Disparities in Weight and Weight Behaviors by Sexual Orientation in College Students

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In 2011, the Institute of Medicine highlighted the significant lack of research on the health of lesbian, gay, and bisexual (LGB) groups.[1] Research has indicated that LGB adults experience worse health outcomes than their heterosexual peers.[2–11] These disparities may be attributable to an array of factors, including stigmatization, stress, and limited access to and use of health services.[1,12,13] Specific areas of potential disparities among LGB groups lacking substantial research evidence include obesity, diet, physical activity patterns, unhealthy weight control behaviors, and body image. With two thirds of US adults now overweight or obese,[14] obesity prevention is a national health priority. Findings from studies examining adult weight disparities by sexual orientation have consistently indicated that lesbian women are more likely to be overweight than heterosexual women.[2,11,15–19] Several recent population-based studies have suggested that gay men may be less likely to be overweight than heterosexual men,[2,18,20] and additional studies have highlighted concerns regarding body image and unhealthy weight control behaviors among gay men.[21–24] Disparities in other behaviors, such as dietary intake and physical activity patterns, have not been studied extensively using population-based samples and, when studied, have yielded inconsistent findings.[11,25,26]

Furthermore, much of the work in this area to date has not focused on the college years. Because nearly half of US high school graduates up to age 24 years are enrolled in postsecondary education,[27] colleges and universities offer unique environments for addressing health disparities among young people, including those of LGB students. For many, the college years represent a time during which health disparities emerge[28,29] and adverse changes occur in weight, dietary quality, physical activity, and other behaviors.[30–38] For LGB people, this age is

Objectives. We assessed disparities in weight and weight-related behaviors among college students by sexual orientation and gender.

Methods. We performed cross-sectional analyses of pooled annual data (2007–2011; n = 33 907) from students participating in a Minnesota state-based survey of 40 two- and four-year colleges and universities. Sexual orientation included heterosexual, gay or lesbian, bisexual, unsure, and discordant heterosexual (heterosexuals engaging in same-sex sexual experiences). Dependent variables included weight status (derived from self-reported weight and height), diet (fruits, vegetables, soda, fast food, restaurant meals, breakfast), physical activity, screen time, unhealthy weight control, and body satisfaction.

Results. Bisexual and lesbian women were more likely to be obese than heterosexual and discordant heterosexual women. Bisexual women were at high risk for unhealthy weight, diet, physical activity, and weight control behaviors. Gay and bisexual men exhibited poor activity patterns, though gay men consumed significantly less regular soda (and significantly more diet soda) than heterosexual men.

Conclusions. We observed disparities in weight-, diet-, and physical activity–related factors across sexual orientation among college youths. Additional research is needed to better understand these disparities and the most appropriate intervention strategies to address them. (*Am J Public Health.* 2015;105:111–121. doi:10.2105/AJPH.2014.302094)

commonly when sexual identity is declared and assimilation into the LGB community occurs.[39] Important postsecondary institutions that could act as platforms for intervention delivery include not only traditional 4-year universities but also 2-year community and technical colleges, which serve millions of students, particularly those from lower income and minority backgrounds.[40,41]

The objective of this study was to characterize gender-specific weight-related disparities among college students by sexual orientation. We analyzed state survey data of nearly 34 000 students attending a wide array of 2- and 4-year colleges and universities in 2007 to 2011, including a subsample of more than 2000 LGB-identified and LGB-questioning participants. This research was intended to fill several gaps in the literature. For example, although a recent wave of studies[11,19,22–25] were published after the release of the Institute

of Medicine report,[1] most of these studies used data from 1999 to 2007 and thus were not able to characterize disparities during the past 5 to 8 years (when important societal shifts in weight-related factors[42,43] and social shifts regarding LGB issues occurred). Moreover, a majority of these studies focused not on the college years but rather on adulthood overall (e.g., 18–74 years) or on adolescence (e.g., 9th–12th grade). Finally, only a small number of studies have examined population-level LGB disparities in dietary intake or physical activity,[11,20,25,26] which are critical factors to address in weight-related intervention strategies. Among the few population-based studies that have addressed diet and activity, unidimensional indicators have been used to assess fruit and vegetable consumption or moderate to vigorous intensity physical activity, but these studies have generally lacked characterization of other important dietary factors

(e.g., frequency of soda, fast food, away-from-home eating, or breakfast consumption) or activities (e.g., strengthening activities, screen time).

METHODS

The College Student Health Survey (CSHS) is an annual health surveillance system of 2- and 4-year Minnesota postsecondary institutions. For these analyses, we merged 5 waves of data (2007–2011), including data from 40 postsecondary institutions (17 four-year and 23 two-year colleges). Survey details are publicly available (https://www.bhs.umn.edu/surveys).

The CSHS recruits participants using random student samples drawn from institutional enrollment lists. For the smallest schools, all enrolled students are invited to participate to ensure sufficient sample sizes for school-level reporting. At all campuses, students receive multiple invitations to participate in the online survey (e.g., postcards, e-mails). On-campus promotions are also used to increase awareness about CSHS. Participants receive a small monetary compensation and opportunities to win larger prizes.

Some colleges in our sample (n = 17) participated in the CSHS in a single year only. However, the other 23 colleges participated more than once from 2007 to 2011, and the possibility of the same student responding to this anonymous survey more than once was a concern. Therefore, we calculated an estimated probability of this type of overlap, similar to previous work in this area.[44] Multiple years of data from a given college were included if the probability of a student participating in the survey in more than 1 year was less than 2%. We calculated the probability of participant overlap using National Center for Education Statistics retention and graduation rates[45] and the sampling probability at each school.

Using these criteria, we included multiple years of data for 6 colleges, which yielded a preliminary data set of 34 392 students from all 40 institutions, reflecting an overall response rate of 42.2%. Similar response rates have been observed for other studies of this kind.[46–54]

Measures

CSHS survey items reflect standard questions from national surveillance and epidemiologic surveys. Except for self-reported height, weight, and age, response options for all items were categorical. For ease in the interpretation of cross-group comparisons, we di- or trichotomized these variables on the basis of risk-based cutpoints where possible.

We assessed sexual orientation using a standard item[55,56] asking participants to identify as heterosexual, gay or lesbian, or bisexual. We also provided an "unsure" response option, reflecting the fact that young adulthood is when sexual identity is commonly formed.[39] Although a response of "unsure" may not represent a distinct orientation per se, it represented a substantial subsample of participants and thus was deemed important to maintain in these analyses.

In preliminary work comparing sexual identity and behavior, we identified students who characterized their orientation as heterosexual but who also reported engaging in same-sex sexual behavior during the past year. Thus, we created another orientation category, discordant heterosexual. Previous research has underscored the importance of using data from multiple dimensions—such as identity and behavior—to characterize orientation.[44,57,58] Although we also examined discordance in the gay or lesbian group, the resulting sample size was too small to be included in analyses.

Body Mass

We calculated body mass index (BMI, defined as weight in kilograms divided by the square of height in meters) from self-reported height and weight and categorized it as underweight (BMI < 18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), grade 1 obese (30.0–34.9 kg/m^2), and grade 2 obese (≥ 35.0 kg/m^2).[59]

Dietary Intake

Participants reported select dietary behaviors, including Youth Risk Behavior Surveillance System items (e.g., 6 items assessing fruit and vegetable intake, 1 item assessing soda consumption).[60] We adapted an analogous question on diet soda from the Youth Risk Behavior Surveillance System. Respondents were asked, "In the past 7 days, how many days did you eat breakfast?"[61] We assessed away-from-home eating with 2 items on frequency of eating fast food meals and eating at other restaurants. We collapsed 8 response options into 3 categories: (1) a few times per year or less, (2) 1 to 2 times per month or once a week, or (3) several times per week or more. These cutpoints correspond with weight-related risk associated with away-from-home eating, especially fast food.[62–65]

Physical Activity and Screen Time

We used items adapted from the Youth Risk Behavior Surveillance System[60] to assess strenuous activity (time spent engaging in activities "that made you breathe hard (e.g. running, swimming laps, fast bicycling . . .)") and moderate-intensity activity (time spent engaging in activities "that did not make you breathe hard (e.g., walking, slow bicycling . . .)"). Data were categorized as zero, 2 or less, or 2.5 or more hours per week. Cutoffs correspond with national recommendations for moderate-intensity activity.[66] Response options did not allow for an exact correspondence with strenuous activity guidelines; thus, we used the same cutoffs as the best available comparison. Participants reported time spent per week engaging in strengthening exercises; however, because recommendations for strengthening activities are based on bouts per week rather than time per week, we categorized strengthening activity as none versus any. Participants also reported average weekly hours watching television and playing video or computer games. On the basis of national media use recommendations for young people, we categorized responses as 2 or more hours per day and less than 2 hours per day.[67,68]

Unhealthy Weight Control, Binge Eating, and Body Satisfaction

We used 3 survey items to assess frequency of unhealthy weight control behaviors during the past year, including using laxatives to control weight, taking diet pills, and inducing vomiting to control weight. Similar items have been used in previous research.[27,69–73] We combined items for analysis (any vs none) because of the low prevalence of each behavior. One survey item assessed binge eating, and 1 item assessed overall satisfaction with body image or size over the past 30 days.[37,61]

Sociodemographics

Participants reported a range of factors, including gender, age, race/ethnicity, year in school, weekly hours worked for pay, credit card debt, relationship status, living arrangement, and status as an international student (yes or no).

Analysis

We excluded data for transgender participants (n = 53) because they were the subject of another publication[74] and data for participants younger than 18 years or older than 99 years (n = 11), those with missing data for gender (n = 54) or sexual orientation (n = 69), and those flagged for suspicious reporting patterns (n = 3). Women currently pregnant (n = 320) were also excluded. This yielded a final analytic sample of n = 33 882. Individual model samples varied slightly because of missing data on other variables.

We ran initial gender-stratified descriptive analyses using the Wald χ^2 test (adjusted for clustering by school) for all sociodemographic and weight-related indicators by sexual orientation. Subsequently, we fit cross-sectional mixed-effects multinomial logistic regression models, with confidence intervals adjusted for clustering by school. Analyses were stratified by gender. To examine the relationship between sociodemographics and sexual orientation, we fit crude models. For weight-related indicators, we fit both crude and adjusted models. Adjusted models included sociodemographic factors that were significantly different across sexual orientation. For adjusted models, we used postestimation predicted probabilities to calculate prevalence.

Although previous studies have used heterosexual participants as the sexual orientation reference group, we made post hoc comparisons across all sexual orientation groups for analyses of weight-related factors. Significance levels were adjusted using an a priori α of .05 divided by the number of tests; for example, the significance level for weight status was 0.05/16 = .003.

We conducted our analyses using the full sample as well as an age-restricted sample of young adults (aged 18–25 years). Given that the findings were highly similar, we present

results for only the full sample here. We conducted all analyses using Stata version 11 (StataCorp, College Station, TX).

RESULTS

In this sample, we categorized 92.9% of participants as heterosexual, 0.8% as discordant heterosexual, 2.8% as bisexual, 1.8% as gay or lesbian, and 1.6% as unsure.

Sociodemographic Factors

Among men, overall χ^2 test results revealed significant sociodemographic differences by sexual orientation (Table 1). These included differences by school type (2-year vs 4-year), race/ethnicity, age, student status, relationship status, living arrangement, weekly hours worked for pay, credit card debt, and international student status. Because of the numerous comparisons in our analysis, we highlight only the most striking differences in this article.

Compared with heterosexual individuals, those identifying as unsure were more likely to be attending a 2-year college, a racial/ethnic minority, young (aged < 21 years), single, and living in their parents' home. Bisexual men were more likely to identify as Black, and gay men were more likely to identify as Latino. The mean age was 24.9 years for heterosexual men, 25.9 years for discordant heterosexual men, 26.0 years for gay men, 24.9 years for bisexual men, and 23.5 years for unsure men. Finally, men identifying as unsure were also significantly more likely to be international students than those identifying as heterosexual.

We also observed significant differences by sexual orientation for all sociodemographic factors examined among women (Table 2). Compared with heterosexual women, those who identified as bisexual were also more likely to identify as Latino or mixed or other, and those who were unsure were more likely to identify as any of the racial/ethnic minority groups. The mean age was 26.0 years for heterosexual women, 26.8 years for discordant heterosexual women, 28.8 years for gay or lesbian women, 24.2 years for bisexual women, and 24.1 years for unsure women. Women identifying as unsure were also more likely to be international students.

Weight Disparities by Sexual Orientation

We examined differences in weight behaviors by sexual orientation in unadjusted and adjusted models; given the similarities in these findings, we present only those for the adjusted model here for men (Table 3) and for women (Table 4).

Adjusting for all sociodemographic covariates in Table 1, we observed overall differences by sexual orientation among men for all weight-related variables ($P \leq .01$) except fruit or vegetable consumption and screen time. Highlighting the key differences in our results, bisexual men were more likely to be underweight (BMI < 18.5 kg/m^2) or classified as grade 2 obese (BMI ≥ 35.0 kg/m^2) than heterosexual men. Gay men were also less likely to be overweight than heterosexuals. Gay men were significantly less likely to drink regular soda but more likely to drink diet soda than men in several other sexual orientation categories. They were also more likely to frequently eat at restaurants.

In terms of physical activity, gay men were less likely than heterosexual men to engage in moderate physical activity or strengthening activity. Heterosexual men were the most likely of all groups to engage in strenuous physical activity.

Finally, nonheterosexual men were more likely to report disordered eating behaviors and body dissatisfaction. For example, discordant heterosexual, gay, and unsure men were more likely to engage in unhealthy weight control behaviors, and bisexual and gay men were more likely to engage in binge eating than heterosexual men. Discordant heterosexual, bisexual, and gay men were least likely to feel satisfied with their body.

Among women, adjusted models revealed overall significant differences by sexual orientation for all weight-related variables ($P < .05$), except for soda and diet soda consumption and screen time. In subsequent pairwise comparisons, bisexual and gay women were the most likely to be obese compared with heterosexual and discordant heterosexual women. Compared with heterosexual women, bisexual women were more likely to skip breakfast all or nearly all days of the week, and bisexual and lesbian women were more likely to frequently eat at sit-down restaurants.

TABLE 1—Prevalence of Sociodemographic Factors Stratified by Sexual Orientation, Men Only (n = 12 498): College Student Health Survey, Minnesota, 2007–2011

Variable	Heterosexual (n = 11 630), %	Discordant Heterosexual (n = 106), %	Bisexual (n = 201), %	Gay (n = 361), %	Unsure (n = 200), %	Wald χ² (df)	P
School type						9.97 (4)	.04
4-y (n = 8349; Ref)	67.0	62.3	62.7	69.5	58.0		
2-y (n = 4149)	33.0	37.7	37.3	30.5	42.0*		
Race/ethnicity						223.9 (16)	< .001
White (n = 10 190; Ref)	82.2	82.1	73.6	82.8	54.8		
Black (n = 548)	4.3	5.7	9.0*	2.8	9.6*		
Asian (n = 928)	7.3	6.6	8.0	3.6	19.6*		
Latino (n = 297)	2.2	1.9	3.5	5.0*	5.5*		
Mixed/other (n = 525)	4.0	3.8	6.0	5.8	10.6*		
Age, y						51.6 (8)	< .001
18–20 (n = 4089; Ref)	32.8	31.1	32.2	27.3	45.5		
21–24 (n = 4224)	34.1	31.1	35.2	29.3	29.5*		
≥ 25 y (n = 4153)	33.1	37.7	32.7	43.5*	25.0*		
Student status						31.5 (8)	< .001
First-time undergraduate (n = 2795; Ref)	22.3	20.8	24.9	19.1	30.0		
Other undergraduate (n = 8370)	67.0	70.8	69.7	65.4	61.0*		
Graduate student (n = 1333)	10.7	8.5	5.5*	15.5*	9.0		
Relationship status						212.1 (12)	< .001
Single (n = 6285; Ref)	49.5	33.0	62.2	62.3	72.5		
Married/domestic partner (n = 2217)	18.0	27.4*	15.4*	11.4	10.0*		
Engaged or committed (n = 3802)	30.9	38.7*	21.4*	24.6*	16.0*		
Separated, divorced, widowed (n = 189)	1.5	0.9	1.0	1.7	1.5		
Living arrangement						137.8 (16)	< .001
Parent's home (n = 2286; Ref)	18.3	14.2	20.5	13.0	30.5		
Rent or share rent (n = 5701)	45.7	47.2	48.5	48.5	34.5*		
Residence hall (n = 2233)	17.9	12.3	17.5	20.8	17.0*		
Own a house (n = 1899)	15.4	20.8	10.5*	13.6	9.5*		
Other (n = 376)	2.9	5.7*	3.0*	4.2	8.5*		
Hours worked for pay						23.6 (8)	.003
0–10 (n = 6040; Ref)	48.9	38.7	51.2	40.7	50.3		
11–30 (n = 4005)	32.0	37.7	30.4	36.3*	38.1		
≥ 31 (n = 2381)	19.1	23.6	18.4	23.0*	11.7		
Credit card debt						61.8 (8)	< .001
Not applicable or none (n = 8420; Ref)	67.8	58.5	65.2	54.9	78.5		
$1–$999 (n = 1645)	13.0	19.8	16.9	16.9*	10.0*		
≥ $1000 (n = 2414)	19.2	21.7	17.9	28.3*	11.5*		
International student						46.4 (4)	< .001
No (n = 11 849; Ref)	95.1	93.4	92.5	96.4	83.0		
Yes (n = 639)	4.9	6.6*	7.5*	3.6*	17.0*		

*Statistically significantly different from heterosexual group, P < .05.

Compared with heterosexual women, unsure women were also more likely to refrain from moderate or strenuous physical activity, and bisexual and unsure women were less likely to engage in strengthening activities. Finally, bisexual and discordant heterosexual women were the most likely to engage in unhealthy weight control and binge eating.

DISCUSSION

The purpose of this study was to assess gender-specific weight disparities among

TABLE 2—Prevalence of Sociodemographic Factors Stratified by Sexual Orientation, Women Only (n = 21 384): College Student Health Survey, Minnesota, 2007–2011

Variable	Heterosexual (n = 19 880), %	Discordant Heterosexual (n = 159), %	Bisexual (n = 747), %	Gay (n = 257), %	Unsure (n = 341), %	Wald χ^2 (df)	P
School type						43.7 (4)	< .001
4-y (n = 13 749; Ref)	64.5	68.6	62.8	72.0	50.7		
2-y (n = 7635)	35.6	31.5	37.2	28.0	49.3*		
Race/ethnicity						352.5 (16)	< .001
White (n = 18 016; Ref)	84.8	83.7	83.0	86.0	61.6		
Black (n = 757)	3.5	5.7*	2.7	3.5	8.8*		
Asian (n = 1204)	5.6	1.3	4.2	3.1	15.3*		
Latino (n = 455)	2.1	2.5	3.4*	1.6	3.2*		
Mixed or other (n = 931)	4.1	6.9	5.8*	6.8	11.1*		
Age, y						51.6 (8)	< .001
18–20 (n = 6747; Ref)	31.7	25.8	32.8	22.6	38.4		
21–24 (n = 6712)	31.4	33.3	34.7	25.3	33.3		
≥ 25 (n = 7861)	37.0	40.9*	32.5	52.1*	28.3*		
Student status						165.3 (8)	.001
First-time undergraduate (n = 4369; Ref)	20.2	16.4	21.7	17.5	32.0		
Other undergraduate (n = 14 511)	67.9	72.3	69.5	64.2	61.9*		
Graduate student (n = 2504)	11.8	11.3	8.8*	18.3*	6.2*		
Relationship status						183.8 (12)	< .001
Single (n = 8036; Ref)	37.3	35.9	40.2	30.4	58.1		
Married or domestic partner (n = 4460)	21.2	21.4	14.7*	26.5*	12.0*		
Engaged or committed (n = 8129)	38.0	38.4	42.8	42.0*	28.5*		
Separated, divorced, widowed (n = 750)	3.6	4.4	2.3*	1.2	1.5*		
Living arrangement						211.7 (16)	< .001
Parent's home (n = 3418; Ref)	15.9	9.4	17.7	9.0	28.8		
Rent or share rent (n = 8974)	41.7	58.5*	47.9	45.5*	34.6*		
Residence hall (n = 3449)	16.0	7.6	19.1	15.6	20.2		
Own a house (n = 4705)	22.6	20.1	11.1*	25.3*	10.0*		
Other (n = 831)	3.8	4.4	4.2	4.7	6.5		
Hours worked for pay						81.66 (8)	< .001
0–10 (n = 8660; Ref)	40.6	30.4	43.0	38.4	52.5		
11–30 (n = 7815)	36.8	43.0*	38.1	31.8	32.6*		
≥ 31 (n = 4778)	22.6	26.6*	18.9*	29.8	14.8*		
Credit card debt						51.9 (8)	< .001
Not applicable or none (n = 13 112; Ref)	61.2	59.1	62.5	55.6	77.4		
$1–$999 (n = 3023)	14.1	18.2	15.8	17.1	11.8*		
≥ $1000 (n = 5205)	24.7	22.6	21.7	27.2	10.9*		
International student						98.4 (4)	< .001
No (n = 20 714; Ref)	97.1	98.1	97.7	98.1	88.8		
Yes (n = 648)	3.0	1.9	2.3	2.0	11.2*		

*Statistically significantly different from heterosexual group, P < .05.

college students identifying as heterosexual, gay or lesbian, bisexual, or unsure. The data used here are unique in that they represent population-based state survey data of 34 000

students attending 2- and 4-year colleges and universities. Our findings highlight robust differences in sociodemographic factors by sexual orientation and also add to the current

understanding of disparities in weight, diet, physical activity, and weight control behaviors across sexual orientation groups. One important finding here was that gay and other

TABLE 3—Adjusted Prevalence of Weight Status and Weight Behaviors by Sexual Orientation, Men Only (n = 12 498): College Student Health Survey, Minnesota, 2007–2011

Variable	Heterosexual (n = 11 630), %	Discordant heterosexual (n = 106), %	Bisexual (n = 201), %	Gay (n = 361), %	Unsure (n = 200), %	χ^2 (df)	P
Weight status[a]						256.7 (16)	< .001
Underweight (n = 321)	2.4[d]	1.9	6.6[b]	5.0	5.6		
Normal weight (n = 5994; Ref)	47.9	54.7	42.9	55.0	53.8		
Overweight (n = 4023)	32.9[e]	31.1	23.5	23.2[b]	23.6		
Grade 1 obese (n = 1419)	11.4	10.4	16.8[e]	9.5[d]	9.7		
Grade 2 obese (n = 694)	5.4[d]	1.9	10.2[b]	7.3	7.2		
Fruit and vegetable consumption						3.0 (4)	.56
< 5 times/d (n = 10 557)	85.5	86.4	84.6	83.5	80.9		
≥ 5 times/d (n = 1818; Ref)	14.5	13.6	15.4	16.5	19.1		
Breakfast consumption						19.8 (8)	.01
0–1 d/wk (n = 2249)	17.9	10.5	24.2	17.5	23.0		
2–4 d/wk (n = 4329)	34.8	39.0	31.3	32.9	34.2		
5–7 d/wk (n = 5910; Ref)	47.2	50.5	44.4	49.6	42.9		
Soda consumption						64.7 (8)	< .001
None (n = 3874; Ref)	30.6	34.0	32.3	46.5	22.6		
< 1/d (n = 5602)	45.1[e]	49.1	37.9	34.8[b,f]	53.9[e]		
≥ 1/d (n = 3005)	24.3[e]	17.0	29.8[e]	18.7[b,d,f]	23.6[e]		
Diet soda consumption						106.1 (8)	< .001
None (n = 8182; Ref)	66.1	58.5	66.2	53.2	65.3		
< 1/d (n = 2802)	22.3[e]	24.5	17.7[e]	26.2[b,d]	24.9		
≥ 1/d (n = 1485)	11.5[e]	17.0	16.2	20.6[b]	9.8		
Fast food consumption						21.5 (8)	.006
≤ a few times/y (n = 2650; Ref)	20.8	26.7	28.3	25.1	29.1		
≤ several times/wk (n = 7203)	58.0[d]	54.3	50.0[b]	53.8	53.1		
≥ several times/wk (n = 2640)	21.2	19.1	21.7	21.2	17.9		
Restaurant food consumption						77.5 (8)	< .001
≤ a few times/y (n = 2179; Ref)	17.3	16.2	18.3	12.8	32.3		
≤ several times/wk (n = 8679)	70.2[f]	69.5	64.0[f]	61.3	56.4[b,d]		
≥ several times/wk (n = 1628)	12.6[e]	14.3	17.8	25.9[b,f]	11.3[e]		
Moderate physical activity						30.7 (8)	< .001
None (n = 1936)	15.2[e]	16.2	20.8	19.8[b]	20.9		
≤ 2 h/wk (n = 5678)	45.7	43.8	40.6[f]	44.1	50.0[d]		
≥ 2.5 h/wk (n = 4843; Ref)	39.1	40.0	38.6	36.0	29.1		
Strenuous physical activity						71.1 (8)	< .001
None (n = 3164)	24.6[c,d,e,f]	34.9[b]	36.0[b]	35.9[b]	31.1[b]		
≤ 2 h/wk (n = 5292)	42.4[f]	45.3	41.1	38.2	48.5[b]		
≥ 2.5 h/wk (n = 4034; Ref)	32.9	19.8	22.8	25.9	20.4		
Strengthening physical activity						60.8 (4)	< .001
Any (n = 8399; Ref)	68.0	63.2	54.0	55.2	63.3		
None (n = 4078)	32.0[d,e]	36.8	46.0[b]	44.8[b]	36.7		
Screen time						5.0 (4)	.29
≥ 2 h/d (n = 6061)	48.2	55.2	52.0	51.8	50.5		
< 2 h/d (n = 6433; Ref)	51.8	44.8	48.0	48.2	49.5		

Continued

TABLE 3—Continued

Unhealthy weight control[g]						92.8 (4)	< .001
None (n = 11 886; Ref)	95.7	82.9	92.9	88.3	88.8		
Any (n = 607)	4.3[c,e,f]	17.1[b,d]	7.1[c]	11.7[b]	11.2[b]		
Binge eating						68.2 (4)	< .001
None (n = 11 000; Ref)	88.6	84.8	81.3	77.9	86.1		
Yes (n = 1481)	11.4[d,e]	15.2	18.7[b]	22.1[b]	13.9		
Body satisfaction						260.1 (12)	< .001
Never (n = 1228)	9.0[c,d,e]	19.8[b]	19.2[b]	23.4[b]	17.9		
Sometimes (n = 3393)	26.7[e]	34.0	28.8[e]	37.9[b,c,f]	34.7[e]		
Most of the time (n = 5579)	45.5	36.8	37.9	32.3[f]	28.6[e]		
Always (n = 2294; Ref)	18.9	9.4	14.1	6.4	18.9		

Note. Models adjusted for school type, race/ethnicity, age, student status, relationship status, living arrangement, hours worked for pay, credit card debt, and international student status.
[a]Weight status was defined as body mass index calculated by self-reported height and weight, and categorized as underweight (< 18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), grade 1 obese (30.0–34.9 kg/m^2), and grade 2 obese (≥ 35.0 kg/m^2).
[b]Statistically different from heterosexual; Bonferroni adjusted.
[c]Statistically different from discordant heterosexual; Bonferroni adjusted.
[d]Statistically different from bisexual; Bonferroni adjusted.
[e]Statistically different from gay; Bonferroni adjusted.
[f]Statistically different from unsure; Bonferroni adjusted.
[g]Includes using laxatives, taking diet pills, and vomiting.

nonheterosexual men were at high risk for poor physical activity and unhealthy weight control behaviors. However, for weight status and dietary patterns relationships were less clear and did not consistently favor heterosexual men. For example, although the frequent consumption of soda and other high-calorie beverages is a leading concern among young adults,[30] gay men consumed significantly less regular soda (and more diet soda) than heterosexual men.

This work also yielded important results for nonheterosexual women. For women, relationships between weight-related factors and specific sexual orientation groups were less consistent, though our findings still provide evidence of nonheterosexual women being at greater risk for adverse weight-related factors. For example, similar to previous research,[15] lesbian and bisexual women were more likely to be obese than heterosexual women. Furthermore, although results for women indicated a variety of ways in which nonheterosexual women were at greater weight-related risk than heterosexual women, bisexual women appeared to exhibit particularly high-risk weight behavior profiles. Previous studies have also found that college-aged women with both male and female partners engage in more health risk behaviors, such as unsafe sex, binge drinking, and tobacco and marijuana use, than those with only opposite-sex partners.[75–77] Possible explanations for these observations include (1) for some women, experience with both male and female partners may be part of a larger behavioral pattern or psychological characteristic and not reflective of sexual orientation per se and may result in a broad range of experimentation or engagement in new or risky behaviors, and (2) bisexual women may be excluded from both heterosexual and lesbian communities and thus exposed to a unique form of stigma, which could have an important impact on social support and health behaviors. More research is needed to understand the underlying causes of these disparities.

Our findings extend previous research by highlighting the behavioral profiles of previously understudied groups, such as discordant heterosexuals, who self-identified as heterosexual but also reported engaging in same-sex behavior. This group likely included students who were exploring their sexuality, who experience their sexuality as fluid, who have engaged in atypical behavior or one-time events, and who are in denial or minimizing their actual attraction. Those exploring their sexuality or in transition between category labels may prefer intermediate classifications, such as "mostly heterosexual."[78] Findings from previous studies have highlighted notable differences between "mostly heterosexuals" or "homosexually experienced heterosexuals" and other orientation groups.[57,58,79] Our findings suggest that unhealthy weight control behaviors may be particularly problematic among both male and female discordant heterosexuals. However, our analyses did not quantify the frequency of same-sex behavior, or the number of same-sex partners, and thus it is difficult to draw extensive conclusions on the basis of these findings. Given our limited understanding of this group, additional research exploring the experience of heterosexual youths engaging in same-sex behavior is needed.

Furthermore, we examined a second unique and understudied group of young people self-identifying as unsure. Despite the importance of assessing health-related risks among LGB-questioning individuals, particularly during the transition from adolescence to adulthood when many individuals go through important developments in identity formation and sexual discovery, our findings for this group may need to be interpreted with caution. The unsure group is interesting because it appears to be more racially and ethnically diverse and younger than other sexual orientation groups. However, 17% of individuals in

TABLE 4—Adjusted Prevalence of Weight Status and Weight Behaviors by Sexual Orientation, Women Only (n = 21 384): College Student Health Survey, Minnesota, 2007–2011

Variable	Heterosexual (n = 19 880), %	Discordant Heterosexual (n = 159), %	Bisexual (n = 747), %	Lesbian (n = 257), %	Unsure (n = 341), %	χ^2 (df)	P
Weight status[a]						101.1 (16)	< .001
Underweight (n = 900)	4.2	3.8	4.0	2.0	8.2		
Normal weight (n = 11 780; Ref)	56.0	57.6	47.2	42.5	50.5		
Overweight (n = 4744)	22.2	26.0	23.0	25.0	22.1		
Grade 1 obese (n = 2111)	9.8[d,e]	7.6[d,e]	12.6[b,c]	15.5[b,c]	9.7		
Grade 2 obese (n = 1723)	7.8[d,e]	5.1[e]	13.2[b]	15.1[b,c]	9.7		
Fruit and vegetable consumption						10.5, (4)	.03
< 5 times/d (n = 17 607)	83.1	82.8	80.8[e]	86.2[d]	82.0		
≥ 5 times/d (n = 3604; Ref)	16.9	17.2	19.2	13.8	18.0		
Breakfast consumption						22.9, (8)	.004
0-1 d/wk (n = 2658)	12.2[d]	10.8	17.3[b]	14.2	16.4		
2-4 d/wk (n = 6317)	29.5[d]	27.8	33.5[b]	31.2	31.0		
5-7 d/wk (n = 12 387; Ref)	58.3	61.4	49.2	54.5	52.5		
Soda consumption						15.6, (8)	.05
None (n = 10 523; Ref)	49.4	48.1	48.9	52.2	43.6		
< 1/d (n = 8011)	37.7	36.7	35.1	33.6	41.5		
≥ 1/d (n = 2815)	13.0	15.2	16.0	14.2	14.9		
Diet soda consumption						11.3 (8)	.18
None (n = 11 954; Ref)	55.8	51.3	58.4	53.1	60.6		
< 1/d (n = 5902)	27.8	32.3	25.4	23.2	27.2		
≥ 1/d (n = 3496)	16.4	16.5	16.2	23.6	12.2		
Fast food consumption						36.8 (8)	< .001
≤ a few times/y (n = 6070; Ref)	28.0	28.5	34.0	32.3	33.2		
< several times/wk (n = 12 571)	59.4[d]	54.4	50.8[b]	52.8	53.6		
≥ several times/wk (n = 2732)	12.6	17.1	15.1	15.0	13.2		
Restaurant food consumption						99.4 (8)	< .001
≤ a few times/y (n = 3655; Ref)	16.9	10.1	16.9	10.2	31.6		
< several times/wk (n = 15 518)	73.1[f]	78.5[f]	69.3	73.2[f]	59.9[b,c,e]		
≥ several times/wk (n = 2177)	10.0[d,e]	11.4	13.8[b]	16.5[b,f]	8.4[e]		
Moderate physical activity						31.4 (8)	< .001
None (n = 3358)	15.6[f]	13.9	13.7[f]	18.6	22.7[b,d]		
≤ 2 h/wk (n = 9943)	46.7	41.1	44.8	46.6	47.8		
≥ 2.5 h/wk (n = 8032; Ref)	37.7	44.9	41.5	34.8	29.6		
Strenuous physical activity						20.2 (8)	.01
None (n = 7256)	33.8[f]	35.9	33.9	35.2	39.1[b]		
≤ 2 h/wk (n = 8610)	40.3	34.2[d,f]	42.0[c]	41.1	43.0[c]		
≥ 2.5 h/wk (n = 5504; Ref)	25.9	32.9	24.1	23.7	17.9		
Strengthening physical activity						15.2 (4)	.004
Any (n = 12 775; Ref)	60.3	58.2	54.9	54.2	50.4		
None (n = 8563)	39.7[d,f]	41.8	45.1[b]	45.8	49.6[b]		
Screen Time						8.0 (4)	.09
≥ 2 h/d (n = 12 472)	58.3	52.5	59.8	60.6	56.4		
< 2 h/d (n = 8907; Ref)	41.7	47.5	40.2	39.4	43.6		

Continued

TABLE 4—Continued

Unhealthy weight control[g]						32.8 (4)	< .001
None (n = 18 632; Ref)	87.4	79.7	81.9	89.8	85.4		
Any (n = 2744)	12.6[c,d]	20.3[b,e]	18.1[b,e]	10.2[c,d]	14.6		
Binge eating						129.6 (4)	< .001
None (n = 17 525; Ref)	82.7	70.9	69.8	76.7	80.2		
Yes (n = 3826)	17.3[c,d,e]	29.1[b]	30.2[b,f]	23.3[b]	19.8[d]		
Body satisfaction						46.4 (12)	< .001
Never (n = 4331)	20.1[c]	17.1[b,d]	21.7[c]	23.6	21.8		
Sometimes (n = 8676)	40.6	42.4[d]	43.7[c]	38.2	37.9		
Most of the time (n = 7086)	33.4	30.4	29.5	31.5	29.6		
Always (n = 1287; Ref)	5.9	10.1	5.1	6.7	10.7		

Note. Models adjusted for school type, race/ethnicity, age, student status, relationship status, living arrangement, hours worked for pay, credit card debt and international student status.
[a]Weight status was defined as body mass index calculated by self-reported height and weight, and categorized as underweight (< 18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), grade 1 obese (30.0–34.9 kg/m^2), and grade 2 obese (≥ 35.0 kg/m^2).
[b]Statistically different from heterosexual; Bonferroni adjusted.
[c]statistically different from discordant heterosexual; Bonferroni adjusted.
[d]Statistically different from bisexual; Bonferroni adjusted.
[e]Statistically different from lesbian; Bonferroni adjusted.
[f]Statistically different from unsure; Bonferroni adjusted.
[g]Includes using laxatives, taking diet pills, and vomiting.

this category were international students (compared with $< 8\%$ in other orientation categories), leading to the speculation that some students may report being unsure because they are not familiar with the sexual orientation terminology used in the survey (i.e., heterosexual, gay or lesbian, bisexual). Depending on students' background, they may not understand this terminology, and important cultural influences on considerations of sexual orientation are likely. Additional research using more detailed classifications of orientation is needed to understand differences between LGB-identified and LGB-questioning young people.

Finally, it is interesting that our overall results yielded few differences between unadjusted analyses and those that were adjusted for a wide range of sociodemographic factors (data not shown). This suggests that despite striking sociodemographic differences by sexual orientation, these factors do not appear to explain much of the association between orientation and weight-related factors. Other factors likely underlying these relationships include cultural issues, social norms, minority stress, felt stigma and discrimination, and factors related to sexual identity. These factors may have a particularly powerful impact at this age when people may be moving through the process of individuation and developmentally establishing themselves as LBG adults. Additional work is needed to understand the nature of these factors and the overall context of the weight-related disparities observed here.

To our knowledge, this population-based study is the first of its kind to examine weight disparities by sexual identity across a large, diverse sample of 2- and 4-year colleges. The sample size is especially notable because it allowed us to independently examine numerous gender-specific subtypes of sexual orientation. However, this work has limitations. For example, our ability to precisely quantify a range of weight-related behaviors is somewhat limited. To maximize the efficiency of this statewide survey, much of the survey is based on single-item indicators of risk. More in-depth assessments of behavioral factors would reduce error and provide higher validity in characterizing behavioral patterns. Furthermore, although self-reported height and weight have been shown to be both reliable and accurate (with correlation coefficients between self-report and measured weight and height between 0.90 and 0.95), they are subject to bias[80]; recent research has also shown that gay men tend to underreport more than their heterosexual peers.[81] Finally, these findings represent only college students from 1 geographic region of the United States and may thus yield limited generalizability to other regions of the country.

In summary, the findings of this study suggest notable disparities in weight-related factors by sexual orientation among the college population, echoing findings from previous studies in other populations and age groups. The most prominent findings from this work are that (1) lesbian women were more likely to be obese; (2) bisexual women were at higher risk for a wide range of unhealthy weight-, diet-, physical activity–, and weight control–related behaviors; and (3) gay and bisexual men exhibited poorer activity and unhealthy weight control patterns than their heterosexual counterparts. Across the United States, very few large, population-based samples such as this exist with sufficient data on LGB participants to allow for in-depth investigation of weight-related issues. It is important that public health researchers and practitioners advocate for systematic assessment of sexual orientation in national and state surveillance systems and other weight-related data sources to facilitate future work in this area. Furthermore, it is critical that future work not only quantify these

disparities but also explore the complex factors underlying these disparities and the means by which intervention strategies should go about addressing the groups at highest risk. ∎

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Contributors

M. N. Laska led the development of the secondary data analysis design, obtained funding, and wrote the article. N. A. VanKim conducted the data analysis under the supervision of D. J. Erickson and M. N. Laska. K. Lust directed the primary data collection. All authors gave input on the data analysis strategy, helped to critically interpret findings, and contributed to the revision of the article.

Human Participant Protection

The University of Minnesota's institutional review board approved all data collection efforts. These analyses were deemed exempt from review owing to the anonymous nature of the dataset.

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