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Assessing underlying health risks for severe COVID-19 infection among sexual and gender minority populations in Hawai'i

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Abstract

The psychosocial impact of COVID-19 on sexual and gender minority (SGM) populations has been widely studied, but risk for severe infection remains less clear, especially in Hawai'i. National studies are not generalizable to Hawai'i's unique racial demographics. This Hawai'i cross-sectional study examined associations between SGM status stratified by race and underlying health conditions and SGM status in Hawai'i, stratified by race, that may increase risk for severe COVID-19. Data from the 2015-2019 Behavioral Risk Factor Surveillance System (BRFSS) of non-institutionalized adults aged 18 years and older in Hawai'i was analyzed using descriptive and regression methods. Sexual and/or gender minority adults accounted for 5.2% and 0.6% of the population, respectively. Compared to Native Hawaiian heterosexual adults, Native Hawaiian sexual minority adults had higher age-adjusted odds of asthma (current – AOR 1.8, CI: 1.33, 2.44 and ever – AOR 1.59, CI: 1.21, 2.09), cancer (AOR 2.07, CI: 1.25, 3.42), and diabetes (AOR 1.58, CI: 1.11, 2.26). Compared to White cisgender adults, Native Hawaiian transgender adults had significantly higher odds of asthma – current (AOR 4.13, CI: 1.44, 11.92), asthma – ever (AOR 4.02, CI: 1.68, 9.66), cancer (AOR 6.67, CI: 1.98, 22.5), diabetes (AOR 4.59, CI: 1.67, 12.62), obesity (AOR 3.76, CI: 1.64, 8.59), a stroke (AOR 3.19, CI: 1.12, 9.06) and cigarette smoking (AOR 3.38, CI: 1.43, 8.02). These chronic health conditions increase vulnerability to severe COVID-19 outcomes. Findings highlight the need for increased chronic disease prevention and management in Hawai'i's SGM communities. Further research is necessary to understand COVID-19's long-term impact and informing equitable public health strategies.

ABBREVIATIONS AND ACRONYMS

BRFSS = Behavioral Risk Factor Surveillance System
CDC = Centers for Disease Control and Prevention
COPD = chronic obstructive pulmonary disease
COVID-19 = coronavirus disease 2019
SGM = sexual and gender minority
SOGI = sexual orientation and gender identity

INTRODUCTION

The psychosocial impact of coronavirus disease 2019 (COVID-19) on sexual and gender minority (SGM) populations has been widely studied.[1-4] However, the health risk for severe COVID-19 disease is less clear, especially in Hawai'i. In the US, SGM communities make up at least 5.6% of the total general population,[5] and they include, but are not limited to, sexual minorities such as lesbian, gay, bisexual, and queer (LGBQ) individuals, as well as gender minorities such as transgender and gender non-binary persons.[6]

Chronic diseases—such as diabetes, chronic obstructive pulmonary disease (COPD), cardiovascular diseases (CVD), hypertension, and cancer—can contribute to increased risk for severe COVID-19 symptoms,[7,8] which include dry cough, fever, severe headache, and tiredness.[9] Furthermore, pneumonia and acute respiratory distress, as major complications that result from COVID-19, can activate inflammatory immune responses in respiratory disease progression.[10] Severe COVID-19 cases may result in organ damage and acute respiratory distress syndrome that can lead to long-term impaired lung function, arrhythmia, and even death.[9] About 70% of patients receiving intensive hospital care for COVID-19 have comorbidities.[11]

Although data on COVID-related infection, complications, and death rates for SGM people are limited, data on chronic diseases is available.[12] For example, sexual minority adults in the US have a higher prevalence of underlying conditions that are associated with severe COVID-19-related disease and death, including cancer (9.2%), kidney disease (4.7%), asthma (13.8%), COPD (10.3%), heart disease (8.0%), hypertension (35.7%), stroke (4.7%), obesity (34.1%), diabetes (12.5%), and cigarette smoking (22.1%), compared to heterosexual adults.[13,14] In 2017, the Hawai'i Department of Health reported that 38% of sexual minority adults had 2 or more chronic conditions and were significantly more likely to smoke cigarettes and consume alcohol compared to their heterosexual counterparts.[15]

The demographic composition of SGM people in Hawai'i represents a uniquely diverse population. In 2020, SGM adults composed 5.9% of the state population and were comprised of the following race proportions: 7.8% White, 7.1% Native Hawaiian, 6.5% Chinese, 3.1% Filipino, and 2.9% Japanese.[16] This is important because sexual orientation and gender health disparities can be amplified by structural inequities related to race and ethnicity.[17,18] In the US in 2020, a higher incidence of COVID-19 infections occurred among racial minority groups compared to non-Hispanic White adults.[19] In Hawai'i, Pacific Islander populations accounted for 22% of COVID-19 cases, while Pacific Islander and Native Hawaiian communities combined experienced the highest incidence (2501 per 100 000 persons), compared to all other race groups. Among Asian communities, the highest COVID-19 incidence rates occurred among Filipino (1247 per 100 000 persons) and Vietnamese (1200 per 100 000 persons) populations, compared to other Asian

groups.[20] Given this context, the objective of this study is to investigate the prevalence of chronic health conditions that have been associated with severe COVID-19 disease among SGM adults in Hawai'i, stratified by race.

METHODS

Study Design

The Behavioral Risk Factor Surveillance System (BRFSS)[21] is an annual cross-sectional, telephone health survey that collects state-level data from non-institutionalized US adult residents regarding their demographics, health-related risk behaviors, chronic health conditions, and preventive service utilization. De-identified Hawai'i BRFSS data from 2015-2019 were analyzed to explore risk of pre-conditions for COVID-19 before onset of the COVID-19 pandemic. Hawai'i residents who did not respond to the sexual orientation and gender identity questions or missing sex and age were excluded. The Hawai'i Department of Health reviewed and approved this study. Institutional Review Board approval is not required to use BRFSS data.

Demographic information such as age, race, sexual orientation, gender identity, and sex assigned at birth were used to describe the study population. Racial groupings included Native Hawaiian, Pacific Islander (excluding Native Hawaiians), Asian, White, and "Unspecified" racial category, which was a combination of race groups with small representation in the study population (Black, American Indian/Alaskan Native, and race groups not listed). For sexual orientation, lesbian, gay, bisexual, questioning respondents were categorized as sexual minority persons versus heterosexual persons. Individuals who responded to the sexual orientation question with "something else" were defined as "questioning" in this study. The queer orientation was not an answer option. Gender identities were categorized as transgender persons versus cisgender persons. Prior to 2018, BRFSS surveyors determined participant sex (male or female) based on cues and household enumeration selection. In 2018, the sex question was changed to "sex assigned at birth".

Self-reported chronic health conditions included asthma (ever and current), cancer, heart disease, stroke, diabetes, kidney disease, obesity, and high blood pressure. Weight status was determined from the calculated body mass index (BMI) based on 2 BRFSS questions about weight and height. Current smoking status was determined by if the respondent had smoked at least 100 cigarettes in a lifetime and now smokes cigarettes every day or some days. Chronic health conditions were categorized into yes, no, and don't know or refused to answer.

Statistical Analysis

Combining multiple years of data was important for SGM analyses, in which unreliable estimates were suppressed due to sample sizes fewer than 50, based on Centers for Disease Control and Prevention (CDC) suppression guidelines.[22] Demographic statistics were calculated for subgroups defined by sex assigned at birth, age, race/ethnicity, sexual orientation, and gender identity. Unadjusted and adjusted logistic regression models analyzed each chronic health condition among SGM groups (yes and no), stratified by race categories. The regression models were adjusted for age groups to determine odds ratio (AOR) with 95% confidence intervals (CI). Comparison groups included heterosexual White adults and cisgender White adults. Additional models within each race group were analyzed. Statistical significance was obtained at $P<.05$. All analyses accounted for the BRFSS complex survey design using SAS 9.4 statistical software (SAS Institute, Cary, NC).

RESULTS

Sexual and Gender Minorities Combined

In Hawai'i, adults who identified as sexual minorities and/or gender minorities accounted for 5.2% and 0.6% of the population, respectively (**Table 1**). Female as sex assigned at birth represented 53.1% and 53.2% of sexual minority and transgender peoples, respectively. A large representation of the younger age groups (18 – 34 years old) was reported across all SGM groups. A low proportion of heart disease, COPD, kidney disease, and experiencing a stroke was found across all SGM groups.

Tables 2 and 3 present unadjusted and adjusted OR (95% CI) of chronic health conditions within each race group among sexual minority and gender minority adults, respectively.

Sexual Minorities

Among sexual minority adults, 31.7% were Asian and 27.1% were White, while Asian (44.5%), and Native Hawaiian (28.9%) individuals made up the largest race groups for transgender adults. A little more than half of the sexual minority adults live with obesity (57.4%), and 27.0% reported having hypertension.

After adjusting for age, Native Hawaiian sexual minority individuals were more likely to self-report asthma – current (AOR 1.80, CI: 1.33, 2.44), asthma – ever (AOR 1.59, CI: 1.21, 2.09), cancer (AOR 2.07, CI: 1.25, 3.42), diabetes (AOR 1.58, CI: 1.11, 2.26) compared to Native Hawaiian heterosexual individuals. Among Pacific Islanders, no statistical difference was found among any chronic health outcome. The likelihood of having COPD was higher among Asian (AOR 2.73, CI: 1.46, 5.10) and unspecified race (AOR 2.61, CI: 1.22, 5.60) sexual minority persons compared to their heterosexual counterparts (**Table 2**). Assessing the gender identity groups within each race found only a statistical association with cancer (AOR 6.67, CI: 1.98, 22.5) among Native Hawaiian adults (**Table 3**).

After adjusting for age, compared to White heterosexual adults, Native Hawaiian sexual minority adults were statistically more likely to have asthma – current (AOR 3.91, CI: 2.87, 5.34), asthma – ever (AOR 3.34, CI: 2.53, 4.41), COPD (AOR 2.19, CI: 1.4, 3.43), diabetes (AOR 5.47, CI: 3.8, 7.85), hypertension (AOR 2.13, CI: 1.53, 2.97) kidney disease (AOR 2.48, CI: 1.38, 4.45), obesity (AOR 3.8, CI: 2.9, 4.97), current smoker (AOR 2.23, CI: 1.63, 3.06), and experienced a stroke

Table 1. Sociodemographic Characteristics and Chronic Health Conditions by Sexual Minority (Lesbian, Gay, Bisexual, and Questioning) versus Heterosexual Adults and Gender Minority (Transgender) versus Cisgender Adults in Hawai'i, Behavioral Risk Factor Surveillance System 2015-2019.

Characteristics	Sexual Minority		Heterosexual		Transgender		Cisgender	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	1828	5.2	33544	94.8	202	0.6	35608	99.4
ASSIGNED SEX AT BIRTH								
Female	948	53.1	17605	49.6	101	53.2	18731	50.0
Male	880	46.9	15939	50.4	101	46.8	16877	50.0
AGE GROUP, YEARS								
18-24	251	23.5	2002	10.5	24	22.3	2236	11.0
25-34	310	25.3	3685	17.5	29	20.1	3986	17.8
35-44	243	15.0	4266	16.6	26	14.3	4518	16.4
45-54	259	11.2	5041	15.3	28	11.5	5316	15.0
55-64	332	11.7	7165	16.9	40	15.0	7538	16.7
65-74	296	7.6	7221	13.6	37	9.4	7575	13.3
75+	137	5.8	4164	9.6	18	7.4	4439	9.7
RACE OR ETHNICITY								
Native Hawaiian	428	22.6	6487	18.4	53	28.9	6907	18.3
Pacific Islander	93	7.2	1089	3.9	13	5.3	1189	4.0
Asian	447	31.7	12048	44.6	83	44.5	12673	44.3
White	648	27.1	11217	25.4	39	14.2	11897	25.4
Unspecified	195	11.3	2494	7.8	12	7.2	2704	7.9
CHRONIC HEALTH CONDITION								
Asthma, Current	283	16.3	3160	9.6	23	20.1	3453	9.9
Asthma, Ever	407	23.6	5341	16.8	37	29.4	5759	17.0
Cancer	264	9.1	4866	9.9	33	13.7	5152	9.8
Heart Disease	69	2.5	1267	3.0	7	1.8	1352	3.0
COPD[a]	134	5.9	1710	4.1	13	4.6	1851	4.2
Diabetes	217	9.4	3992	10.6	26	9.7	4245	10.6
Hypertension	471	27.0	9211	32.2	61	29.5	9746	32.1
Kidney Disease	78	3.9	1296	3.2	9	2.1	1378	3.2
Obesity	990	57.4	18823	58.9	120	60.9	19864	58.6
Smoking, Current	333	20.6	3938	12.8	34	16.7	4259	13.1
Stroke	87	3.4	1188	2.9	11	3.8	1292	2.9

[a]COPD: Chronic Obstructive Pulmonary Disease

(AOR 3.26, CI: 1.92, 5.53) (Table 4). The unspecified race category was 2.19 (CI: 1.01, 4.75) times as likely to experience a stroke compared to White heterosexual adults. Diabetes was statistically higher in all race groups compared to White heterosexual counterparts.

Gender Minorities

Among those who identify as transgender, high proportions reported having obesity (60.9%), hypertension (29.5%), asthma – ever (29.4%), and asthma – current (20.1%) (Table 1). Compared to White cisgender adults, Native Hawaiian transgender adults were more likely to report having asthma – current (AOR 4.13, CI: 1.44, 11.92), asthma – ever (AOR 4.02, CI: 1.68, 9.66), diabetes (AOR 4.59, CI: 1.67, 12.62), obesity (AOR 3.76, CI: 1.64, 8.59), smoking (AOR 3.38, CI: 1.43, 8.02), and a stroke (AOR 3.19, CI: 1.12, 9.06), after adjusting for age (Table 5). No statistically significant difference in the estimates of any chronic health conditions was observed among transgender individuals who identified as Pacific Islander, Asian, White, or in the unspecified race categories.

Table 2. Unadjusted and Adjusted Odds Ratio and 95% Confidence Interval of Chronic Health Conditions among Sexual Minority Adults within each Race Group in Hawai'i, Behavioral Risk Factor Surveillance System 2015-2019.

	Reference	**Native Hawaiian Heterosexual**		**Pacific Islander Heterosexual**		**Asian Heterosexual**		**Unspecified Heterosexual**		**White Heterosexual**	
Outcome	Sexual Minority	Native Hawaiian OR (95% CI)	*P*-value	Pacific Islander OR (95% CI)	*P*-value	Asian OR (95% CI)	*P*-value	Unspecified OR (95% CI)	*P*-value	White OR (95% CI)	*P*-value
Asthma Current	Unadjusted	1.86 (1.38, 2.51)	<.001	1.44 (0.71, 2.92)	.31	1.99 (1.37, 2.87)	<.001	1.35 (0.74, 2.46)	.33	1.69 (1.16, 2.46)	.006
	Adjusted	1.80 (1.33, 2.44)	<.001	1.42 (0.7, 2.87)	.33	1.90 (1.31, 2.77)	<.001	1.29 (0.71, 2.35)	.40	1.62 (1.12, 2.36)	.011
Asthma Ever	Unadjusted	1.72 (1.31, 2.26)	<.001	0.86 (0.44, 1.66)	.65	1.55 (1.14, 2.1)	.005	1.18 (0.7, 1.99)	.53	1.51 (1.11, 2.05)	.008
	Adjusted	1.59 (1.21, 2.09)	<.001	0.81 (0.42, 1.6)	.55	1.41 (1.03, 1.92)	.032	1.05 (0.62, 1.78)	.85	1.38 (1.02, 1.88)	.039
Cancer	Unadjusted	1.29 (0.82, 2.02)	.27	0.21 (0.04, 1.04)	.057	0.95 (0.6, 1.52)	.84	0.76 (0.37, 1.54)	.44	0.8 (0.62, 1.03)	.084
	Adjusted	2.07 (1.25, 3.42)	.005	0.24 (0.05, 1.3)	.098	1.31 (0.78, 2.19)	.31	1.25 (0.58, 2.69)	.57	1.14 (0.87, 1.5)	.34
Heart Disease	Unadjusted	0.81 (0.43, 1.5)	.49	0.63 (0.08, 4.71)	.65	0.96 (0.43, 2.17)	.92	0.84 (0.35, 2.04)	.70	0.67 (0.41, 1.08)	.099
	Adjusted	1.32 (0.69, 2.54)	.40	0.78 (0.13, 4.74)	.79	1.35 (0.57, 3.2)	.50	1.48 (0.6, 3.6)	.39	0.95 (0.59, 1.54)	.84
COPD[a]	Unadjusted	1.09 (0.7, 1.68)	.72	0.76 (0.27, 2.15)	.60	2.17 (1.16, 4.05)	.015	1.87 (0.88, 3.94)	.102	1.14 (0.75, 1.73)	.55
	Adjusted	1.42 (0.91, 2.22)	.12	0.85 (0.29, 2.44)	.76	2.73 (1.46, 5.1)	.002	2.61 (1.22, 5.6)	.014	1.45 (0.95, 2.22)	.086
Diabetes	Unadjusted	1.03 (0.72, 1.46)	.88	0.64 (0.29, 1.42)	.27	0.86 (0.6, 1.23)	.41	1.00 (0.5, 2.01)	.99	0.84 (0.55, 1.29)	.44
	Adjusted	1.58 (1.11, 2.26)	.012	0.82 (0.39, 1.74)	.60	1.22 (0.83, 1.8)	.32	1.71 (0.81, 3.64)	.16	1.14 (0.73, 1.77)	.56
Hypertension	Unadjusted	0.74 (0.55, 1.01)	.056	0.67 (0.3, 1.5)	.33	0.84 (0.63, 1.13)	.25	0.82 (0.45, 1.5)	.52	0.91 (0.7, 1.18)	.47
	Adjusted	1.02 (0.73, 1.42)	.91	0.85 (0.33, 2.18)	.73	1.17 (0.86, 1.6)	.32	1.23 (0.61, 2.47)	.56	1.2 (0.9, 1.59)	.22
Kidney Disease	Unadjusted	1.06 (0.6, 1.89)	.83	0.66 (0.14, 3.14)	.60	1.96 (1.12, 3.43)	.018	0.57 (0.12, 2.63)	.47	1.00 (0.57, 1.75)	.99
	Adjusted	1.45 (0.81, 2.61)	.21	0.76 (0.15, 3.81)	.74	2.54 (1.41, 4.58)	.002	0.81 (0.17, 3.87)	.79	1.29 (0.74, 2.28)	.37

Outcome	Reference	**Native Hawaiian Heterosexual**		**Pacific Islander Heterosexual**		**Asian Heterosexual**		**Unspecified Heterosexual**		**White Heterosexual**	
	Sexual Minority	Native Hawaiian OR (95% CI)	*P*-value	Pacific Islander OR (95% CI)	*P*-value	Asian OR (95% CI)	*P*-value	Unspecified OR (95% CI)	*P*-value	White OR (95% CI)	*P*-value
Obesity	Unadjusted	1.1 (0.84, 1.44)	.49	1.09 (0.59, 1.99)	.79	1.17 (0.85, 1.62)	.35	1.34 (0.81, 2.24)	.26	0.94 (0.7, 1.27)	.68
	Adjusted	1.2 (0.92, 1.57)	.18	1.16 (0.64, 2.12)	.63	1.3 (0.93, 1.81)	.12	1.51 (0.9, 2.53)	.12	0.99 (0.73, 1.34)	.94
Smoking	Unadjusted	1.39 (1.02, 1.89)	.036	1.69 (0.85, 3.36)	.13	1.9 (1.35, 2.68)	<.001	1.26 (0.72, 2.18)	.42	1.86 (1.36, 2.53)	<.001
	Adjusted	1.35 (0.99, 1.84)	.056	1.72 (0.87, 3.39)	.12	1.86 (1.32, 2.61)	<.001	1.23 (0.7, 2.17)	.48	1.77 (1.3, 2.42)	<.001
Stroke	Unadjusted	1.1 (0.66, 1.83)	.70	0.31 (0.08, 1.26)	.10	1.37 (0.71, 2.65)	.35	0.92 (0.42, 2.03)	.83	1.4 (0.81, 2.43)	.23
	Adjusted	1.7 (1, 2.9)	.052	0.36 (0.09, 1.5)	.16	1.86 (0.97, 3.58)	.06	1.49 (0.66, 3.37)	.34	1.98 (1.15, 3.42)	.014

[a]COPD: Chronic Obstructive Pulmonary Disease

Table 3. Unadjusted and Adjusted Odds Ratio and 95% Confidence Interval of Chronic Health Conditions among Gender Identity Minority (Transgender) Adults compared to Cisgender Adults within each Race Group in Hawai'i, Behavioral Risk Factor Surveillance System 2015-2019.

	Reference	**Native Hawaiian Cisgender**		**Pacific Islander Cisgender**		**Asian Cisgender**		**Unspecified Cisgender**		**White Cisgender**	
		Native Hawaiian		**Pacific Islander**		**Asian**		**Unspecified**		**White**	
Outcome	Gender Minority (Transgender)	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Asthma Current	Unadjusted	1.81 (0.63, 5.18)	.27	1.7 (0.21, 13.52)	.62	1.15 (0.49, 2.68)	.75	1.36 (0.21, 8.72)	.74	3.51 (0.74, 16.73)	.13
	Adjusted	1.87 (0.65, 5.39)	.24	1.58 (0.21, 12.05)	.65	1.11 (0.48, 2.6)	.80	1.41 (0.22, 9.11)	.72	3.25 (0.74, 14.37)	.12
Asthma Ever	Unadjusted	1.88 (0.78, 4.53)	.16	2.37 (0.51, 11.05)	.27	1.3 (0.66, 2.58)	.45	1.13 (0.23, 5.63)	.88	2.02 (0.45, 9.04)	.36
	Adjusted	1.88 (0.79, 4.52)	.16	2.09 (0.49, 8.81)	.32	1.24 (0.62, 2.48)	.55	1.10 (0.21, 5.83)	.92	1.78 (0.45, 7.03)	.41
Cancer	Unadjusted	4.65 (1.77, 12.21)	.002	--		1.56 (0.73, 3.34)	.25	0.56 (0.07, 4.32)	.58	0.63 (0.26, 1.56)	.32
	Adjusted	6.67 (1.98, 22.5)	.002	--		1.81 (0.8, 4.12)	.16	0.99 (0.17, 5.83)	.99	0.70 (0.28, 1.76)	.45
Heart Disease	Unadjusted	0.32 (0.07, 1.38)	.13	--		0.48 (0.12, 2)	.31	1.33 (0.16, 11.23)	.79	1.73 (0.31, 9.59)	.53
	Adjusted	0.34 (0.08, 1.52)	.16	--		0.54 (0.13, 2.26)	.39	2.72 (0.32, 23.01)	.36	2.01 (0.33, 12.38)	.45
COPD[a]	Unadjusted	0.94 (0.36, 2.49)	.91	--		2.34 (0.83, 6.61)	.11	0.55 (0.07, 4.6)	.58	--	
	Adjusted	1.00 (0.38, 2.63)	.99	--		2.53 (0.87, 7.37)	.09	0.82 (0.11, 6.34)	.85	--	
Diabetes	Unadjusted	1.12 (0.43, 2.9)	.82	0.18 (0.02, 1.39)	.100	0.72 (0.34, 1.54)	.40	1.52 (0.18, 12.83)	.70	1.13 (0.23, 5.51)	.88
	Adjusted	1.31 (0.48, 3.6)	.60	0.25 (0.03, 2.02)	.194	0.77 (0.36, 1.66)	.50	2.99 (0.41, 21.8)	.28	1.32 (0.27, 6.4)	.73
Hypertension	Unadjusted	0.54 (0.24, 1.23)	.14	0.57 (0.13, 2.52)	.45	0.91 (0.5, 1.68)	.77	2.09 (0.41, 10.71)	.38	1.08 (0.44, 2.65)	.86
	Adjusted	0.55 (0.27, 1.13)	.10	0.94 (0.22, 4.05)	.94	1.08 (0.53, 2.2)	.84	3.43 (0.6, 19.77)	.17	1.35 (0.55, 3.32)	.52
Kidney Disease	Unadjusted	0.54 (0.13, 2.17)	.38	--		0.65 (0.15, 2.91)	.58	--		1.48 (0.41, 5.43)	.55
	Adjusted	0.57 (0.15, 2.18)	.41	--		0.71 (0.16, 3.09)	.64	--		1.67 (0.45, 6.17)	.44

Outcome	Reference	Native Hawaiian Cisgender		Pacific Islander Cisgender		Asian Cisgender		Unspecified Cisgender		White Cisgender	
	Gender Minority (Transgender)	Native Hawaiian		Pacific Islander		Asian		Unspecified		White	
		OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Obesity	Unadjusted	1.17 (0.51, 2.68)	.71	0.37 (0.1, 1.35)	.132	1.72 (0.9, 3.28)	.098	1.36 (0.19, 9.82)	.76	1.37 (0.54, 3.53)	.51
	Adjusted	1.17 (0.51, 2.68)	.70	0.44 (0.13, 1.47)	.181	1.81 (0.96, 3.39)	.066	1.40 (0.19, 10.34)	.74	1.60 (0.63, 4.11)	.33
Smoking	Unadjusted	2.14 (0.9, 5.14)	.09	1.57 (0.43, 5.77)	.50	0.89 (0.39, 2.01)	.77	0.67 (0.12, 3.85)	.66	0.51 (0.17, 1.54)	.23
	Adjusted	2.12 (0.89, 5.01)	.09	1.60 (0.46, 5.54)	.46	0.89 (0.39, 2.02)	.78	0.56 (0.1, 3.29)	.52	0.55 (0.18, 1.63)	.28
Stroke	Unadjusted	1.44 (0.52, 4.01)	.49	--		1.23 (0.31, 4.84)	.77	--		2.66 (0.58, 12.31)	.21
	Adjusted	1.63 (0.57, 4.64)	.36	--		1.35 (0.33, 5.49)	.67	--		3.14 (0.64, 15.38)	.16

[a]COPD: Chronic Obstructive Pulmonary Disease

Table 4. Unadjusted and Adjusted Odds Ratio and 95% Confidence Interval of Chronic Health Conditions among Sexual Minority Adults compared to Heterosexual Adults within each Race Group in Hawaii, Behavioral Risk Factor Surveillance System, 2015 – 2019.

	Reference	White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual	
	Sexual Minority	Native Hawaiian		Pacific Islander		Asian		Unspecified		White	
Outcome		OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Asthma Current	Unadjusted	4.16 (3.07, 5.63)	<.001	1.70 (0.89, 3.26)	.111	2.27 (1.56, 3.3)	<.001	2.29 (1.29, 4.08)	.005	1.97 (1.17, 3.32)	.011
	Adjusted	3.91 (2.87, 5.34)	<.001	1.6 (0.83, 3.09)	.163	2.16 (1.48, 3.17)	<.001	2.15 (1.21, 3.83)	.009	1.85 (1.09, 3.14)	.023
Asthma Ever	Unadjusted	3.89 (2.95, 5.13)	<.001	1.03 (0.55, 1.92)	.93	1.91 (1.4, 2.61)	<.001	1.85 (1.11, 3.06)	.017	1.52 (0.95, 2.43)	.083
	Adjusted	3.34 (2.53, 4.41)	<.001	0.85 (0.45, 1.62)	.63	1.71 (1.24, 2.34)	<.001	1.56 (0.93, 2.59)	.090	1.30 (0.80, 2.11)	.30
Cancer	Unadjusted	0.42 (0.27, 0.66)	<.001	0.04 (0.01, 0.17)	<.001	0.3 (0.19, 0.47)	<.001	0.26 (0.13, 0.52)	<.001	0.60 (0.40, 0.90)	.014
	Adjusted	0.95 (0.58, 1.55)	.83	0.09 (0.02, 0.44)	.003	0.37 (0.22, 0.62)	<.001	0.6 (0.29, 1.24)	.166	1.21 (0.81, 1.81)	.36
Heart Disease	Unadjusted	0.69 (0.37, 1.27)	.23	0.74 (0.1, 5.38)	.77	0.75 (0.33, 1.7)	.50	0.55 (0.24, 1.26)	.155	0.71 (0.32, 1.55)	.39
	Adjusted	1.78 (0.93, 3.4)	.081	2.54 (0.43, 15.05)	.30	1.06 (0.45, 2.51)	.90	1.48 (0.63, 3.43)	.37	1.49 (0.69, 3.22)	.32
COPD[a]	Unadjusted	1.26 (0.81, 1.94)	.30	0.61 (0.23, 1.58)	.31	1.27 (0.68, 2.36)	.45	1.87 (0.92, 3.8)	.085	0.85 (0.45, 1.61)	.62
	Adjusted	2.19 (1.4, 3.43)	<.001	1.19 (0.45, 3.15)	.73	1.59 (0.86, 2.97)	.14	3.41 (1.65, 7.04)	<.001	1.35 (0.71, 2.56)	.36
Diabetes	Unadjusted	2.33 (1.64, 3.32)	<.001	1.64 (0.75, 3.58)	.21	1.99 (1.38, 2.87)	<.001	1.58 (0.81, 3.08)	.180	1.19 (0.67, 2.15)	.55
	Adjusted	5.47 (3.8, 7.85)	<.001	5.15 (2.5, 10.64)	<.001	2.99 (2.01, 4.45)	<.001	3.87 (1.88, 8)	<.001	2.31 (1.27, 4.20)	<.001
Hypertension	Unadjusted	0.98 (0.73, 1.33)	.91	0.61 (0.28, 1.35)	.23	1.3 (0.97, 1.74)	.08	0.88 (0.49, 1.6)	.68	0.72 (0.48, 1.09)	.12
	Adjusted	2.13 (1.53, 2.97)	<.001	1.65 (0.66, 4.17)	.29	1.95 (1.43, 2.68)	<.001	1.93 (0.98, 3.81)	.056	1.26 (0.83, 1.93)	.28
Kidney Disease	Unadjusted	1.34 (0.76, 2.36)	.32	0.67 (0.15, 3.09)	.61	2.00 (1.14, 3.5)	.016	0.53 (0.12, 2.34)	.398	0.54 (0.17, 1.69)	.29
	Adjusted	2.48 (1.38, 4.45)	<.001	1.44 (0.3, 6.95)	.65	2.59 (1.43, 4.69)	<.001	1.00 (0.22, 4.54)	.99	0.89 (0.28, 2.79)	.84

Outcome	Reference	White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual	
	Sexual Minority	**Native Hawaiian**		**Pacific Islander**		**Asian**		**Unspecified**		**White**	
		OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Obesity	Unadjusted	3.32 (2.53, 4.35)	<.001	4.67 (2.59, 8.42)	<.001	1.07 (0.77, 1.49)	.67	2.35 (1.43, 3.86)	<.001	1.09 (0.66, 1.78)	.74
	Adjusted	3.8 (2.9, 4.97)	<.001	5.51 (3.07, 9.88)	<.001	1.23 (0.88, 1.71)	.23	2.66 (1.6, 4.4)	<.001	1.21 (0.72, 2.01)	.47
Smoking, Current	Unadjusted	2.49 (1.83, 3.39)	<.001	3.28 (1.69, 6.34)	<.001	1.5 (1.06, 2.12)	.022	1.57 (0.92, 2.68)	.097	2.52 (1.58, 4.00)	<.001
	Adjusted	2.23 (1.63, 3.06)	<.001	2.91 (1.51, 5.59)	<.001	1.49 (1.05, 2.11)	.026	1.4 (0.81, 2.43)	.235	2.34 (1.48, 3.72)	<.001
Stroke	Unadjusted	1.41 (0.85, 2.32)	.179	0.27 (0.07, 1.04)	.057	1.35 (0.7, 2.6)	.38	0.93 (0.44, 1.95)	.84	0.90 (0.42, 1.92)	.79
	Adjusted	3.26 (1.92, 5.53)	<.001	0.73 (0.18, 2.9)	.65	1.81 (0.94, 3.49)	.075	2.19 (1.01, 4.75)	.046	1.77 (0.85, 3.67)	.13

[a]COPD: Chronic Obstructive Pulmonary Disease

Table 5. Unadjusted and Adjusted Odds Ratio and 95% Confidence Interval of Chronic Health Conditions among Gender Minority (Transgender) Adults Compared to White Cisgender Adults, by Race in Hawaii, Behavioral Risk Factor Surveillance System, 2015 – 2019.

Outcome	Reference	White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual	
	Gender Minority (Transgender)	Native Hawaiian	*P*-value	Pacific Islander	*P*-value	Asian	*P*-value	Unspecified	*P*-value	White	*P*-value
		OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)	
Asthma Current	Unadjusted	4.12 (1.44, 11.83)	.009	1.99 (0.25, 15.62)	.51	1.32 (0.57, 3.09)	.52	2.30 (0.36, 14.63)	.38	3.51 (0.74, 16.73)	.115
	Adjusted	4.13 (1.44, 11.92)	.009	1.76 (0.23, 13.27)	.58	1.27 (0.54, 2.98)	.58	2.32 (0.36, 14.96)	.38	3.25 (0.74, 14.37)	.120
Asthma Ever	Unadjusted	4.32 (1.79, 10.44)	<.001	2.70 (0.59, 12.44)	.20	1.59 (0.80, 3.15)	.18	1.75 (0.35, 8.71)	.49	2.02 (0.45, 9.04)	.36
	Adjusted	4.02 (1.68, 9.66)	<.001	2.08 (0.50, 8.65)	.31	1.49 (0.74, 2.99)	.26	1.60 (0.30, 8.46)	.58	1.78 (0.45, 7.03)	.41
Cancer	Unadjusted	1.54 (0.59, 4.04)	.38	--		0.49 (0.23, 1.05)	.068	0.20 (0.03, 1.50)	.116	0.63 (0.26, 1.56)	.32
	Adjusted	3.10 (0.92, 10.42)	.068	--		0.51 (0.23, 1.17)	.111	0.48 (0.08, 2.79)	.42	0.70 (0.28, 1.76)	.45
Heart Disease	Unadjusted	0.28 (0.06, 1.20)	.086	--		0.41 (0.10, 1.68)	.21	0.85 (0.10, 7.04)	.88	1.73 (0.31, 9.59)	.53
	Adjusted	0.47 (0.10, 2.10)	.32	--		0.44 (0.10, 1.86)	.27	2.71 (0.33, 22.56)	.36	2.01 (0.33, 12.38)	.45
COPD[a]	Unadjusted	1.09 (0.41, 2.86)	.87	--		1.41 (0.50, 3.96)	.51	0.58 (0.07, 4.75)	.61	--	
	Adjusted	1.54 (0.59, 4.02)	.38	--		1.5 (0.52, 4.36)	.46	1.11 (0.15, 8.56)	.91	--	
Diabetes	Unadjusted	2.56 (0.99, 6.65)	.053	0.45 (0.06, 3.50)	.45	1.71 (0.80, 3.64)	.17	2.41 (0.29, 20.19)	.42	1.13 (0.23, 5.51)	.88
	Adjusted	4.59 (1.67, 12.62)	<.001	1.54 (0.19, 12.28)	.68	1.90 (0.88, 4.10)	.10	6.89 (0.95, 49.67)	.056	1.32 (0.27, 6.40)	.73
Hypertension	Unadjusted	0.71 (0.31, 1.62)	.41	0.51 (0.12, 2.24)	.37	1.43 (0.78, 2.64)	.25	2.22 (0.44, 11.29)	.34	1.08 (0.44, 2.65)	.86
	Adjusted	1.16 (0.57, 2.35)	.69	1.81 (0.43, 7.68)	.42	1.81 (0.88, 3.69)	.106	5.34 (0.93, 30.62)	.060	1.35 (0.55, 3.32)	.52
Kidney Disease	Unadjusted	0.68 (0.17, 2.76)	.59	--		0.69 (0.15, 3.05)	.62	--		1.48 (0.41, 5.43)	.55
	Adjusted	0.97 (0.25, 3.75)	.97	--		0.73 (0.17, 3.21)	.68	--		1.67 (0.45, 6.17)	.44

Outcome	Reference	White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual		White Heterosexual	
	Gender Minority (Transgender)	**Native Hawaiian**	*P*-value	**Pacific Islander**	*P*-value	**Asian**	*P*-value	**Unspecified**	*P*-value	**White**	*P*-value
		OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)	
Obesity	Unadjusted	3.58 (1.57, 8.18)	.003	1.65 (0.46, 5.94)	.45	1.58 (0.83, 3.01)	.166	2.44 (0.34, 17.61)	.38	1.37 (0.54, 3.53)	.51
	Adjusted	3.76 (1.64, 8.59)	.002	2.13 (0.64, 7.09)	.22	1.7 (0.91, 3.20)	.098	2.56 (0.35, 18.76)	.36	1.60 (0.63, 4.11)	.33
Smoking	Unadjusted	3.73 (1.56, 8.93)	.003	3.02 (0.83, 10.97)	.093	0.68 (0.3, 1.54)	.36	0.83 (0.15, 4.70)	.83	0.51 (0.17, 1.54)	.23
	Adjusted	3.38 (1.43, 8.02)	.006	2.66 (0.78, 9.11)	.120	0.70 (0.31, 1.59)	.39	0.63 (0.11, 3.63)	.60	0.55 (0.18, 1.63)	.28
Stroke	Unadjusted	1.87 (0.67, 5.19)	.23	--		1.21 (0.31, 4.78)	.79	--		2.66 (0.58, 12.31)	.21
	Adjusted	3.19 (1.12, 9.06)	.029	--		1.30 (0.32, 5.27)	.72	--		3.14 (0.64, 15.38)	.159

[a]COPD: Chronic Obstructive Pulmonary Disease

DISCUSSION

The findings of this study provide evidence that many chronic health conditions have an association with sexual minority persons in Hawai'i compared to White heterosexual counterparts, except for heart disease. Notable differences among gender minority persons were observed in Native Hawaiian adults compared to White cisgender counterparts. Thesefindings align with a 2021 CDC report that found a higher prevalence of several underlying health conditions associated with severe COVID-19 among sexual minority populations compared to non-sexual minority populations in the US.[14]

Although a study by the CDC reported the increased understanding of the impact of COVID-19 on SGM people across the US, the limited race groups used in the study were not generalizable to the unique racial demography of Hawai'i[14] In 2020, COVID-19 disparities in the US as a whole primarily affected African American, Native American, and LatinX communities,[23] whereas Pacific Islander and Native Hawaiian communities were the most affected communities in Hawai'i that same year.[19] Minority individuals, particularly SGM people, experience stigmatization and discrimination,[24] which may prevent optimal health care and access to care, and reduce overall well-being. This study illustrates that the disparities are especially pronounced for Native Hawaiian sexual minority people, for multiple underlying health conditions compared to Native Hawaiian and White heterosexuals. Among Native Hawaiian transgender people, associations with asthma, diabetes, obesity, smoking, and stroke (compared to White heterosexuals) were reported.

A true understanding of the health issues of SGM people in Hawai'i is currently limited by the lack of published research, both locally and nationally. SGM data are often not collected in electronic health records within institutional systems, including COVID-19 surveillance.[19,24] Such exclusion in reporting of data has resulted in limited information for SGM communities.[25] This hinders health care services and may mask public health significance for vulnerable communities like SGM persons who need special care and services.[25,26] The Hawai'i BRFSS has collected data through the Sexual Orientation and Gender Identity (SOGI) module since 2014.[27] Including this module in state-level data collection and reporting is one important way to track behavioral and chronic diseases among SGM adults that could lead to sustainable preventive measures and care. Notably, Hawai'i also collects data on sexual orientation and gender identity among high school and middle school students via the Youth Risk Behavior Survey.[28]

To reduce race and SGM disparities for health conditions in Hawai'i, culturally appropriate prevention, surveillance, and management are needed. Digital health interventions tailored for SGM individuals hold the potential for cost-effectiveness and may reduce barriers to health care access, especially in using social media-delivered interventions focused on improving mental and physical health outcomes.[29] Future interventions can benefit from enhancing protective and resilience factors (adult and peer support, and adaptive coping strategies) and reducing known risk factors to improve SGM health.[29] Given the disparate impact on Native Hawaiian SGM communities, culturally congruent research and resources (eg, *No Ka Māhūi: Kanaka LGBTQIA+ & Māhū Toolkit* from Papa Ola Lōkahi[30]) will play an important role in improving health outcomes.

This study adds to the limited reporting of health outcomes by sexual orientation and gender identity with race by having a large representation of Native Hawaiian adults. The study also brings attention to the large disparities between SGM and race needed to ensure health equity for all, especially for populations in the Pacific region.

There are several limitations to this study. BRFSS is a cross-sectional survey based on self-reported information, and respondents may have felt uncomfortable answering honestly about sexual orientation, gender identity, and/or personal health information. Generally, the SOGI module has a low refusal rate, but this differs by age, sex, education, and language.[31] Individuals who responded to the sexual orientation question as "something else" were categorized as "questioning", but it is unclear if the respondent did not understand the question. Hawai'i residents who did not respond to the SOGI questions and responses missing sex and age were excluded from the current study. This may have resulted in undercounting of SGM people in this analysis. Also, underlying health conditions reported by the CDC as COVID-19 risk factors were not assessed for clinical determination. The study reports on data prior to the COVID-19 pandemic, and the prevalence of these conditions may have changed. Lastly, the decision to utilize AOR as the primary measure of association rather than reporting prevalence estimates could be a limitation. While AOR offers valuable insights into the strength and direction of relationships between measures, the AOR reported may overestimate the association compared to prevalence estimates.

CONCLUSION

Chronic health conditions that may pose an increased risk for severe COVID-19 illness are disproportionately prevalent among SGM populations in Hawai'i. These disparities are evident among certain racial groups, especially Native Hawaiian SGM people. The lack of surveillance data, especially on COVID-19, among SGM patients in health care systems restricts public health efforts for this population. Further research is needed to assess COVID-19-related illness among SGM and racial minority populations, especially Native Hawaiian communities in Hawai'i. Policy and program efforts to protect vulnerable communities in culturally congruent ways are needed to support optimal health and well-being for all.

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Institutional Review Board Statement

The Hawai‘i Department of Health reviewed and approved this study and data usage protocols. Public de-identified data from a national survey was used for secondary analysis and did not require Institutional Review.

Declaration of Interest

The authors declare no conflicts of interest.

Author Contribution

ABY: contributed to the conceptualization, formal analysis, methodology, writing of the draft, review, and editing; TP: contributed to the conceptualization and writing of the draft, review, and editing. All authors read and approved the final manuscript.

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