Disparities by Sexual Orientation in Frequent Engagement in Cancer-Related Risk Behaviors: A 12-Year Follow-Up

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Objectives. We examined sexual-orientation disparities in frequent engagement in cancer-related risk indicators of tobacco, alcohol, diet and physical activity, ultraviolet radiation, and sexually transmitted infections (STIs).

Methods. We used longitudinal data from the national Growing Up Today Study (1999–2010). Of the analytic sample (n = 9958), 1.8% were lesbian or gay (LG), 1.6% bisexual (BI), 12.1% mostly heterosexual (MH), and 84.5% completely heterosexual (CH).

Results. More sexual minorities (LGs, BIs, and MHs) than CHs frequently engaged in multiple cancer-related risk behaviors (33%, 29%, 28%, and 19%, respectively). Sexual-minority young women, especially BI and MH, more frequently engaged over time in substance use and diet and physical activity risk than CH women. More young gay than CH men frequently engaged over time in vomiting for weight control (odds ratio [OR] = 3.2; 95% confidence interval [CI] = 1.1, 9.4), being physically inactive (OR = 1.7; 95% CI = 1.2, 2.4), and using tanning booths (OR = 4.7; 95% CI = 3.0, 7.4), and had a higher prevalence of ever having an STI (OR = 3.5; 95% CI = 2.0, 6.4). Individual analyses were generally comparable to the group-level analyses.

Conclusions. Young sexual minorities are at risk for cancer through frequent exposure to cancer-related risk behaviors over time. Long-term, longitudinal studies and surveillance data are essential and warranted to track frequent engagement in the risk behaviors and cancer-related morbidity and mortality. (*Am J Public Health.* 2016;106:698–706. doi:10.2105/AJPH.2015.302977)

A 2011 report by the Institute of Medicine highlighted the absence of national data on cancer incidence and prevalence for sexual minorities (lesbians, gays, and bisexuals) and transgender individuals.[1] The lack of data is surprising because cancer remains the second-leading cause of mortality in the United States, responsible for approximately 1 in 4 deaths.[2] Furthermore, behaviors that increase the risk of cancer are more prevalent among sexual minorities. Despite the fact that cancer-related risk behaviors may become habitual over time through behaviorally reinforcing contingencies and neurobiological reward circuits, little is known about the extent to which sexual minorities engage in the behaviors over time. Frequent engagement in the behaviors over time would increase risk for cancer, as would the potential additive or synergistic effects resulting from clustering of the behaviors.

Although the prevalence of engaging (yes or no) in risk behaviors among sexual minorities has been studied in literatures that are relatively independent of each other, rarely has the risk of many such behaviors for cancer been noticed. Such awareness and documentation are necessary to argue for the surveillance of cancer morbidity and mortality that the Institute of Medicine[1] found lacking. We used a large national cohort of young people to document sexual-orientation disparities in frequent engagement over time in cancer-related risk behaviors at the group and individual levels of analysis.

TOBACCO AND ALCOHOL

Tobacco and alcohol are risk factors for developing various cancers—for example, lung, esophageal, oropharyngeal, and colon[3–9]—with cigarette smoking accounting for approximately 30% to 40% of cancer mortality in the United States.[10,11] In addition, the combined use of tobacco and alcohol has synergistic effects on cancer risk.[12,13] From adolescence through adulthood, sexual minorities are more likely than heterosexuals to use tobacco and alcohol,[14–21] including smoking more frequently[22] and binge drinking over time.[23,24]

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DIET AND PHYSICAL ACTIVITY

Approximately 30% of cancers are believed to be attributable to diet-related behaviors.[25] Moreover, 15% to 20% of cancer deaths in the United States are estimated to be a function of being overweight or obese.[26] Diet and physical activity are linked to cancer via several cellular processes.[27]

Studies find that being obese, overweight, or physically inactive is more prevalent in sexual-minority than heterosexual women,[28–35] and the disparities exist as early as adolescence.[21,36,37] However, sexual-orientation disparities among men are less consistent. Although one study found a comparable prevalence of being overweight or obese in sexual-minority men,[38] other studies found a lower prevalence in sexual-minority men compared with heterosexual men.[33,39,40] Similarly, one study found higher rates of limited physical activity in sexual-minority men,[33] but other studies found either similar exercise levels between them and heterosexual men[40–42] or lower rates among sexual-minority male youths.[37,43] The inconsistency of sexual-minority men generally having a lower body mass index but similar or lower exercise levels than heterosexual men[37,42,44,45] may be explained by other diet-related activities. For example, purging as a means of reducing caloric intake may be more prevalent among sexual-minority than heterosexual men.[46] In fact, the sexual-orientation disparity in purging may be apparent during adolescence and in both sexes.[21,47,48] Purging is concerning because it may be a risk for Barrett's esophageal cancer.[49–51]

ULTRAVIOLET RADIATION

Exposure to solar or manufactured ultraviolet radiation (UVR) is a risk for skin cancer.[52–55] Therefore, protective practices are critical, such as reducing exposure to UVR, avoiding sunburn, and using sunscreen.[56–58] Young women are more likely than young men to expose themselves to UVR,[59–61] although they are more likely to use sunscreen than are young men.[59,62] The extent to which these findings generalize to sexual minorities is unknown.

SEXUALLY TRANSMITTED INFECTIONS

Infection with human papillomavirus (HPV) is a risk factor for cervical, anal, oral, and penile cancer.[63,64] Infection with hepatitis B virus is a risk for liver,[65,66] pancreatic, lung, and skin cancer, and leukemia.[66]

Little is known about the prevalence of HPV or hepatitis B virus among sexual minorities. Infections with these viruses are associated with several sexual risk behaviors, including numbers of partners, concurrent partners, early age at initiating sexual intercourse, lack of condom use, and substance use during sexual activity.[63,67–78] Women who have sex with women are at higher risk for each of these behaviors than women who have sex only with men.[79–81] Not only are sexual-minority men at higher risk for these sexual risk behaviors, but anal intercourse, HPV, and anal cancer are related,[82] especially among those infected with HIV.[83]

A host of sexually transmitted infections (STIs) commands attention for 2 related reasons. First, STIs are comorbid: HPV and hepatitis B virus co-occur.[78] They are also related to HIV[84,85] and other STIs.[86,87] Second, the comorbidity among STIs is not surprising in light of the common set of sexual risk behaviors that increases vulnerability to STIs.

METHODS

Participants in the Growing Up Today Study (GUTS) are the children of the women in Nurses' Health Study II—a national, prospective cohort of female registered nurses. Nurses' Health Study II mothers were sent letters inviting them to enroll their 9- to 14-year-old children. Eligible children were sent a questionnaire in 1996 and asked to return it if they wished to participate. Of GUTS participants, 9039 were girls and 7843 were boys; 95.4% were White and 4.6% were ethnic/racial minority. A detailed description of GUTS is available.[88]

We included GUTS participants in the current analyses if they provided data at baseline in 1999. We included 6 subsequent assessment waves: 2000, 2001, 2003, 2005, 2007, and 2010. In an assessment of missing data, we found no significant association between sexual-orientation group and missing 3 or more of the 7 assessment waves, after we adjusted for sex, age, ethnicity/race, and sibling clusters.

Measures

Sexual orientation. An item adapted from the Minnesota Adolescent Health Survey[89] inquired, "Which of the following best describes your feelings?," ranging from 1 = completely heterosexual to 5 = completely homosexual. The item responses have been related to health and other outcomes in expected ways.[90–92] Sexual orientation in GUTS was assessed in 1999, 2001, 2003, 2005, 2007, and 2010. We categorized responses into 4 groups: completely or mostly homosexual (LG), bisexual (BI), mostly heterosexual (MH), and completely heterosexual (CH). This report assigned sexual orientation on the basis of consistency or trend in the individual's sexual orientation across his or her 3 most recent assessments. We placed greater emphasis on the most recent assessment for which data were available, if discrepancies existed among the assessments (e.g., for CH to MH to BI, designation was BI; for CH to CH to MH, designation was MH). We only went as far back as the 2001, 2003, and 2005 assessments because the young person becomes more certain of a minority sexual orientation as time passes. We did not include the 1999 data because the youths were, on average, aged between 14 and 15 years in 1999, a time when a minority sexual orientation still remains to be discovered by many.[93]

Substance use. Three variables were adapted from the Massachusetts Youth Risk Behavior Survey and the California Tobacco Control Program,[94,95] using a binary response of high (1) versus low (0) cancer risk. Smoking 5 or more cigarettes daily during the past year was assessed in 1999, 2001, 2003, 2005, 2007, and 2010. Other tobacco use, meaning smoking cigars or chewing tobacco in the past year, was assessed in 1999, 2000, and 2001. Binge drinking alcohol 6 or more times in the past year was assessed in all 7 waves, with binge drinking defined as consuming 4 (women) or 5 (men) or more drinks in a few hours. Also, a count of the 3 binary outcomes generated a risk composite of substance use: we classified scores of 0 and 1 as low risk (0),

and 2 and 3 as high risk (1). For these and the variables that follow, the cutoffs defining low and high risk arbitrarily capture more than happenstance or experimentation.

Diet and physical activity. Three variables assessed diet and physical activity risk. Weight and height were collected at all waves to compute body mass index, per the Centers for Disease Control and Prevention's (CDC's) algorithms.[96–98] Individuals who were overweight or obese were at risk (1) and those who were neither were at low risk (0). An item from the CDC's Youth Risk Behavior Surveillance System[99] assessed vomiting in all waves "to lose weight or keep from gaining weight." We considered vomiting at least monthly during the past year high risk (1) and vomiting less than monthly, if at all, low risk (0). Numerous physical activity items for youths aged 9 to 18 years, which were validated for the CDC,[100] were used. Based on CDC-recommended activity guidelines by age and sex,[101] we classified individuals in 1999, 2001, and 2005 as physically inactive (1) or not (0) during the past year. We summed all 3 binary outcomes. We classified those scoring 0 and 1 as low risk (0) and those scoring 2 and 3 as high risk (1) in the diet and physical activity risk composite.

Ultraviolet radiation. The items assessing exposure to solar or manufactured UVR are comparable to those assessed by others and found to be reliable and valid.[58,59,102] We dichotomized the responses to indicate high (1) or low (0) risk for 4 exposure variables: Solar exposure during 10:00 AM to 4:00 PM during the past summer was a risk if it occurred sometimes, often, or always (1) versus never or seldom (0). Being sunburned 5 or more times in the past summer was a risk (1). Using sunblock (sun protection factor 15 or more) never or seldom during the past summer when outdoors during sunny days was a risk (1) versus sometimes, often, or always using sunblock (low risk = 0). Using a tanning booth 10 or more times during the past year was a risk (1). We summed all 4 binary outcomes. We classified values of 0 and 1 as low risk (0) and 2 to 4 as high risk (1) in the UVR risk composite. Sun exposure was assessed in 2001, 2003, 2005, and 2007. Sunblock use and sunburn were assessed in all waves except 2010. Tanning booth data were collected in 1999, 2001, 2003, 2005, 2007, and 2010. We excluded the 2010 data because the only data assessed in the 2010 UVR set of variables was using a tanning booth.

Sexually transmitted infections. Youths were asked in 1999, 2005, and 2007, "Have you ever been told by a doctor or nurse that you had a sexually transmitted disease or STD?" Several STIs were listed as examples, including HPV infection. We scored any reported STI (1) and their absence (0).

Risk composite(s). We computed an overall risk composite of the individual risk composites of substance use, diet and physical activity, UVR, and STI, summing the individual risk composites. We classified values of 0 and 1 as low risk (0) and 2 to 4 as high risk (1) in the overall risk composite.

Persistence. We examined persistence in frequent engagement in the risk behaviors over time at the individual level. We did not compute other tobacco use (smoking cigars and chewing tobacco) because chewing tobacco was not assessed in 2000 among female youths; thus, we focused only on cigar smoking in the persistence analyses. Frequent engagement in this or any other risk behavior over 4, 5, 6, or 7 of 7 assessments, over 3, 4, 5, or 6 of 6 assessments, over 2, 3, or 4 of 4 assessments, or over 2 or 3 of 3 assessments was a marker of persistence (1); no participant had 5 assessments. Failure to meet this definition of persistence indicated little persistence (0) over time.

Statistical Analysis

We assessed sexual-orientation disparities in prevalence of ever engaging frequently in the overall and individual risk composites and each of the 11 cancer-related risk behaviors by logistic regression for the whole cohort and stratified by sex. We conducted repeated measures analyses across the assessments and stratified by sex on all risk composites and each cancer-related risk behavior, with adjustment for age and ethnicity/race. The exception was STI, for which we used logistic regression because lifetime prevalence of STI was assessed at each wave. We also used logistic regression to examine persistence over time in frequent engagement in the risk behaviors at the individual level, with adjustment for age and ethnicity/race. We made no adjustments for social class because the young people were middle-class; their mothers were registered nurses. We used generalized estimating equations with a working exchangeable assumption in all analyses to adjust for nonindependence introduced by repeated measures on participants or with sibling clusters,[103,104] procedures we have used elsewhere with longitudinal data.[92,105] We performed analyses with SAS version 9.3 (SAS Institute Inc, Cary, NC).

RESULTS

The mean age of the analytic sample (n = 9958) in 1999 was 14.6 years (SD = 1.6). Few individuals were ethnic/racial minorities (4.6%). Most were female (61.9%).

We found unadjusted sexual-orientation disparities in prevalence of ever engaging frequently in cancer-related risk behaviors (Table 1). More sexual-minority than CH persons engaged in risk behaviors associated with 2 or more of 4 cancer-related categories, as well as categories of substance use, diet and physical activity risk, and STIs. Analyses by sex indicated that many of the sexual-orientation disparities occurred among the young women for substance use and diet and physical inactivity (Table 2). For the young men, fewer disparities emerged and most indicated that more gay than CH men engaged in several cancer-related risk behaviors.

We found differences within and across the sexes for frequent engagement over time in the risk behaviors (Table 3). Although we found health disparities across the risk behaviors between each sexual-minority group of young women and female CHs, the pattern of findings differed for the individual cancer-related risk behaviors. Lesbians were significantly elevated only on frequently smoking cigarettes relative to CH young women, but many more significant disparities existed between BI or MH and CH women on substance use, diet and physical inactivity, and STIs. Interestingly, CH women were more likely than all sexual-minority women to frequently use tanning booths.

Among the young men, we found few significant disparities over time (Table 3). However, gay men were more likely than CH men to frequently vomit for weight control, be physically inactive, and use tanning booths. They also had a higher lifetime prevalence of STIs.

TABLE 1—Prevalence of Ever Engaging Frequently in Cancer-Related Risk Behaviors by Sexual Orientation in the Growing Up Today Study (n = 9958): United States, 1999–2010

Variable	LG (n = 181), %	BI (n = 160), %	MH (n = 1206), %	CH (n = 8411), %	Total (n = 9958), %
Overall high cancer risk (≥ 2 of 4 risk composite categories)	32.6***	28.8**	27.9***	19.0	20.5
High substance use (≥ 2 of 3 risk behaviors)	28.7*	33.8***	28.5***	20.6	21.9
High diet and physical activity (≥ 2 of 3 risk behaviors)	18.3	27.5***	23.3***	15.9	17.0
High ultraviolet radiation (≥ 2 of 4 risk behaviors)	48.9**	28.7*	34.7*	38.4	38.0
Ever sexually transmitted infection	13.5	20.1**	19.5***	10.7	12.0
Substance use risks, past year					
Cigarettes (smoked ≥ 5 daily)	18.2**	27.5***	21.0***	10.2	11.9
Ever other tobacco use (i.e., smoking cigars or chewing tobacco)	22.1	26.9**	21.6	19.0	19.5
Binge drinking (≥ 6 times)	65.2	62.5	67.4***	57.8	59.2
Diet and physical activity risks					
Overweight or obese BMI[a]	44.2	51.9	44.4	46.4	46.2
Vomited for weight control (≥ 1 per month in past year)	6.2	11.9***	10.2***	4.8	5.6
Physically inactive in past year	35.8	43.8***	37.5***	29.3	30.6
Ultraviolet radiation risks, past summer, except tanning booth					
Sun exposed (sometimes, often, or always)	88.6	78.6*	83.6	85.2	85.0
Sunburned (≥ 5 times)	21.0	22.5	22.6	24.0	23.7
Used sunblock (never or seldom)	18.2**	9.4	9.8	11.5	11.4
Used tanning booth (≥ 10 times per year)	23.3	19.4*	26.1	27.6	27.2

Note. BI = bisexual; BMI = body mass index; CH = completely heterosexual (the reference group to which each sexual-minority group was compared); LG = lesbian or gay; MH = mostly heterosexual. Prevalence of frequently engaging in the risk behavior in any 1 of the longitudinal assessments is presented. Data for the composites of substance use and diet and physical activity were collected over 7 longitudinal assessments (1999, 2000, 2001, 2003, 2005, 2007, and 2010); for ultraviolet radiation over 6 assessments (1999, 2000, 2001, 2003, 2005, and 2007); and for sexually transmitted infection over 3 assessments (1999, 2005, and 2007). Data for individual risk behaviors, including sexually transmitted infection, were collected over 7 or fewer assessments. Adjustments were made for sibling clusters in the analyses.

[a]BMI was computed according to the Centers for Disease Control and Prevention algorithms.[96–98]

*$P < .05$; **$P < .01$; ***$P < .001$.

Findings for individual persistence over time in each cancer-related risk behavior were generally comparable to these group-level analyses just discussed (Table A, available as a supplement to the online version of this article at http://www.ajph.org).

DISCUSSION

We found sexual-orientation disparities in risk categories of substance use, diet and physical activity, UVR, and STIs, as well as among individual cancer-related risk behaviors in a large national cohort of young people followed from adolescence into young adulthood. We were mindful that exposure to a potential carcinogen usually must occur over time and that the likelihood of cancer increases as exposure increases (i.e., the dosage or frequency of use rises). We assessed frequent engagement in each cancer-related risk behavior over time at the group and individual levels of analysis, except STI. As a consequence, this report adds to the literature in important ways. The literature on sexual-orientation disparities is predominantly cross-sectional in design rather than longitudinal. The literature has investigated many of the behaviors examined herein, but its focus has often been on the prevalence (ever or never) of the behavior, rather than frequent engagement. Although many of these risk behaviors have multiple health outcomes, their implications for cancer have generally been neglected. Such oversight must not continue, in light of the enormous public health burden of cancer.

Our findings indicate that sexual minorities relative to same-sex CHs are at risk for cancer through multiple risk behaviors occurring over time and at elevated exposure levels. This is concerning because the additive or synergistic effect of another cancer-related risk behavior may provoke or exacerbate a determinant of cancer: chronic inflammation.[106–108] It also may increase the number of cancers that might develop.[109]

Sexual-Orientation Disparities in Cancer-Related Behaviors

Frequent engagement in multiple categories of risk behaviors and substance use was approximately twice as likely among sexual-minority as CH young women, but sexual-minority young men generally did not significantly differ from CH men. This pattern of findings occurred for group differences over time (repeated measures) and individuals over time (persistence analysis). Others have found a similar pattern in a cross-sectional and group-level analysis of a representative sample of young adults.[110] Two explanations are likely.[111] First, more sexual-minority women than men engage in risky behaviors. Second, the sexual minorities do not differ, but fewer CH women than CH men frequently engage in risky

TABLE 2—Prevalence of Ever Engaging Frequently in Cancer-Related Risk Behaviors by Sex and Sexual Orientation in the Growing Up Today Study (n = 9958): United States, 1999–2010

	Young Women, % or Mean (SD)					Young Men, % or Mean (SD)				
Variable	Lesbian (n = 80)	BI (n = 136)	MH (n = 961)	CH (n = 4984)	Total (n = 6161)	Gay (n = 101)	BI (n = 24)	MH (n = 245)	CH (n = 3427)	Total (n = 3797)
Overall high cancer risk (≥ 2 of 4 risk composite categories)	35.0***	31.6***	28.5***	18.9	20.9	30.7**	12.5	25.3*	19.2	19.9
High substance use (≥ 2 of 3 risk behaviors)	27.5**	35.3***	28.1***	14.2	17.0	29.7	25.0	30.2	29.9	29.9
High diet and physical activity (≥ 2 of 3 risk behaviors)	15.0	27.9***	23.4***	16.0	17.4	21.0	25.0	22.9**	15.8	16.4
High ultraviolet radiation (≥ 2 of 4 risk behaviors)	47.5	29.2**	35.9***	42.6	41.3	50.0***	26.1	30.3	32.8	33.1
Ever sexually transmitted infection	12.2	23.7**	22.8***	14.8	16.2	14.4***	0.0	5.8	4.4	4.7
Substance use risks, in past year										
Cigarettes (smoked ≥ 5 daily)	17.5*	29.4***	21.1***	8.6	11.1	18.8	16.7	20.4***	12.5	13.2
Ever other tobacco use (i.e., smoking cigars or chewing tobacco)	18.8	27.2***	20.6***	12.1	13.9	24.8	25.0	25.3	29.0	28.6
Binge drinking (≥ 6 times)	61.3	61.8	67.7***	53.5	56.0	68.3	66.7	66.1	64.0	64.2
Diet and physical activity risks										
Overweight or obese BMI[a]	42.5	49.3*	42.4	39.4	40.1	45.5*	66.7	52.2	56.6	56.0
Vomited for weight control (≥ 1 per month in past year)	8.8	13.2*	12.4***	7.4	8.4	4.1**	4.2	1.2	0.9	1.0
Physically inactive in past year	31.7	44.9***	36.4***	29.8	31.2	39.2*	37.5	41.8***	28.5	29.7
Ultraviolet radiation risks, past summer, except tanning booth										
Sun exposed (sometimes, often, or always)	85.7	76.5*	82.6	83.7	83.4	90.9	91.3	87.6	87.4	87.6
Sunburned (≥ 5 times)	25.0	23.5	23.0	25.3	24.9	17.8	16.7	20.9	22.1	21.9
Used sunblock (never or seldom)	15.0*	9.6	8.3	7.4	7.7	20.8	8.3	15.6	17.6	17.5
Used tanning booth (≥ 10 times per year)	22.5**	21.3***	31.3***	41.6	39.3	24.0***	8.3	5.7	7.2	7.5
Demographic characteristics in 1999										
Age in years	14.9 (1.6)	14.7 (1.5)	14.6 (1.6)	14.7 (1.6)	14.6 (1.6)	14.7 (1.7)	14.0 (1.4)	14.5 (1.7)	14.5 (1.6)	14.5 (1.6)
Ethnic/racial minority background	3.8	7.4	5.8*	4.4	4.6	6.9	0.0	7.4	4.2	4.5

Note. BI = bisexual; BMI = body mass index; CH = completely heterosexual (the reference group to which each sexual-minority group was compared); MH = mostly heterosexual. Prevalence of frequently engaging in the risk behavior in any 1 of the longitudinal assessments is presented. Data for the composites of substance use and diet and physical activity were collected over 7 longitudinal assessments (1999, 2000, 2001, 2003, 2005, 2007, and 2010); for ultraviolet radiation over 6 assessments (1999, 2000, 2001, 2003, 2005, and 2007); and for sexually transmitted infection over 3 assessments (1999, 2005, and 2007). Data for individual risk behaviors, including sexually transmitted infection, were collected over 7 or fewer assessments. Adjustments were made for sibling clusters in the analyses.

[a]BMI was computed according to the Centers for Disease Control and Prevention algorithms.[96–98]

*$P < .05$; **$P < .01$; ***$P < .001$.

behaviors. Thus, the difference between sexual-minority and CH women is magnified. Others have supported the second explanation.[111] Here, the second explanation seems likely for substance use. However, it does not apply to UVR, as more CH women than CH men frequently expose themselves to UVR (Table 2).

Overall cancer-related risk behaviors. Of 11 cancer-related risk behaviors, BI women had 5 and MH women 6 behaviors on which they differed significantly from CH women, but lesbians only had 1. Why these disparities exist for BIs and MHs, but less so for lesbians, is unknown. "Gay-related"[112] or "minority"[113] stress may explain the findings, provided greater stress is experienced by BIs and MHs than by LGs. Indeed, female and male BIs have reported experiencing more stress than LGs.[114–116] However, not only did we not find a comparable pattern of frequent engagement in BI and MH young men relative to CH men, but also gay men reported frequent engagement in several risk behaviors. Future research must explore possible reasons why identifying as a BI or MH woman and as a gay man elevates risk, assuming the findings generalize.

Substance use. Relative to same-sex CHs, sexual-minority women are generally at greater risk for substance use, but not sexual-minority men.[110,117] A trajectory analysis using a representative sample of the population found that at the beginning of the study lesbian and BI women had higher rates of tobacco and alcohol use than consistently heterosexual women, but gay and BI men did not differ from consistently

TABLE 3—Repeated Measures of Sexual-Orientation Disparities in Frequent Engagement Over Time in Cancer-Related Risk Behaviors Stratified by Sex in the Growing Up Today Study: United States, 1999–2010

Variable	Young Women, OR (95% CI)			Young Men, OR (95% CI)			Sex by Sexual Orientation Interaction, *P*
	Lesbian (n = 80)	BI (n = 136)	MH (n = 961)	Gay (n = 101)	BI (n = 24)	MH (n = 245)	
Overall high cancer risk (≥ 2 of 3 risk composite categories)[a]	2.0 (1.2, 3.3)	1.9 (1.3, 2.8)	1.6 (1.3, 1.9)	1.1 (0.6, 1.8)	1.3 (0.6, 2.7)	1.0 (0.7, 1.4)	.047
High substance use (≥ 2 of 3 risk behaviors)	2.3 (1.3, 4.2)	2.6 (1.7, 3.9)	2.4 (2.0, 2.9)	1.1 (0.7, 2.0)	0.8 (0.3, 1.8)	1.0 (0.7, 1.3)	< .001
High diet and physical activity (≥ 2 of 3 risk behaviors)	1.5 (0.9, 2.3)	2.0 (1.5, 2.8)	1.3 (1.1, 1.5)	1.5 (1.0, 2.2)	2.2 (1.2, 4.2)	1.1 (0.9, 1.5)	.76
High ultraviolet radiation (≥ 2 of 4 risk behaviors)	0.9 (0.7, 1.2)	0.8 (0.6, 1.1)	0.9 (0.8, 1.0)	1.2 (1.0, 1.6)	1.2 (0.7, 2.2)	1.0 (0.8, 1.2)	.14
Substance use risks, in past year							
Cigarettes (smoked ≥ 5 daily)	2.3 (1.2, 4.5)	3.9 (2.5, 6.0)	2.6 (2.2, 3.3)	1.5 (0.8, 2.8)	1.4 (0.4, 4.7)	1.6 (1.2, 2.3)	.017
Ever other tobacco use (i.e., smoking cigars or chewing tobacco)	1.3 (0.7, 2.3)	3.1 (2.1, 4.5)	2.0 (1.6, 2.4)	0.7 (0.4, 1.1)	0.7 (0.3, 1.4)	0.8 (0.6, 1.2)	< .001
Binge drinking (≥ 6 times)	1.2 (0.9, 1.7)	1.2 (1.0, 1.6)	1.5 (1.3, 1.7)	1.0 (0.7, 1.4)	1.1 (0.5, 2.6)	0.9 (0.7, 1.1)	< .001
Diet and physical activity risks							
Overweight or obese BMI[b]	1.0 (0.6, 1.9)	1.8 (1.2, 2.6)	1.2 (1.0, 1.4)	0.6 (0.3, 1.0)	1.8 (0.6, 5.5)	0.8 (0.6, 1.1)	.28
Vomited for weight control (≥ 1 per month in past year)	1.3 (0.6, 2.9)	1.6 (0.9, 2.8)	1.7 (1.3, 2.3)	3.2 (1.1, 9.4)	4.4 (0.6, 29.7)	1.2 (0.3, 4.2)	.35
Physically inactive in past year	1.0 (0.7, 1.4)	1.6 (1.2, 2.1)	1.3 (1.2, 1.5)	1.7 (1.2, 2.4)	1.9 (1.0, 3.4)	1.6 (1.2, 2.0)	.11
Ultraviolet radiation risks, past summer, except tanning booth							
Sun exposed (sometimes, often, always)	1.0 (0.7, 1.4)	0.8 (0.6, 1.0)	1.0 (0.9, 1.1)	0.9 (0.7, 1.3)	1.0 (0.5, 2.0)	0.9 (0.8, 1.1)	.65
Sunburned (≥ 5 times)	1.1 (0.7, 1.9)	1.1 (0.7, 1.7)	0.9 (0.8, 1.1)	0.8 (0.5, 1.3)	0.6 (0.2, 1.4)	1.0 (0.7, 1.3)	.27
Used sunblock (never or seldom)	1.3 (0.9, 1.7)	1.0 (0.8, 1.3)	1.0 (0.9, 1.1)	1.1 (0.8, 1.5)	1.2 (0.6, 2.3)	1.0 (0.8, 1.2)	.60
Used tanning booth (≥ 10 times per year)	0.4 (0.3, 0.7)	0.4 (0.3, 0.6)	0.6 (0.6, 0.7)	4.7 (3.0, 7.4)	1.3 (0.4, 4.9)	0.6 (0.3, 1.1)	< .001
Ever sexually transmitted infection	0.8 (0.4, 1.6)	1.8 (1.2, 2.7)	1.7 (1.5, 2.1)	3.5 (2.0, 6.4)	. . .[c]	1.4 (0.7, 2.4)	.012[c]

Note. BI = bisexual; BMI = body mass index; CI = confidence interval; MH = mostly heterosexual; OR = odds ratio (completely heterosexual is the group [0] to which each sexual-minority group [1] is compared). All risks were assessed over 7 waves (1999, 2000, 2001, 2003, 2005, 2007, and 2010), except for cigarette use (all waves except 2000), other tobacco use (1999, 2000, and 2001), physically inactive (1999, 2001, and 2005), sun exposed (2001, 2003, 2005, and 2007), sunburned and use of sunblock (1999, 2000, 2001, 2003, 2005, and 2007), use of tanning booth (1999, 2001, 2003, 2005, 2007, and 2010, although 2010 data were not used), and sexually transmitted infection (1999, 2005, and 2007). Adjustments were made for age in 1999, ethnicity/race, and sibling clusters.

[a]Sexually transmitted infection is not included, given its measurement: ever had a sexually transmitted infection at each of its 3 assessments. The findings for sexually transmitted infection appear in the last row.

[b]BMI was computed according to the Centers for Disease Control and Prevention algorithms.[96–98]

[c]No male bisexuals reported a sexually transmitted infection. Thus, male bisexuals were excluded from the analyses because of model nonconvergence.

heterosexual men.[118] These initial disparities persisted over time, from adolescence (age 11–21 years) through early adulthood (age 24–32 years) for both sexes. However, inconsistencies exist. Although another representative sample found the pattern of significant sexual-orientation disparities for women but not men in binge drinking, it found sexual-orientation disparities for both sexes in past-year alcohol dependence.[19] A literature review found that both male and female sexual minorities had higher rates of tobacco use than same-sex heterosexuals.[17] In addition, adolescent studies have documented sexual-orientation disparities for both sexes in tobacco and alcohol use.[21] Despite inconsistencies in the literature, our study and much of the literature agree that sexual-minority women are more likely to smoke tobacco and drink alcohol than CH women.

Diet and physical activity risk. We found that BI and MH women were more likely than CH women to be overweight or physically inactive; lesbians did not differ from CH women. Interestingly, more lesbian adults than heterosexual women have been found to be overweight or obese.[29,34] Perhaps some younger lesbians become overweight with the passage of time, catching up to BI and MH women over time.

Ultraviolet radiation. We found sex by sexual-orientation disparities on exposure to manufactured UVR. The sexual-minority young women were less likely to frequently use tanning booths than were CH women. However, gay young men were more than 4 times as likely as CH men to frequently use tanning booths. This pattern of findings may suggest that both young CH women and gay men

strive to be attractive to themselves or their preferred sexual object by tanning, which has been confirmed for CH young women[119] and gay young men.[120]

Limitations

This report has limitations. Not all cancer-related risk behaviors were measured at all assessment waves. Measurement error exists. For example, participants were asked about lifetime STIs at every assessment rather than time-specific diagnoses. Insufficient power existed to assess differences between BI and CH young men. There were too few ethnic/racial minorities to generalize to them.

Conclusions

Young sexual minorities are at risk for cancer by means of cancer-related risk behaviors to which they are frequently exposed over time. Long-term longitudinal studies are essential to track frequent engagement in the risk behaviors and cancer morbidity and mortality. Throughout this process, sensitivity will be needed to differences among sexual minorities relative to CH persons. Finally, national surveillance data on cancer morbidity and mortality by sexual orientation need to be collected to document the potential burden of cancer among sexual minorities. AJPH

CONTRIBUTORS

M. Rosario conceptualized and directed all aspects of the report. She, F. Li, and D. Wypij managed the statistical and data analytic issues. All authors were involved in interpreting the data and revising the article.

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HUMAN PARTICIPANT PROTECTION

This study was approved by the institutional review board of Brigham and Women's Hospital.

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