias when describing access to care and health conditions. In addition, sexual orientation and gender identity are generally underreported (Safer et al., 2016). This sample of data also suffers from selection bias, as it excludes the homeless population and anyone institutionalized, such as in a nursing facility, prison, or homeless shelter. This exclusion is of particular concern in light of the disproportionate representation of SGM in the homeless population (Newcomb et al., 2019). The BRFSS is also a cross-sectional survey, so it is difficult to establish whether the health access factors are the cause of the health outcomes; we can only assess correlation. Additionally, not all states are included in the BRFSS data used, so the results cannot be generalized for the entire United States population.

Further health and gender equity research should be done to evaluate the consequence of lower access to care among SGM individuals, and the specificity of not seeing a doctor due to cost despite the presence of other indicators of access. Further research is also needed to identify causes for increased risk of smoking-related conditions specified in this study, which are not explained by smoking behavior. Despite these limitations, this study's strengths include a more thorough analysis of physical health outcomes, which have not been stressed in previous research. While our results were consistent with previous research, identifying more specific health outcomes for which SGM populations face greater burdens can help guide future public health measures and preventative health efforts in a primary care setting.

5. Conclusion

We sought to identify inequities in physical health outcomes affecting SGM individuals compared to non-SGM individuals and their associations with healthcare access such as satisfaction with care, cost of care, and amount/frequency of doctor visits. After factoring in age, region, education, income, employment, race, smoking, and drinking, common chronic physical conditions investigated remained more common in the SGM group. Notably, these disparities persisted despite controlling for smoking history. Although the reasons behind these correlations are still unclear, this study has found a significant relationship with prohibitive cost barriers, which can be attributed to larger societal discrimination regarding SGM individuals. Further research exploring these results is critical, but these findings have identified areas of healthcare inequity that can be addressed at both public health and primary care settings.

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CRediT authorship contribution statement

Manasvi Pinnamaneni: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Lauren Payne:** Writing – review & editing. **Jordan Jackson:** Writing – review & editing. **Chin-I Cheng:** Methodology, Formal analysis, Writing – review & editing. **M.**

Table 3a
Logistic regression models estimates based on weighted/adjusted, Unweighted/adjusted and weighted/unadjusted for health outcome variables with Bonferroni adjustment. Odds ratio with 95% confidence interval are listed.

	PHYSHLTH	CVDINFR4	CVDSTRK3	CHCCOPD1	PDIABTST	_MENT14D	CHCKIDNY	POORHLTH
SGM (Ref = Yes)	¥0.67 (0.64, 0.70)*	¥0.67 (0.64, 0.70)*	¥0.76 (0.65, 0.89)*	¥0.70 (0.63, 0.77)*	¥0.91 (0.85, 0.98)*	¥0.59 (0.56, 0.62)* when COVID = No		
¥0.49 (0.44, 0.56)* when COVID = Yes	¥0.69 (0.60, 0.81)*	¥0.61 (0.57, 0.65)* when COVID = No						
¥0.46 (0.41, 0.53)* when COVID = Yes								
	ϕ0.72 (0.70, 0.74)*	ϕ0.85 (0.80, 0.91)*	ϕ0.76 (0.71, 0.82)*	ϕ0.78 (0.74, 0.82)*	ϕ0.88 (0.85, 0.91)*	ϕ0.62 (0.60, 0.63)* when COVID = No		
ϕ0.49 (0.47, 0.52)* when COVID = Yes	ϕ0.75 (0.70, 0.81)*	ϕ0.65 (0.63, 0.68)* when COVID = No						
ϕ0.52 (0.48, 0.55)* when COVID = Yes								
	ψ0.62 (0.59, 0.65)*	ψ1.16 (1.01, 1.33)*	ψ0.97 (0.83, 1.12)	ψ0.78 (0.71, 0.86)*	ψ1.29 (1.20, 1.37)*	ψ0.42 (0.40, 0.44)*	ψ0.88 (0.76, 1.03)	ψ0.53 (0.50, 0.56)*
COVID (Ref = Yes)	¥1.43 (1.38, 1.48)*	¥1.43 (1.38, 1.48)*	¥1.09 (0.98, 1.21)	¥0.98 (0.91, 1.06)	¥1.22 (1.17, 1.28)*	¥1.07 (1.03, 1.11)* when SGM = No		
¥0.90 (0.79, 1.02) when SGM = Yes	¥1.04 (0.93, 1.16)	¥0.95 (0.90, 0.99)* when SGM = No						
¥0.72 (0.63, 0.82)* when SGM = Yes								
	ϕ1.39 (1.37, 1.41)*	ϕ1.01 (0.97, 1.04)	ϕ1.01 (0.97, 1.06)	ϕ0.98 (0.95, 1.01)	ϕ1.24 (1.21, 1.26)*	ϕ1.11 (1.09, 1.13)* when SGM = No		
ϕ0.89 (0.84, 0.95)* when SGM = Yes	ϕ0.96 (0.91, 1.00)*	ϕ1.01 (0.99, 1.03) when SGM = No						
ϕ0.80 (0.74, 0.86)* when SGM = Yes								
	ψ1.42 (1.37, 1.47)*	ψ1.07 (0.99, 1.16)	ψ1.07 (0.96, 1.19)	ψ1.03 (0.96, 1.11)	ψ1.22 (1.17, 1.28)*	ψ1.09 (1.05, 1.13)*	ψ0.99 (0.89, 1.10)	ψ0.91 (0.87, 0.95)*
Age (Ref = 25–34)								
35–44	¥1.03 (0.98, 1.09)	¥2.04 (1.51, 2.74)*	¥1.44 (1.05, 1.99)*	¥1.19 (1.01, 1.39)*	¥1.44 (1.34, 1.55)*	¥0.81 (0.76, 0.85)*	¥1.44 (1.12, 1.85)*	¥0.95 (0.89, 1.02)
	ϕ1.03 (1.00, 1.06)	ϕ1.76 (1.49, 2.08)*	ϕ1.68 (1.42, 1.98)*	ϕ1.29 (1.18, 1.41)*	ϕ1.39 (1.34, 1.44)*	ϕ0.83 (0.81, 0.85)*	ϕ1.41 (1.23, 1.62)*	ϕ0.95 (0.91, 0.98)*
45–54	¥1.04 (0.99, 1.09)	¥4.13 (3.22, 5.30)*	¥2.74 (2.10, 3.58)*	¥1.82 (1.57, 2.10)*	¥2.01 (1.87, 2.16)*	¥0.63 (0.59, 0.66)*	¥2.01 (1.57, 2.57)*	¥0.96 (0.90, 1.02)
	ϕ1.03 (1.00, 1.06)*	ϕ4.22 (3.64, 4.88)*	ϕ2.99 (2.57, 3.47)*	ϕ2.03 (1.87, 2.20)*	ϕ2.02 (1.95, 2.10)*	ϕ0.66 (0.64, 0.68)*	ϕ1.92 (1.69, 2.17)*	ϕ0.97 (0.93, 1.00)
55–64	¥0.98 (0.93, 1.03)	¥6.75 (5.31, 8.58)*	¥3.78 (2.93, 4.87)*	¥2.67 (2.32, 3.08)*	¥2.80 (2.60, 3.02)*	¥0.46 (0.43, 0.48)*	¥2.66 (2.14, 3.30)*	¥0.92 (0.86, 0.98)*
	ϕ0.95 (0.93, 0.98)*	ϕ6.87 (5.96, 7.92)*	ϕ4.17 (3.61, 4.82)*	ϕ2.96 (2.74, 3.20)*	ϕ2.85 (2.74, 2.96)*	ϕ0.47 (0.46, 0.48)*	ϕ2.49 (2.20, 2.80)*	ϕ0.92 (0.89, 0.96)*
65+	¥0.87 (0.81, 0.93)*	¥12.05 (9.44, 15.37)*	¥6.70 (5.12, 8.78)*	¥3.87 (3.32, 4.51)*	¥3.00 (2.73, 3.29)*	¥0.30 (0.28, 0.33)*	¥4.27 (3.40, 5.37)*	¥0.75 (0.68, 0.82)*
	ϕ0.86 (0.84, 0.89)*	ϕ13.23 (11.45, 15.29)*	ϕ7.06 (6.09, 8.18)*	ϕ4.40 (4.05, 4.78)*	ϕ3.18 (3.04, 3.32)*	ϕ0.31 (0.30, 0.32)*	ϕ4.12 (3.64, 4.66)*	ϕ0.74 (0.70, 0.77)*
18–24	¥1.11 (1.03, 1.19)*	¥0.79 (0.49, 1.26)*	¥0.90 (0.50, 1.60)	¥1.00 (0.79, 1.26)	¥0.61 (0.55, 0.68)*	¥1.51 (1.40, 1.63)*	¥1.12 (0.70, 1.80)	¥1.15 (1.06, 1.25)*
	ϕ1.11 (1.07, 1.16)*	ϕ0.77 (0.58, 1.03)	ϕ0.72 (0.55, 0.96)*	ϕ1.03 (0.90, 1.17)	ϕ0.58 (0.55, 0.61)*	ϕ1.39 (1.33, 1.45)*	ϕ0.80 (0.64, 1.00)	ϕ1.12 (1.06, 1.17)*
Region (Ref = Northeast)								
Southeast	¥1.12 (1.08, 1.17)*	¥0.91 (0.83, 1.00)*	¥0.91 (0.81, 1.02)	¥0.85 (0.79, 0.92)*	¥0.86 (0.82, 0.91)*	¥1.29 (1.24, 1.34)*	¥0.86 (0.76, 0.97)*	¥0.99 (0.94, 1.04)
	ϕ1.05 (1.02, 1.07)*	ϕ0.88 (0.83, 0.92)*	ϕ0.82 (0.78, 0.88)*	ϕ0.87 (0.83, 0.90)*	ϕ0.80 (0.78, 0.82)*	ϕ1.04 (1.02, 1.06)*	ϕ0.82 (0.77, 0.88)*	ϕ0.99 (0.96, 1.02)
Southwest	¥1.02 (0.95, 1.09)	¥0.94 (0.78, 1.13)	¥1.22 (1.00, 1.49)	¥0.86 (0.74, 1.00)	¥0.85 (0.76, 0.95)*	¥0.96 (0.89, 1.04)	¥1.26 (1.02, 1.55)*	¥0.95 (0.87, 1.05)
	ϕ1.03 (0.99, 1.06)	ϕ0.92 (0.85, 0.99)*	ϕ1.05 (0.96, 1.15)	ϕ0.95 (0.89, 1.01)	ϕ0.90 (0.85, 0.94)*	ϕ0.97 (0.93, 1.00)	ϕ1.06 (0.96, 1.16)	ϕ1.01 (0.97, 1.06)
West	¥1.07 (1.01, 1.12)*	¥0.81 (0.71, 0.91)*	¥1.00 (0.85, 1.17)	¥0.88 (0.79, 0.98)*	¥0.77 (0.72, 0.82)*	¥1.11 (1.05, 1.17)*	¥1.10 (0.95, 1.29)	¥1.13 (1.06, 1.21)*
	ϕ1.07 (1.05, 1.09)*	ϕ0.81 (0.77, 0.86)*	ϕ0.90 (0.84, 0.96)*	ϕ0.78 (0.75, 0.82)*	ϕ0.77 (0.75, 0.79)*	ϕ1.14 (1.11, 1.16)*	ϕ1.00 (0.94, 1.06)	ϕ1.12 (1.08, 1.15)*
Midwest	¥1.05 (1.02, 1.09)*	¥0.94 (0.87, 1.03)	¥1.03 (0.93, 1.14)	¥0.84 (0.78, 0.90)*	¥0.89 (0.85, 0.94)*	¥1.18 (1.14, 1.23)*	¥0.98 (0.88, 1.10)	¥0.96 (0.91, 1.00)
	ϕ0.97 (0.95, 0.99)*	ϕ0.92 (0.88, 0.96)*	ϕ0.90 (0.85, 0.95)*	ϕ0.80 (0.76, 0.83)*	ϕ0.83 (0.81, 0.85)*	ϕ1.13 (1.10, 1.15)*	ϕ0.90 (0.85, 0.96)*	ϕ0.96 (0.93, 0.98)*
Education (ref = Not High School Grad)								
Graduated High School	¥0.88 (0.82, 0.95)*	¥0.79 (0.68, 0.91)*	¥0.93 (0.78, 1.10)	¥0.88 (0.79, 0.99)*	¥1.14 (1.01, 1.27)*	¥1.05 (0.97, 1.14)	¥0.86 (0.71, 1.05)	¥0.95 (0.86, 1.05)
	ϕ0.93 (0.90, 0.97)*	ϕ0.76 (0.71, 0.82)*	ϕ0.84 (0.77, 0.91)*	ϕ0.82 (0.78, 0.87)*	ϕ1.18 (1.12, 1.25)*	ϕ1.07 (1.02, 1.11)*	ϕ0.88 (0.80, 0.97)*	ϕ0.96 (0.91, 1.01)

(*continued on next page*)

Table 3a (*continued*)

	PHYSHLTH	CVDINFR4	CVDSTRK3	CHCCOPD1	PDIABTST	_MENT14D	CHCKIDNY	POORHLTH
Graduated College/Tech	¥0.97 (0.90, 1.05)	¥0.53 (0.45, 0.61)*	¥0.74 (0.62, 0.89)*	¥0.56 (0.49, 0.64)*	¥1.31 (1.17, 1.47)*	¥1.44 (1.32, 1.56)*	¥0.84 (0.68, 1.04)	¥1.17 (1.06, 1.29)*
	ϕ1.05 (1.01, 1.10)*	ϕ0.54 (0.50, 0.58)*	ϕ0.73 (0.67, 0.80)*	ϕ0.57 (0.53, 0.60)*	ϕ1.34 (1.27, 1.42)*	ϕ1.47 (1.41, 1.53)*	ϕ0.94 (0.85, 1.04)	ϕ1.20 (1.14, 1.26)*
Attended College/Tech	¥1.00 (0.93, 1.08)	¥0.69 (0.60, 0.80)*	¥0.97 (0.81, 1.15)	¥0.87 (0.77, 0.98)*	¥1.33 (1.19, 1.49)*	¥1.34 (1.23, 1.45)*	¥0.95 (0.77, 1.17)	¥1.12 (1.01, 1.23)*
	ϕ1.08 (1.04, 1.12)*	ϕ0.67 (0.62, 0.72)*	ϕ0.86 (0.79, 0.94)*	ϕ0.81 (0.76, 0.86)*	ϕ1.39 (1.31, 1.47)*	ϕ1.35 (1.29, 1.40)*	ϕ0.97 (0.88, 1.07)	ϕ1.12 (1.07, 1.18)*
Income (ref = 25,000 to <35,000)								
35,000 to <50,000	¥0.92 (0.86, 0.98)*	¥1.03 (0.89, 1.19)	¥0.86 (0.73, 1.02)	¥0.96 (0.85, 1.08)	¥1.04 (0.94, 1.14)	¥0.93 (0.86, 1.00)	¥0.99 (0.82, 1.21)	¥0.94 (0.86, 1.02)
	ϕ0.92 (0.89, 0.94)*	ϕ0.98 (0.92, 1.05)	ϕ0.85 (0.78, 0.91)*	ϕ0.88 (0.83, 0.93)*	ϕ1.08 (1.03, 1.12)*	ϕ0.89 (0.86, 0.92)*	ϕ0.91 (0.83, 0.98)*	ϕ0.95 (0.92, 0.99)*
50000+	¥0.79 (0.74, 0.83)*	¥0.82 (0.73, 0.93)*	¥0.67 (0.57, 0.79)*	¥0.67 (0.60, 0.74)*	¥1.23 (1.13, 1.34)*	¥0.73 (0.68, 0.77)*	¥0.91 (0.78, 1.07)	¥0.86 (0.80, 0.92)*
	ϕ0.74 (0.73, 0.76)*	ϕ0.81 (0.77, 0.86)*	ϕ0.65 (0.60, 0.69)*	ϕ0.62 (0.59, 0.65)*	ϕ1.27 (1.22, 1.32)*	ϕ0.67 (0.65, 0.69)*	ϕ0.78 (0.73, 0.84)*	ϕ0.85 (0.82, 0.88)*
<15,000	¥1.29 (1.18, 1.41)*	¥1.20 (1.01, 1.43)*	¥1.29 (1.06, 1.58)*	¥1.31 (1.15, 1.50)*	¥0.78 (0.68, 0.90)*	¥1.28 (1.16, 1.42)*	¥1.30 (1.03, 1.65)*	¥1.36 (1.23, 1.51)*
	ϕ1.30 (1.25, 1.35)*	ϕ1.19 (1.10, 1.29)*	ϕ1.33 (1.22, 1.45)*	ϕ1.36 (1.28, 1.45)*	ϕ0.78 (0.74, 0.83)*	ϕ1.35 (1.29, 1.41)*	ϕ1.20 (1.09, 1.33)*	ϕ1.35 (1.28, 1.42)*
15,000 to <25,000	¥1.15 (1.08, 1.23)*	¥1.11 (0.97, 1.28)	¥1.25 (1.06, 1.48)*	¥1.25 (1.12, 1.38)*	¥0.92 (0.83, 1.02)	¥1.10 (1.02, 1.19)	¥1.20 (1.01, 1.42)*	¥1.11 (1.02, 1.21)*
	ϕ1.16 (1.12, 1.19)*	ϕ1.18 (1.10, 1.25)*	ϕ1.17 (1.09, 1.27)*	ϕ1.22 (1.16, 1.29)*	ϕ0.90 (0.86, 0.94)*	ϕ1.11 (1.08, 1.15)*	ϕ1.11 (1.02, 1.20)*	ϕ1.13 (1.08, 1.17)*
Employment (ref = A homemaker)								
A student	¥0.99 (0.87, 1.13)	¥0.63 (0.30, 1.31)	¥0.44 (0.22, 0.87)*	¥0.80 (0.51, 1.25)	¥0.84 (0.68, 1.02)	¥1.07 (0.92, 1.24)	¥0.65 (0.36, 1.15)	¥1.00 (0.86, 1.17)
	ϕ0.95 (0.88, 1.01)	ϕ1.04 (0.72, 1.50)	ϕ0.69 (0.48, 1.00)*	ϕ0.91 (0.74, 1.11)	ϕ0.94 (0.85, 1.03)	ϕ1.01 (0.94, 1.09)	ϕ0.77 (0.57, 1.05)	ϕ0.97 (0.89, 1.05)
Employed for wages	¥0.76 (0.70, 0.83)*	¥1.02 (0.77, 1.36)	¥0.62 (0.47, 0.80)*	¥0.67 (0.55, 0.81)*	¥0.97 (0.85, 1.12)	¥0.73 (0.66, 0.81)*	¥0.83 (0.65, 1.05)	¥0.73 (0.65, 0.81)*
	ϕ0.77 (0.74, 0.81)*	ϕ1.12 (0.98, 1.28)	ϕ0.63 (0.55, 0.72)*	ϕ0.75 (0.68, 0.82)*	ϕ1.08 (1.02, 1.15)*	ϕ0.74 (0.70, 0.77)*	ϕ0.72 (0.63, 0.83)*	ϕ0.75 (0.71, 0.79)*
Out of work for 1 year or more	¥1.34 (1.15, 1.55)*	¥1.97 (1.35, 2.87)*	¥1.58 (0.93, 2.66)	¥1.15 (0.88, 1.50)	¥0.92 (0.72, 1.18)	¥1.12 (0.95, 1.32)	¥1.32 (0.92, 1.90)	¥1.85 (1.55, 2.20)*
	ϕ1.33 (1.24, 1.43)*	ϕ2.05 (1.71, 2.45)*	ϕ1.35 (1.11, 1.64)*	ϕ1.22 (1.07, 1.39)*	ϕ1.05 (0.95, 1.16)	ϕ1.16 (1.07, 1.25)*	ϕ1.34 (1.09, 1.64)*	ϕ1.86 (1.70, 2.03)*
Out of work for<1 year	¥0.94 (0.82, 1.06)	¥1.48 (1.00, 2.20)	¥1.13 (0.73, 1.77)	¥0.94 (0.72, 1.23)	¥1.06 (0.87, 1.29)	¥1.01 (0.87, 1.17)	¥1.21 (0.76, 1.92)	¥1.35 (1.15, 1.57)*
	ϕ0.98 (0.92, 1.04)	ϕ1.46 (1.20, 1.76)*	ϕ1.01 (0.82, 1.24)	ϕ1.04 (0.91, 1.19)	ϕ1.08 (0.99, 1.18)	ϕ1.07 (1.00, 1.14)	ϕ1.02 (0.83, 1.26)	ϕ1.34 (1.24, 1.45)*
Retired	¥1.01 (0.92, 1.12)	¥1.85 (1.39, 2.47)*	¥1.31 (0.99, 1.75)	¥1.07 (0.88, 1.31)	¥1.12 (0.96, 1.30)	¥0.68 (0.61, 0.76)	¥1.47 (1.15, 1.88)*	¥1.13 (0.99, 1.28)
	ϕ0.97 (0.92, 1.01)	ϕ1.84 (1.61, 2.09)*	ϕ1.29 (1.13, 1.48)*	ϕ1.17 (1.07, 1.28)*	ϕ1.15 (1.08, 1.23)*	ϕ0.65 (0.62, 0.69)*	ϕ1.18 (1.04, 1.36)*	ϕ1.15 (1.08, 1.22)*
Self-employed	¥0.71 (0.65, 0.79)*	¥1.29 (0.96, 1.75)	¥0.74 (0.54, 1.01)	¥0.63 (0.50, 0.79)*	¥0.87 (0.75, 1.01)	¥0.63 (0.57, 0.71)*	¥0.90 (0.68, 1.20)	¥0.84 (0.74, 0.95)*
	ϕ0.70 (0.66, 0.73)*	ϕ1.37 (1.19, 1.58)*	ϕ0.71 (0.61, 0.83)*	ϕ0.66 (0.59, 0.74)*	ϕ0.90 (0.84, 0.96)*	ϕ0.61 (0.58, 0.64)*	ϕ0.76 (0.65, 0.88)*	ϕ0.84 (0.79, 0.89)*
Unable to work	¥4.42 (3.88, 5.04)*	¥3.60 (2.65, 4.90)*	¥3.65 (2.71, 4.92)*	¥2.45 (1.98, 3.04)*	¥1.41 (1.17, 1.71)*	¥2.10 (1.83, 2.42)*	¥3.57 (2.69, 4.74)*	¥4.31 (3.70, 5.02)*
	ϕ4.99 (4.69, 5.31)*	ϕ3.78 (3.28, 4.36)*	ϕ3.30 (2.86, 3.82)*	ϕ2.93 (2.65, 3.24)*	ϕ1.56 (1.43, 1.70)*	ϕ2.10 (1.97, 2.23)*	ϕ3.01 (2.60, 3.50)*	ϕ4.31 (4.01, 4.64)*
Race (ref = Black only, Non-Hispanic)								
Hispanic	¥0.95 (0.88, 1.03)	¥1.16 (0.91, 1.48)	¥0.71 (0.55, 0.93)*	¥0.86 (0.71, 1.05)	¥0.93 (0.82, 1.04)	¥0.86 (0.79, 0.93)*	¥1.02 (0.78, 1.32)	¥1.02 (0.92, 1.13)
	ϕ0.97 (0.93, 1.01)	ϕ1.24 (1.10, 1.39)*	ϕ0.73 (0.65, 0.83)*	ϕ0.88 (0.80, 0.97)*	ϕ0.89 (0.84, 0.94)*	ϕ0.88 (0.84, 0.92)*	ϕ1.02 (0.90, 1.15)	ϕ1.09 (1.03, 1.15)*
Multiracial, Non-Hispanic	¥1.26 (1.13, 1.40)*	¥1.38 (1.04, 1.83)*	¥0.98 (0.72, 1.33)	¥1.61 (1.27, 2.04)*	¥0.80 (0.69, 0.94)*	¥1.39 (1.24, 1.56)*	¥1.00 (0.72, 1.39)	¥1.26 (1.09, 1.45)*
	ϕ1.20 (1.13, 1.26)*	ϕ1.60 (1.40, 1.83)*	ϕ1.08 (0.94, 1.25)	ϕ1.61 (1.45, 1.79)*	ϕ0.80 (0.74, 0.86)*	ϕ1.28 (1.21, 1.36)*	ϕ1.08 (0.92, 1.26)	ϕ1.24 (1.15, 1.32)*
Other race only, Non-Hispanic	¥0.90 (0.81, 0.99)*	¥1.34 (1.04, 1.74)*	¥0.89 (0.65, 1.22)	¥1.06 (0.79, 1.41)	¥0.57 (0.49, 0.65)*	¥0.84 (0.76, 0.94)*	¥0.95 (0.66, 1.37)	¥1.15 (1.01, 1.31)*
	ϕ0.93 (0.88, 0.97)*	ϕ1.50 (1.34, 1.69)*	ϕ0.89 (0.78, 1.01)	ϕ1.12 (1.01, 1.23)*	ϕ0.66 (0.62, 0.71)*	ϕ0.82 (0.78, 0.86)*	ϕ0.95 (0.83, 1.09)	ϕ1.13 (1.07, 1.21)*
White	¥1.10 (1.05, 1.17)*	¥1.22 (1.06, 1.42)*	¥0.69 (0.60, 0.81)*	¥1.24 (1.11, 1.39)*	¥0.69 (0.64, 0.74)*	¥1.17 (1.10, 1.24)*	¥0.85 (0.71, 1.00)*	¥1.08 (1.01, 1.16)*
	ϕ1.06 (1.03, 1.10)*	ϕ1.27 (1.18, 1.38)*	ϕ0.73 (0.68, 0.79)*	ϕ1.28 (1.20, 1.36)*	ϕ0.68 (0.65, 0.71)*	ϕ1.13 (1.10, 1.17)*	ϕ0.85 (0.78, 0.93)*	ϕ1.07 (1.03, 1.12)*

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Table 3a (*continued*)

	PHYSHLTH	CVDINFR4	CVDSTRK3	CHCCOPD1	PDIABTST	_MENT14D	CHCKIDNY	POORHLTH
Smoking (ref = Current smoker-Smokes everyday)								
Current smoker-Smokes some days	¥0.97 (0.90, 1.04)	¥0.91 (0.76, 1.07)	¥0.93 (0.76, 1.14)	¥0.66 (0.58, 0.74)*	¥1.14 (1.02, 1.26)*	¥0.91 (0.84, 0.98)	¥1.00 (0.76, 1.30)	¥0.99 (0.91, 1.09)
	ϕ0.97 (0.93, 1.00)	ϕ0.89 (0.82, 0.96)*	ϕ0.88 (0.80, 0.97)*	ϕ0.69 (0.65, 0.73)*	ϕ1.12 (1.06, 1.18)*	ϕ0.96 (0.92, 1.00)*	ϕ0.93 (0.83, 1.05)	ϕ1.04 (0.99, 1.09)
Former smoker	¥0.91 (0.87, 0.96)*	¥0.85 (0.76, 0.96)*	¥0.87 (0.76, 0.98)*	¥0.52 (0.48, 0.56)*	¥1.22 (1.13, 1.31)*	¥0.80 (0.75, 0.84)*	¥1.18 (1.02, 1.36)*	¥0.93 (0.87, 0.99)*
	ϕ0.91 (0.89, 0.93)*	ϕ0.85 (0.81, 0.90)*	ϕ0.81 (0.76, 0.87)*	ϕ0.48 (0.46, 0.50)*	ϕ1.22 (1.18, 1.27)*	ϕ0.81 (0.79, 0.83)*	ϕ1.16 (1.08, 1.24)*	ϕ0.93 (0.90, 0.96)*
Never Smoked	¥0.83 (0.79, 0.87)*	¥0.48 (0.43, 0.55)*	¥0.62 (0.54, 0.71)*	¥0.21 (0.19, 0.23)*	¥1.08 (1.01, 1.16)*	¥0.72 (0.68, 0.76)*	¥0.95 (0.83, 1.10)	¥0.83 (0.78, 0.88)*
	ϕ0.81 (0.79, 0.83)*	ϕ0.49 (0.46, 0.51)*	ϕ0.61 (0.58, 0.65)*	ϕ0.17 (0.17, 0.18)*	ϕ1.09 (1.05, 1.13)*	ϕ0.73 (0.72, 0.75)*	ϕ0.93 (0.87, 1.00)	ϕ0.84 (0.81, 0.86)*
Drink (ref = Yes)	¥0.98 (0.96, 1.01)	¥0.98 (0.96, 1.01)	¥1.08 (0.98, 1.18)	¥1.07 (1.01, 1.13)*	¥1.24 (1.19, 1.28)*	¥0.88 (0.85, 0.90)*	¥1.32 (1.19, 1.45)*	¥0.94 (0.91, 0.97)*
	ϕ1.01 (0.99, 1.02)	ϕ1.10 (1.06, 1.14)*	ϕ1.13 (1.08, 1.18)*	ϕ1.01 (0.99, 1.04)	ϕ1.18 (1.16, 1.20)*	ϕ0.88 (0.87, 0.89)*	ϕ1.34 (1.28, 1.40)*	ϕ0.97 (0.95, 0.98)*

Note: *: significant at level of 0.05; ¥:Weighted adjusted estimates; ϕ:Unweighted adjusted estimates; ψ:weighted unadjusted estimates.
Abbreviations: PHYSHLTH(ref = NO) = Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?;
CVDINFR4(ref = No)= (Ever told) you had a heart attack, also called a myocardial infarction?;
CVDSTRK3(ref = No)= (Ever told) you had a stroke.;
CHCCOPD1(ref = No)= (Ever told) you have chronic obstructive pulmonary disease, C.O.P.D., emphysema or chronic bronchitis?;
PDIABTST(ref = No) = Have you had a test for high blood sugar or diabetes within the past three years?;
_MENT14D(ref = 0 days when metal health is not good) = not good mental health status: 0 days, 1–13 days, 14–30 days.; CHCKIDNY(ref = No)= (Ever told) you have kidney disease?;
POORHLTH(ref = 0 days) = During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

Ariel Cascio: Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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