

A Population-Based Study of Sexual Orientation Identity and Gender Differences in Adult Health

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Most research on sexual minority health in the United States has been conducted using convenience samples. Although the findings of this research have made significant contributions to the literature, data collected from nonprobability samples have limited utility for public health planning because of concerns regarding selection bias and external validity. Population-based health statistics play a key role in informing the prioritization of public health problems and public investment in health promotion activity.

Relatively recent inclusion of sexual orientation measures in a few federal and state health surveillance surveys is enabling the production of population-based information about sexual minority health and its status relative to that of the heterosexual majority. Although the amount of sexual orientation data collected with known probability is increasing, published studies of such data are limited in number and scope. To date, most have reported on sexual orientation differences in the prevalence of psychiatric disorders,^{1–5} and a handful have explored other health issues (e.g., tobacco use, health care access, violence victimization, and chronic disease risk).^{6–11}

Examination of variability within the sexual minority population is another limitation of the current population-based literature. Few studies have been adequately powered to investigate variability in health by sexual orientation, let alone by orientation and other key social characteristics (e.g., gender, race/ethnicity, socioeconomic status); yet research suggests heterogeneity in sexual minority health. For instance, lesbians who participated in the National Survey of Family Growth were much more likely to be overweight than were heterosexual women, but the same was not true of bisexual women.⁶ Bisexual women and gay male participants in the representative California Quality of Life Survey (QLS) were more likely to report digestive problems than were their

Objectives. We provide estimates of several leading US adult health indicators by sexual orientation identity and gender to fill gaps in the current literature.

Methods. We aggregated data from the 2001–2008 Massachusetts Behavioral Risk Factor Surveillance surveys (N=67 359) to examine patterns in self-reported health by sexual orientation identity and gender, using multivariable logistic regression.

Results. Compared with heterosexuals, sexual minorities (i.e., gays/lesbians, 2% of sample; bisexuals, 1%) were more likely to report activity limitation, tension or worry, smoking, drug use, asthma, lifetime sexual victimization, and HIV testing, but did not differ on 3-year Papanicolaou tests, lifetime mammography, diabetes, or heart disease. Compared with heterosexuals, bisexuals reported more barriers to health care, current sadness, past-year suicidal ideation, and cardiovascular disease risk. Gay men were less likely to be overweight or obese and to obtain prostate-specific antigen tests, and lesbians were more likely to be obese and to report multiple risks for cardiovascular disease. Binge drinking and lifetime physical intimate partner victimization were more common among bisexual women.

Conclusions. Sexual orientation disparities in chronic disease risk, victimization, health care access, mental health, and smoking merit increased attention. More research on heterogeneity in health and health determinants among sexual minorities is needed. (*Am J Public Health.* 2010;100:1953–1960. doi:10.2105/AJPH.2009.174169)

same-gender, heterosexual peers, whereas lesbians and bisexual men were not.¹²

This study extends the literature by providing estimates of several leading US health indicators by both sexual orientation identity and gender. To our knowledge, ours is one of few studies to do so and is the first to report on a US East Coast sample. As Healthy People 2020 priorities are established, information about sexual orientation differences across a spectrum of health issues and geographic regions is greatly needed.

METHODS

The Behavioral Risk Factor Surveillance System is a state-based system of health surveys operated collaboratively by the US Centers for Disease Control and Prevention and state departments of public health.¹³ Each year in Massachusetts, a geographically stratified household sample of adults who can be

reached by landline telephone is drawn, using random-digit-dialing methods (average 2001–2008 cooperation rate=62%).¹⁴ After an interviewer from a survey research firm obtains oral consent by telephone, 1 adult per household completes a 25- to 35-minute anonymous survey in English, Spanish, or Portuguese. To reduce the time required to complete the survey, respondents are randomly assigned to 3 survey completion patterns. Topics such as health insurance coverage, cancer screening, and sexual behavior are assessed with core items provided by the Centers for Disease Control and Prevention and supplemental items provided by states. In 2001, Massachusetts added the following item: “Do you consider yourself to be: heterosexual or straight, homosexual or gay (if male), lesbian (if female), bisexual, or other?”¹⁵ “Don’t know” responses and refusals were recorded by the interviewer.

From 2001 through 2008, 70 600 Massachusetts residents aged 18 to 64 years were asked their sexual orientation identity as part of

the Behavioral Risk Factor survey. A small minority ($n=2314$; 3.2% weighted) declined or refused to provide a response. Others ($n=406$; 0.5%) answered that they “didn’t know,” and some ($n=521$; 0.5%) selected “other” as their sexual orientation identity. Demographic comparisons of nonresponders to responders indicated that people who refused to answer the sexual orientation question were more likely to refuse to answer other demographic questions. Those who said they “didn’t know” were more likely to have completed the survey in Spanish or Portuguese or to have reported less than a high school education. No clear demographic pattern emerged among respondents who selected “other” as their sexual orientation identity. Data on the gender of past-year sexual partners were collected from a subset of all respondents, disallowing any meaningful reclassification of nonresponders and those who selected “other.” Thus, the analytic sample was restricted to 67 359 Massachusetts residents who reported sexual identities of heterosexual or straight, gay/lesbian or homosexual, or bisexual.

Measures

Most demographic and health characteristics were assessed with single items.¹⁵ All data were self-reported. Participant-reported annual household income range and size were used to create an ordinal measure of percentage poverty. Annual household income was recoded to the midpoint for each income range, or to the 80th percentile of annual family income (\$94 150–\$113 205)¹⁶ for those who selected the highest income category ($\geq \$75 000$). Recoded income was divided by size-specific poverty thresholds¹⁷ to obtain percentage poverty (i.e., the “income-to-needs ratio” according to US census criteria).¹⁸ Following Cochran and Mays,¹² we dichotomized percentage poverty to create higher ($<300\%$ poverty) and lower ($\geq 300\%$ poverty) economic status groups.

Self-rated health was parameterized as poor or fair versus good or better. A cutpoint of 15 or more days of tension or worry and sad or blue mood during the prior month was used to create indicators of poor mental health. Mutually exclusive weight groups (underweight, normal, overweight, obese) were created on the basis of Centers for Disease Control and Prevention guidelines for body mass index

(calculated on the basis of height and weight).¹⁹ High risk for cardiovascular disease was indicated by the presence of obesity or smoking plus 1 “other” risk factor (i.e., lack of moderate physical activity, lifetime diabetes, high blood pressure, and high cholesterol) or 3 or more “other” risk factors in the absence of obesity or smoking.²⁰ Lifetime physical intimate partner victimization was indicated by a report of ever having been hit, slapped, pushed, kicked, physically hurt, or threatened with any of these behaviors by an intimate partner.

Analysis

Two sets of analyses were conducted to evaluate similarities and differences in health by sexual orientation. First, age- and gender-standardized prevalence proportions were estimated to provide information about the burden of a particular health condition or risk factor in each sexual orientation group. Next, multivariable binary and multinomial logistic regression procedures were used to generate odds ratios (ORs) and 95% confidence intervals (CIs). Demographic covariates that were statistically associated with sexual orientation, and thus could confound associations between sexual orientation and health outcomes, were included in regression models. Adjusted ORs represent the odds of a health characteristic occurring among gays/lesbians or bisexuals relative to the odds among heterosexuals, while accounting for differences in the age, gender, and educational composition of each sexual orientation group.

To assess whether associations between sexual orientation and health varied in magnitude or direction between women and men, we tested for effect modification. The presence of a statistically significant interaction term (between gender and dummy variables for gay or lesbian and bisexual sexual orientation) in regression models that also contained main effects was considered evidence of effect modification. Given that tests of interaction may be statistically underpowered in smaller subsets of participants, gender-stratified estimates were produced for all health characteristics.

Analyses were conducted with SUDAAN statistical software that produces design-adjusted standard errors.²¹ Missing values on sociodemographic items (range: 0.1% missing on

education to 10.0% missing on income) were multiply imputed with the MI procedure from SAS version 9.1.²² Missing values for health outcomes were either uncommon or were missing completely at random²³ because of skip patterns and were not imputed. Sampling weights provided by the Massachusetts Department of Public Health were used to address different probabilities of survey selection and participation, such that the weighted sample reflects the state adult household population. Tests of statistical association were 2-tailed and relied upon an α of 0.05. Design-based estimates and CIs are presented in the text and tables; sample sizes correspond to the actual number of participants.

RESULTS

Three percent of the weighted sample self-identified as either gay or lesbian (2.0%; 95% CI=1.9, 2.2) or bisexual (1.0%; 95% CI=0.9, 1.1), and 97.0% (95% CI=96.8, 97.2) reported a heterosexual or straight sexual orientation identity. The age distribution of gays and lesbians was similar to that of heterosexuals, and bisexuals were younger (Table 1). A larger (59%) weighted proportion of gay/lesbian adults in the sample were men, whereas more bisexuals were women (66% weighted proportion, not shown). Sexual minorities and heterosexuals were distributed similarly across racial/ethnic groups, but they differed on relationship status, the presence of children in the household, and indicators of socioeconomic status.

Gays and lesbians were more likely to have at least a 4-year college degree than were heterosexuals and bisexuals (not shown). Unemployment was more common (OR=1.7; 95% CI=1.3, 2.3) among gay men than among heterosexual men, and among bisexuals (OR=2.8; 95% CI=1.9, 3.9) than among heterosexuals, after adjustment for educational attainment (not shown). Bisexuals were more likely (OR=1.5; 95% CI=1.1, 2.1) than were heterosexuals to be living at less than 300% poverty, with adjustment for education and employment, whereas gays and lesbians were not (not shown).

No health insurance, the absence of a regular health care provider, and no dental care within the prior year were more commonly reported

TABLE 1—Demographic Characteristics of Participants (N=67 359), by Sexual Orientation Identity and Gender: Massachusetts Behavioral Risk Factor Surveillance Survey Respondents, 2001–2008

	Heterosexual			Gay or Lesbian			Bisexual		
	All	Men	Women	All	Men	Women	All	Men	Women
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Total	65 088 (100)	25 387 (100)	39 701 (100)	1645 (100)	926 (100)	719 (100)	626 (100)	194 (100)	432 (100)
Age, y									
18–33	14 511 (33.1)	5 698 (33.7)	8 813 (32.5)	277 (29.7)	141 (29.2)	136 (30.4)	259 (59.5)	46 (48.6)	213 (65.1)
34–49	26 736 (39.8)	10 395 (39.5)	16 341 (40.2)	832 (49.3)	474 (49.7)	358 (48.8)	232 (29.5)	81 (35.3)	151 (26.5)
50–64	23 841 (27.1)	9 294 (26.8)	14 547 (27.3)	536 (21.0)	311 (21.1)	225 (20.9)	135 (11.0)	67 (16.2)	68 (8.4)
Race/ethnicity									
White, non-Hispanic	52 439 (82.3)	20 836 (81.4)	31 603 (83.2)	1423 (84.2)	805 (82.1)	618 (87.2)	469 (77.2)	139 (74.0)	330 (78.9)
Black, non-Hispanic	3422 (4.2)	1248 (4.3)	2174 (4.1)	77 (4.7)	42 (4.8)	35 (4.5)	40 (4.9)	13 (5.3)	27 (4.7)
Hispanic	6687 (8.9)	2125 (8.8)	4562 (8.9)	103 (7.6)	57 (9.0)	46 (5.7)	75 (10.9)	28 (14.1)	47 (9.3)
Asian	1486 (3.2)	753 (3.8)	733 (2.6)	19 (2.3)	14 (3.2)	5 (1.2)	21 (5.0)	7 (3.6)	14 (5.7)
American Indian and other ^a	1054 (1.4)	425 (1.6)	629 (1.2)	23 (1.2)	8 (1.0)	15 (1.5)	21 (2.0)	7 (3.0)	14 (1.6)
Relationship status									
Married	34 869 (59.2)	14 413 (59.5)	20 456 (59.0)	309 (19.1)	130 (14.4)	179 (25.8)	148 (23.6)	43 (24.7)	105 (23.0)
Formerly married	13 660 (12.1)	4049 (9.7)	9611 (14.5)	193 (8.2)	94 (7.6)	99 (9.1)	149 (15.7)	55 (20.7)	94 (13.1)
Never married	13 958 (23.8)	5916 (26.0)	8042 (21.6)	743 (42.4)	513 (51.1)	230 (29.9)	241 (44.5)	85 (48.2)	156 (42.6)
Coupled	2601 (4.9)	1009 (4.9)	1592 (4.9)	400 (30.3)	189 (27.0)	211 (35.1)	88 (16.2)	11 (6.4)	77 (21.3)
Child in household									
Yes	28 938 (48.3)	10 218 (46.0)	18 720 (50.5)	248 (18.7)	70 (12.2)	178 (27.9)	211 (34.5)	32 (28.3)	179 (37.7)
No	36 150 (51.7)	15 169 (54.1)	20 981 (49.5)	1397 (81.3)	856 (87.8)	541 (72.1)	415 (65.5)	162 (71.7)	253 (62.3)
Education									
≤ High school/GED	21 206 (30.7)	8567 (32.6)	12 639 (28.9)	284 (21.0)	162 (22.9)	122 (18.3)	188 (29.6)	62 (33.6)	126 (27.5)
1–3 y college	15 540 (24.4)	5473 (22.9)	10 066 (26.0)	368 (22.9)	214 (24.8)	154 (20.1)	145 (25.0)	48 (27.5)	97 (23.7)
≥ 4 y college	28 342 (44.9)	11 346 (44.6)	16 996 (45.1)	993 (56.1)	550 (52.3)	443 (61.6)	293 (45.4)	84 (38.8)	209 (48.8)
Employment status									
Employed	47 483 (74.8)	20 079 (81.1)	27 404 (68.6)	1281 (78.3)	726 (78.3)	555 (78.4)	383 (59.6)	120 (65.8)	263 (56.3)
Unemployed	8836 (10.3)	3199 (9.6)	5637 (10.9)	239 (12.6)	129 (13.2)	110 (11.9)	141 (20.5)	51 (20.6)	90 (20.5)
Not in workforce	8769 (15.0)	2109 (9.2)	6660 (20.5)	125 (9.1)	71 (8.6)	54 (9.8)	102 (19.9)	23 (13.6)	79 (23.2)
Percentage poverty									
< 300%	24 266 (35.3)	8204 (33.1)	16 061 (37.5)	452 (28.0)	236 (27.2)	217 (29.0)	329 (51.8)	96 (49.9)	233 (52.8)
≥ 300%	40 822 (64.7)	17 183 (66.9)	23 640 (62.6)	1193 (72.0)	690 (72.8)	502 (71.0)	297 (48.2)	98 (50.1)	199 (47.2)

Note. GED = general equivalency diploma. Percentages do not always equal 100 because of rounding. Numbers are unweighted counts; percentages are weighted proportions.

^aAlaska and Hawaii Natives and Pacific Islanders.

by bisexuals than by heterosexuals (Tables 2 and 3). Bisexuals were more likely (OR=3.5; 95% CI=2.4, 5.0) to report fair/poor health and an activity limitation attributable to a physical, mental, or emotional disability than were heterosexuals (for men, OR =2.2; 95% CI=1.3, 3.6; for women, OR=4.5; 95% CI=3.3, 6.3). Gays and lesbians were also more likely (OR=1.6; 95% CI=1.3, 1.9) to report an activity limitation. Gay men were less likely to be overweight (OR=0.5; 95%

CI=0.4, 0.7) or obese (OR=0.5; 95% CI=0.3, 0.6) than were heterosexual men, whereas lesbians were more likely to be obese (OR=2.1; 95% CI=1.6, 2.7) than were heterosexual women. Weight did not differ between bisexuals and heterosexuals.

Lifetime HIV screening was more common among sexual minorities than among heterosexuals; however, the magnitudes of these differences varied by sexual orientation and gender. The odds of HIV screening were 1.8 times greater

(95% CI=1.4, 2.2) among lesbians than among heterosexual women, 2.7 times greater (95% CI=2.0, 3.6) among bisexuals than among heterosexuals, and 6.8 times greater (95% CI=5.2, 9.0) among gay men than among heterosexual men. Gay men aged 50 years and older were more likely to report receipt of a sigmoidoscopy or colonoscopy (OR=1.7; 95% CI=1.1, 2.6) than were heterosexual men the same age, whereas gay men aged 40 years and younger were less likely (OR=0.7; 95% CI=0.5, 0.9) to report

TABLE 2—Standardized Health Characteristics of Participants, by Sexual Orientation Identity and Gender (N = 67 359): Massachusetts Behavioral Risk Factor Surveillance Survey Respondents, 2001–2008

	No. ^a	Heterosexual (n = 65 088)			Gay or Lesbian (n = 1645)			Bisexual (n = 626)		
		All	Men	Women	All	Men	Women	All	Men	Women
		% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)	% (SE)
Health care access										
No health insurance	67 224	9.3 (0.2)	11.5 (0.3)	7.1 (0.2)	9.6 (1.2)	12.3 (1.9)	7.0 (1.4)	18.3 (2.6)	23.7 (4.8)	12.9 (2.3)
No regular provider	67 231	13.8 (0.2)	18.5 (0.4)	9.2 (0.2)	13.1 (1.6)	14.9 (2.1)	11.3 (2.3)	22.4 (2.6)	28.8 (4.6)	16.1 (2.5)
No dental cleaning, prior year	32 842	21.6 (0.4)	24.7 (0.6)	18.6 (0.4)	22.9 (2.7)	24.7 (3.4)	21.2 (4.1)	31.8 (4.3)	34.7 (7.3)	29.0 (4.6)
General health										
Fair/poor self-rated health	67 047	9.7 (0.2)	9.3 (0.3)	10.1 (0.2)	9.8 (1.0)	8.9 (1.4)	10.6 (1.5)	22.0 (2.8)	24.7 (4.9)	19.4 (2.8)
Activity limitation caused by disability	63 635	14.9 (0.2)	13.9 (0.3)	15.9 (0.3)	20.5 (1.4)	17.1 (1.9)	23.9 (2.2)	33.8 (2.8)	26.3 (4.3)	41.0 (3.7)
Weight										
Underweight	60 935	1.7 (0.1)	0.6 (0.1)	2.8 (0.1)	1.8 (0.5)	1.7 (0.7)	1.9 (0.7)	3.5 (1.0)	2.4 (1.4)	4.5 (1.5)
Normal		43.2 (0.3)	32.4 (0.4)	53.5 (0.4)	47.6 (1.9)	47.4 (2.6)	47.8 (2.8)	44.4 (3.3)	39.5 (5.3)	49.2 (3.9)
Overweight		35.9 (0.3)	45.8 (0.5)	26.3 (0.3)	30.3 (1.6)	36.9 (2.5)	23.9 (2.1)	30.4 (2.9)	34.2 (4.9)	26.7 (3.3)
Obese		19.2 (0.2)	21.2 (0.4)	17.4 (0.3)	20.3 (1.4)	14.0 (1.7)	26.4 (2.3)	21.7 (2.6)	23.9 (4.3)	19.6 (2.9)
Screening tests^b										
HIV	63 580	42.8 (0.3)	41.5 (0.5)	44.0 (0.4)	69.5 (1.6)	81.9 (2.1)	57.5 (2.4)	67.7 (2.9)	70.5 (4.7)	65.0 (3.5)
Sigmoidoscopy or colonoscopy ^c	17 915	57.8 (0.5)	59.5 (0.8)	56.2 (0.7)	65.4 (3.3)	73.3 (4.3)	57.9 (5.0)	65.0 (6.4)	55.2 (10.2)	74.2 (7.7)
Prostate-specific antigen ^d	10 483		49.8 (0.7)			42.9 (3.1)			51.6 (8.6)	
Mammogram ^d	27 264			58.9 (0.3)			65.4 (3.9)			56.4 (3.4)
Papanicolaou test, prior 3 years	21 946			90.1 (0.3)			89.8 (2.1)			86.7 (3.4)
Chronic health conditions										
Diabetes	67 296	4.3 (0.1)	4.7 (0.2)	3.9 (0.1)	3.8 (0.6)	3.8 (0.9)	3.8 (0.9)	4.2 (1.1)	4.4 (1.9)	3.9 (1.1)
Heart disease	51 129	1.9 (0.1)	2.5 (0.1)	1.3 (0.1)	2.5 (0.7)	3.2 (1.2)	1.8 (0.6)	3.8 (1.5)	4.3 (2.0)	3.3 (2.2)
Asthma	67 217	15.0 (0.2)	12.6 (0.3)	17.4 (0.3)	20.2 (1.5)	15.4 (1.8)	24.9 (2.3)	20.5 (2.4)	15.0 (3.7)	25.7 (3.1)
High CVD risk	25 833	29.0 (0.4)	30.8 (0.7)	27.3 (0.5)	31.1 (2.6)	28.1 (3.6)	34.0 (3.7)	47.0 (5.6)	53.0 (9.9)	41.3 (5.5)
Mental health										
Tense/worried ≥ 15 of prior 30 d	22 258	20.8 (0.4)	19.1 (0.6)	22.5 (0.5)	25.6 (2.5)	23.9 (3.6)	27.3 (3.5)	37.3 (4.8)	37.5 (8.0)	37.2 (5.4)
Sad/blue ≥ 15 of prior 30 d	16 669	16.0 (0.4)	15.2 (0.7)	16.8 (0.5)	16.5 (2.4)	19.1 (3.8)	14.0 (3.1)	25.3 (4.0)	24.3 (6.4)	26.3 (4.9)
Seriously considered suicide, prior y	14 325	3.0 (0.3)	3.2 (0.4)	2.9 (0.3)	4.2 (1.2)	5.8 (1.9)	2.5 (1.5)	18.5 (4.4)	11.1 (6.2)	25.7 (6.3)
Cigarette smoking										
Current smoker	67 159	20.0 (0.2)	20.6 (0.4)	19.4 (0.3)	29.3 (1.9)	32.5 (2.5)	26.3 (2.7)	36.2 (3.1)	35.4 (5.0)	36.9 (3.7)
Former smoker		24.8 (0.2)	25.3 (0.4)	24.3 (0.3)	28.4 (1.5)	24.9 (2.1)	31.8 (2.3)	19.4 (2.1)	14.9 (2.9)	23.8 (3.0)
Nonsmoker		55.3 (0.3)	54.1 (0.4)	56.3 (0.4)	42.2 (1.9)	42.6 (2.5)	41.9 (2.7)	44.5 (3.1)	49.7 (5.3)	39.4 (3.3)
Binge drinking, prior 30 d	66 208	21.0 (0.2)	29.5 (0.4)	12.6 (0.3)	24.2 (1.7)	31.0 (2.4)	17.5 (2.5)	22.1 (2.6)	26.7 (4.5)	17.6 (2.6)
Illicit drug use, prior 30 d	14 207	7.7 (0.3)	10.1 (0.6)	5.4 (0.4)	16.5 (2.5)	23.5 (4.4)	9.7 (2.5)	29.8 (5.5)	19.9 (8.8)	39.4 (6.7)
Lifetime violence victimization										
Sexual assault	19 464	12.1 (0.3)	5.9 (0.4)	18.1 (0.5)	26.9 (2.8)	18.9 (3.2)	34.7 (4.5)	36.6 (4.1)	15.3 (5.3)	57.3 (6.2)
Physical intimate partner	2 222	18.2 (1.2)	14.1 (1.6)	22.2 (1.7)	31.2 (7.0)	31.2 (10.8)	31.1 (8.9)	32.8 (3.4)	2.7 (2.9)	61.9 (6.2)

Note. CVD = cardiovascular disease. Percentages are weighted proportions; SEs are design-adjusted standard errors.

^aNumber of participants who answered the survey item in the aggregate sample.

^bLifetime, unless otherwise noted.

^cParticipants aged ≥ 50 years.

^dParticipants aged ≥ 40 years.

receipt of a prostate-specific antigen test than were heterosexual men the same age. For women aged 40 years and older, there were no

statistically significant sexual orientation differences in lifetime mammography or receipt of a Papanicolaou test within the prior 3 years.

Sexual minorities and heterosexuals did not differ on lifetime diagnoses of diabetes or heart disease; however, sexual minorities were more

TABLE 3—Adjusted Odds Ratios (AORs) Comparing Health Characteristics of Gay/Lesbian and Bisexual Participants to Those of Heterosexual Participants: Massachusetts Behavioral Risk Factor Surveillance Survey Respondents, 2001–2008

	Gay/Lesbian vs Heterosexual				Bisexual vs Heterosexual				
	All		Men	Women	All		Men	Women	
	AOR (95% CI)	P	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	P	AOR (95% CI)	AOR (95% CI)	
Health care access									
No health insurance	1.17 (0.89, 1.53)	.78	1.20 (0.86, 1.69)	1.12 (0.72, 1.73)	2.22 (1.55, 3.18)	.28	2.76 (1.54, 4.94)	2.04 (1.32, 3.14)	
No regular provider	0.95 (0.73, 1.24)	.05	0.80 (0.57, 1.11)	1.35 (0.87, 2.08)	2.04 (1.47, 2.81)	.78	2.15 (1.26, 3.66)	2.02 (1.35, 3.03)	
No dental cleaning, prior year	1.13 (0.83, 1.54)	.54	1.05 (0.73, 1.50)	1.29 (0.75, 2.23)	1.85 (1.21, 2.82)	.86	1.75 (0.83, 3.71)	1.94 (1.19, 3.17)	
General health									
Fair/poor self-rated health	1.19 (0.93, 1.52)	.26	1.06 (0.74, 1.51)	1.39 (1.00, 1.95)	3.45 (2.39, 5.00)	.56	4.03 (2.09, 7.76)	3.14 (2.02, 4.87)	
Activity limitation caused by disability	1.58 (1.31, 1.89)	.08	1.37 (1.05, 1.80)	1.86 (1.45, 2.37)	3.68 (2.78, 4.88)	.01	2.15 (1.31, 3.55)	4.54 (3.26, 6.33)	
Weight									
		<.01				.19			
Overweight	0.73 (0.61, 0.87)		0.54 (0.43, 0.68)	1.08 (0.83, 1.40)	0.92 (0.67, 1.27)		0.67 (0.38, 1.20)	1.11 (0.79, 1.57)	
Obese	0.91 (0.74, 1.11)		0.46 (0.34, 0.63)	2.05 (1.56, 2.69)	1.17 (0.81, 1.69)		0.93 (0.50, 1.74)	1.28 (0.82, 2.00)	
Screening tests^a									
HIV	3.62 (3.08, 4.26)	<.01	6.84 (5.23, 8.97)	1.76 (1.42, 2.19)	2.72 (2.04, 3.63)	.42	3.28 (1.99, 5.41)	2.29 (1.60, 3.26)	
Sigmoidoscopy or colonoscopy ^b	1.34 (0.99, 1.82)	.07	1.67 (1.07, 2.61)	1.00 (0.66, 1.51)	1.28 (0.71, 2.32)	.11	0.82 (0.36, 1.86)	2.16 (0.96, 4.86)	
Prostate-specific antigen ^c			0.69 (0.51, 0.93)				1.10 (0.51, 2.35)		
Mammogram ^c				1.63 (0.88, 3.02)				1.31 (0.70, 2.46)	
Papanicolaou test, prior 3 years				0.84 (0.51, 1.38)				0.62 (0.32, 1.19)	
Chronic health conditions									
Diabetes	1.04 (0.72, 1.50)	.52	0.94 (0.56, 1.57)	1.23 (0.74, 2.06)	1.14 (0.61, 2.14)	.92	1.21 (0.37, 3.96)	1.04 (0.62, 1.76)	
Heart disease	1.50 (0.83, 2.71)	.68	1.37 (0.62, 3.03)	1.92 (0.95, 3.87)	2.19 (0.88, 5.43)	.65	1.90 (0.65, 5.51)	2.24 (0.53, 9.43)	
Asthma	1.48 (1.23, 1.77)	.21	1.32 (1.00, 1.73)	1.68 (1.32, 2.14)	1.39 (1.05, 1.85)	.33	1.07 (0.57, 1.99)	1.58 (1.15, 2.18)	
High CVD risk	1.23 (0.98, 1.55)	.07	1.01 (0.73, 1.39)	1.63 (1.17, 2.26)	2.24 (1.47, 3.43)	.96	2.25 (1.05, 4.79)	2.27 (1.36, 3.78)	
Mental health									
Tense/worried ≥15 of prior 30 d	1.42 (1.08, 1.86)	.89	1.38 (0.93, 2.04)	1.46 (0.99, 2.15)	2.75 (1.91, 3.96)	.92	2.69 (1.35, 5.36)	2.82 (1.83, 4.34)	
Sad/blue ≥15 of prior 30 d	1.26 (0.88, 1.81)	.37	1.45 (0.89, 2.35)	1.02 (0.60, 1.75)	2.43 (1.56, 3.78)	.68	2.08 (0.93, 4.68)	2.48 (1.47, 4.19)	
Seriously considered suicide, prior year	1.87 (0.96, 3.65)	.56	2.13 (0.97, 4.66)	1.38 (0.35, 5.44)	11.28 (5.24, 24.28)	.08	4.27 (0.82, 22.16)	20.56 (9.00, 47.00)	
Substance use									
Cigarettes		.05					.03		
Current smoker	2.33 (1.91, 2.84)		2.42 (1.88, 3.11)	2.20 (1.58, 3.07)	2.65 (1.95, 3.58)		2.03 (1.18, 3.49)	3.00 (2.10, 4.29)	
Former smoker	1.57 (1.32, 1.86)		1.39 (1.08, 1.78)	1.85 (1.46, 2.35)	1.21 (0.86, 1.71)		0.66 (0.38, 1.15)	1.57 (1.04, 2.37)	
Binge drinking, prior 30 d	1.16 (0.95, 1.42)	.13	1.05 (0.84, 1.32)	1.43 (0.98, 2.09)	1.16 (0.83, 1.61)	.05	0.78 (0.45, 1.34)	1.49 (1.02, 2.17)	
Illicit drug use, prior 30 d	2.76 (1.86, 4.08)	.34	3.09 (1.85, 5.17)	2.14 (1.18, 3.87)	5.33 (2.92, 9.74)	.06	2.28 (0.62, 8.39)	9.14 (4.54, 18.38)	
Lifetime violence victimization									
Sexual assault	2.93 (2.17, 3.95)	.15	3.72 (2.39, 5.79)	2.32 (1.60, 3.37)	3.87 (2.48, 6.05)	.37	2.83 (1.29, 6.24)	4.36 (2.50, 7.61)	
Physical intimate partner	1.90 (0.82, 4.39)	.6	2.44 (0.61, 9.70)	1.55 (0.65, 3.67)	2.62 (0.85, 8.09)	.02	0.26 (0.03, 2.27)	7.91 (1.46, 42.70)	

Note. CI = confidence interval; CVD = cardiovascular disease. The total sample size was N = 67 359. Odds ratios are adjusted for age, gender, and educational attainment; CIs are design-adjusted. All P values are χ -square P values for interaction to evaluate effect modification by gender.

^aLifetime, unless otherwise noted.

^bParticipants aged ≥ 50 years.

^cParticipants aged ≥ 40 years.

likely to report that a health provider had told them they had asthma (gays and lesbians, OR=1.5; 95% CI=1.2, 1.8; bisexuals, OR=1.4; 95% CI=1.1, 1.9). Lesbians and bisexuals were more likely than were heterosexuals to report

multiple risks for cardiovascular disease (lesbians, OR=1.6; 95% CI=1.2, 2.3; bisexuals, OR=2.2; 95% CI=1.5, 3.4).

Bisexuals fared poorly on all 3 indicators of mental health. The odds of frequent tension or

worry and sadness were 2 to 3 times greater among bisexuals than among heterosexuals. The odds of prior-year suicidal ideation were also elevated (OR=11.3; 95% CI=5.2, 24.3) among bisexuals. Frequent tension or worry

was more common (OR=1.4; 95% CI=1.1, 1.9) among gays/lesbians than among heterosexuals.

The odds of current smoking (OR=2.3; 95% CI=1.9, 2.8), former smoking (OR=1.6; 95% CI=1.3, 1.9), and any 30-day drug use (OR=2.8; 95% CI=1.9, 4.1) were greater among gays and lesbians than among heterosexuals. Bisexual men and women were also more likely to be current smokers (OR=2.0; 95% CI=1.2, 3.5; and OR=3.0; 95% CI=2.1, 4.3, respectively) than were their same-gender peers. Bisexual women were more likely than were heterosexual women to report binge drinking (OR=1.5; 95% CI=1.0, 2.2) and illegal drug use (OR=9.1; 95% CI=4.5, 18.4) within the prior 30 days.

Sexual minorities were more likely than were heterosexuals to report lifetime sexual assault victimization (gays and lesbians, OR=2.9; 95% CI=2.2, 4.0; bisexuals, OR=3.9; 95% CI=2.5, 6.1). Bisexual women were more likely than were heterosexual women to report lifetime experiences of intimate partner violence (OR=7.9; 95% CI=1.5, 42.7); there were no statistically significant differences between bisexual and heterosexual men or between gay/lesbian and heterosexual respondents on this measure.

DISCUSSION

This article is the first to present population-based estimates of adult health by sexual orientation identity and gender for a US East Coast sample. Health was poorer among sexual minorities than among heterosexuals on 16 out of 22 health characteristics, although we observed considerable variability by sexual orientation identity and gender. Lifetime mammography, 3-year cervical cancer screening, diabetes, and heart disease did not vary by sexual orientation identity. In a couple of instances—sigmoidoscopy or colonoscopy and weight for gay men—sexual minorities fared better than heterosexuals. Bisexuals reported lower socioeconomic status, and, on average, poorer health than did heterosexual and gay/lesbian respondents.

Despite a higher prevalence of chronic disease risk factors among sexual minorities, they were no more likely than were heterosexuals to report diabetes or heart disease diagnoses in

our sample or in the California Quality of Life Survey sample.¹² The absence of sexual orientation differences in diabetes is somewhat surprising, given the elevated rates of obesity among lesbians in our sample and nationally.⁶ The relatively young age of both the samples may account for these null findings, but underdetection may also be a contributing factor; therefore, this finding should be further examined using clinical measures. Lifetime reports of asthma were elevated among sexual minorities in our sample as well as among Californian gays and lesbians.¹² This may be attributable to sexual orientation differences in smoking and urbanicity²⁴ and is the subject of follow-up analyses.

Our findings corroborate the results of the Los Angeles County Health Survey, as no sexual orientation differences in lifetime rates of mammography were found.⁸ This may be related to an increase in health provider awareness motivated by an increase in published studies on lesbian breast cancer risk from 1995 through 1999.²⁵ In contrast, although lesbians reported lower rates of 2-year Papanicolaou tests than did heterosexual women in Los Angeles County,⁸ we did not observe sexual orientation differences in 3-year cervical cancer screening among Massachusetts women. These discrepant findings may stem from differences in the socioeconomic and racial/ethnic composition of each sample. HIV testing was more common among sexual minorities in our study, a pattern that has been noted among sexual minority men in other probability samples.^{26,27}

Bisexuals in our study were more likely than were heterosexuals to report 30-day tension or worry, sadness, and illegal drug use; current smoking; and prior-year suicidal ideation. Binge drinking was more common among bisexual women than among heterosexual women, and gay/lesbian respondents were more likely to report 30-day tension or worry and drug use, current smoking, and former smoking than were heterosexuals. Elevated rates of smoking among sexual minorities have been documented in other probability samples, including surveys of urban adults and in-school adolescents.²⁸ Several, but not all, population-based studies have found elevated rates of anxiety, major depressive disorder, and substance use disorders among sexual minorities.^{1,3,5,29} Suicidal ideation has been reported at higher rates among sexual minority men in other

population-based studies^{1,2} but not among women. Ours may be the first population-based study to document elevated rates of suicidal ideation among bisexual women.

Although population-based studies of adolescents consistently report elevated rates of unwanted sexual contact among sexual minorities,³⁰ few studies have included adults. Our finding of elevated risk of lifetime sexual assault among sexual minority women is consistent with findings from a national probability survey of women. Moracco et al. found that lesbian or bisexual women were more likely to report both sexual assault by a stranger and sexual assault by a known person than were heterosexual women.¹¹ Ours may be among the first population-based studies to observe sexual orientation differences in lifetime sexual assault victimization among men.

We observed differences in access to health care for bisexual respondents but not for gay or lesbian respondents. Our findings stand in contrast to those of Heck et al.,¹⁰ who observed greater barriers to health care among sexual minority women (but not men). It is possible that the overrepresentation of bisexuals among sexual minority women drove the Heck et al. findings. It is also possible that the Massachusetts Gay, Lesbian, Bisexual, and Transgender Health Access Project,³¹ launched in 1997, succeeded in raising awareness of institutional and provider-level barriers to care for gays and lesbians across Massachusetts, but that improved cultural competence within the health care system may have been insufficient to address economic barriers to care for bisexuals.

Sexual minorities in our study were more likely than were heterosexuals to report activity limitations, whereas only bisexual adults were more likely to report poor or fair health. Bisexual women in the California Quality of Life Survey sample were also more likely to report activity limitations¹²; however, in the California sample, self-rated health did not statistically differ between sexual minorities and heterosexuals. Differences in statistical power and the covariates included in statistical models may contribute to variation between study findings.

Strengths of this study include the breadth of health issues examined in a large population-based sample that supported stratification by both sexual orientation identity and

gender. Major limitations include the cross-sectional nature of the Behavioral Risk Factor Surveillance System and the use of single-item, self-reported measures. Cross-sectional analyses are vulnerable to bias because of uncontrolled confounding.³² If we failed to adjust for characteristics that are associated with sexual orientation and health and that occurred prior to sexual orientation identity formation and expression, then our statistical models would be misspecified and our estimates would be biased. We controlled for age, gender, and educational attainment, but not for employment, income, or legal marital status, characteristics that are affected by sexual orientation^{33,34} and thus may be on the causal pathway between sexual orientation and health. The validity of single-item, self-report measures is likely limited, yet sexual orientation data are not collected elsewhere (e.g., death certificates, service delivery records) that would allow us to triangulate findings.

Issues related to response bias, sexual orientation subgroup size, and external validity also merit discussion. If the individuals included in our analytic sample differed systematically from the Massachusetts adult household population on characteristics related to sexual orientation and health outcomes, then our results would be biased. The use of sampling weights that adjust for differential survey response by age and gender may correct some bias (because age and gender are associated with sexual orientation and health outcomes); however, we do not have information that would allow us to assess the scope or impact of differential survey participation on our results. There were no systematic differences between those who self-identified as heterosexual, gay or lesbian, or bisexual and those who refused to answer the sexual orientation question (the majority excluded from analyses), except for an increased unwillingness to answer other demographic items. For this reason, we believe that bias attributable to item nonresponse was likely minimal.

The relatively small number of bisexuals in our sample, coupled with skip patterns and inconsistent inclusion of survey items across years, resulted in some wide CIs. Readers should consider the width of CIs (a reflection of the stability of the point estimate) when basing programmatic or policy decisions upon the

magnitude of effect estimates. Last, the generalizability of our findings to other states is somewhat uncertain. Massachusetts is a socially progressive state; thus, observed disparities by sexual orientation may be heightened elsewhere.

Potential determinants of sexual orientation disparities in health include unequal access to health-promoting resources³⁵ and elevated exposure to adversity. In our study, lower socioeconomic status may contribute to observed disparities between bisexuals and heterosexuals. For instance, access to health care is clearly related to socioeconomic status via access to employer-provided health insurance. Sexual minorities in our study and in others^{11,30} reported much higher rates of violence victimization. Exposure to violence has been linked to a range of mental and physical health problems.^{36,37} Discrimination is another likely determinant of observed health disparities,³⁸ although it was not examined in this study.

Our results underscore the importance of collecting data on sexual orientation and the utility of aggregating data to investigate similarities and differences in health within a diverse minority population. Our findings corroborate the findings of others to indicate that mental health, drug use, smoking, violence victimization, and access to health care remain important priorities for Healthy People 2020. In addition, obesity⁶ and cardiovascular disease risk³⁹—especially among lesbians and bisexuals—warrant prioritization. Investigation of mechanisms that produce disparities in health by sexual orientation is an important area for future inquiry. ■

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Contributors

K.J. Conron and S.J. Landers conceptualized the study. K.J. Conron and M.J. Mimiaga analyzed the data. K.J. Conron wrote the final draft of the article. All authors interpreted findings, contributed ideas, and participated in the writing of the article.

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Human Participant Protection

Protocol approval was not necessary because data were obtained from secondary sources. However, a data use agreement was obtained from the Massachusetts Department of Public Health, allowing us to use Massachusetts Behavioral Risk Factor Surveillance data for this study.

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