

Sexual Orientation Disparities in Cancer-Related Risk Behaviors of Tobacco, Alcohol, Sexual Behaviors, and Diet and Physical Activity: Pooled Youth Risk Behavior Surveys

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A 2011 Institute of Medicine report detailed the lack of national data to estimate cancer incidence and prevalence among lesbian, gay, bisexual, and transgender individuals,¹ representing little progress since a 1999 report from the Institute on the health of lesbians that highlighted the absence of cancer data for that group.² The persistent lack of national surveillance data on cancer among sexual minorities is a significant public health omission. Cancer remains the second most common cause of mortality in the United States, accounting for nearly 1 of every 4 deaths.³ Behaviors that increase the risk for cancer are elevated among sexual minorities, are likely to be apparent at young ages, and may become habitual over the life span by means of behavioral reinforcement and neurobiological reward circuits.

RISK BEHAVIORS

Tobacco and alcohol use are behavioral risk factors for developing numerous types of cancers, such as lung, esophageal, oropharyngeal, and colon.⁴⁻¹⁰ Despite decades of scientific awareness of the causal link between tobacco and alcohol use and cancer, these substances continue to exact a heavy toll on the US population.¹¹ Furthermore, evidence suggests that tobacco and alcohol used together have synergistic effects on cancer risk.^{12,13} However, not all population subgroups are at similar risk for engaging in these substance use behaviors. Ample evidence suggests that across adolescence and adulthood, individuals with a minority sexual orientation are more likely than heterosexuals to use tobacco and alcohol.¹⁴⁻²³

Some sexual behaviors are associated with elevated risk of cancers, and some of these behaviors are gender specific. Number of sexual partners, earlier age of first intercourse, concurrent sexual partners, lack of condom

use, and substance use during sexual activity have all been shown to be associated with elevated risk of contracting cancer-related pathogens, for example, human papillomavirus (HPV).²⁴⁻³⁴ Recent research has shown that bisexual and heterosexual women who have sex with women have higher rates of engaging in these sexual risk behaviors than do heterosexual women with only other-sex partners.³⁵⁻³⁷ Moreover, lesbians, particularly those who have never had sexual intercourse with men, have been shown to be less likely to be screened for HPV,^{36,38,39} despite documented risks of HPV transmission during female-to-female sexual activity.⁴⁰

Documenting male HPV risk is important for understanding HPV transmission to female partners, but also because HPV is linked to anal, oral, and penile cancers among men.^{33,41} The risk of cancer-related sexual behaviors may be elevated among sexual minority men because of the established links between anal intercourse, HPV, and anal cancer,⁴² particularly among men who are also HIV positive.⁴³

Objectives. We examined sexual orientation disparities in cancer-related risk behaviors among adolescents.

Methods. We pooled data from the 2005 and 2007 Youth Risk Behavior Surveys. We classified youths with any same-sex orientation as sexual minority and the remainder as heterosexual. We compared the groups on risk behaviors and stratified by gender, age (< 15 years and > 14 years), and race/ethnicity.

Results. Sexual minorities (7.6% of the sample) reported more risk behaviors than heterosexuals for all 12 behaviors (mean = 5.3 vs 3.8; $P < .001$) and for each risk behavior: odds ratios (ORs) ranged from 1.3 (95% confidence interval [CI] = 1.2, 1.4) to 4.0 (95% CI = 3.6, 4.7), except for a diet low in fruit and vegetables (OR = 0.7; 95% CI = 0.5, 0.8). We found sexual orientation disparities in analyses by gender, followed by age, and then race/ethnicity; they persisted in analyses by gender, age, and race/ethnicity, although findings were nuanced.

Conclusions. Data on cancer risk, morbidity, and mortality by sexual orientation are needed to track the potential but unknown burden of cancer among sexual minorities. (*Am J Public Health.* 2014;104:245-254. doi:10.2105/AJPH.2013.301506)

Diet-related behaviors are thought to account for about 30% of cancers in developed countries.⁴⁴ Similarly, it has been estimated that 15% to 20% of cancer deaths in the United States can be attributed specifically to overweight and obesity.⁴⁵ According to several studies, obesity and overweight, physical inactivity, and diets low in fruit and vegetables are significantly more prevalent among sexual minority than heterosexual women.⁴⁶⁻⁵⁴

However, in the sexual minority male population, studies on the prevalence of overweight, physical inactivity, and diets low in fruit and vegetables are less consistent. Some have found a higher prevalence of obesity and overweight among sexual minority than heterosexual men,⁵⁵ but others have found the opposite in representative samples of the population.^{56,57} Similarly, a study of a representative sample found higher rates of limited physical activity in sexual minority men,⁵³ but others found similar exercise levels among sexual minority and heterosexual men in representative⁵⁷ and convenience⁵⁸ samples.

Fewer studies have compared fruit and vegetable intake among male sexual orientation groups. One study of a representative sample of the population found no significant difference between sexual minority and heterosexual men.⁵⁷ However, dieting behavior has been found to be more common among sexual minority than heterosexual men, which may affect fruit and vegetable consumption.^{58–60} In addition, purging as a means of reducing caloric intake may be elevated among sexual minority men relative to heterosexual men.⁶¹ In fact, the sexual orientation disparity in purging may be apparent during adolescence and in both genders.^{62,63} Purging may be a risk for Barrett's esophageal cancer.^{64–66}

We used the Youth Risk Behavior Survey (YRBS) to examine disparities between sexual minorities and heterosexuals in the prevalence of known cancer-related risk behaviors associated with tobacco and alcohol use, sexual activity, and diet and physical activity. We also examined disparities by gender, age (younger vs older adolescents), and race/ethnicity.

METHODS

The YRBS is conducted biennially across mostly public high schools in the United States. A 2-stage, cluster sampling design is used in each jurisdiction (city or state) to generate a representative sample of students in grades 9 through 12. Although the national survey does not ask about sexual orientation, jurisdictions are allowed to add items to the survey. Our pooled YRBS data sets for 2005 and 2007 contained 14 (Boston, MA; Chicago, IL; Connecticut; Delaware; Hawaii; Maine; Massachusetts; New York City, NY; Rhode Island; San Diego and San Francisco, CA; Vermont; Wisconsin; and Milwaukee, WI) of 15 jurisdictions that collected sexual orientation data; 1 jurisdiction did not grant us access to its data. We used weights to ensure a representative sample for each assessment year and to allow for pooling across years. Detailed information on the procedures used to pool the data sets is available elsewhere.⁶⁷

Measures

Sexual orientation and demographic characteristics. We defined sexual orientation by sexual attractions, gender of sexual partners,

or sexual identity. Some jurisdictions used multiple indicators of sexual orientation, others only 1. In addition, wording varied in comparable items across jurisdictions. We used all available data because the 3 markers define the multidimensionality of sexual orientation.⁶⁸ When we found any indication of a same-sex orientation, including being uncertain of one's identity, we classified the respondent as sexual minority. We defined heterosexuals as those with exclusive other-sex orientation on all available data. We coded race/ethnicity as White, Latino, Black, or Asian. We classified youths who identified as Hispanic/Latino or multiple Hispanic as Latino. We classified youths who identified as Asian or Native Hawaiian/other Pacific Islander as Asian. We excluded youths of American Indian/Native Alaskan (too few for analysis) and multiple non-Latino (ungeneralizable as a group) backgrounds.

Cancer-related risk behaviors. We evaluated prevalence of substance use, sexual risk behaviors, and dietary and physical activity risks. In addition, we computed a sum of items endorsed in each of the 3 sets of risk indicators, varying from zero to 4 for each set. We also derived a total sum of risk indicators across the 3 sets as a composite of cancer-related risk behaviors, varying from zero to 12.

The 4 indicators of substance use during the past 30 days involved any smoking of cigarettes, consuming tobacco by other means (chewing tobacco or smoking cigars), drinking alcohol, and binge drinking. The survey defined binge drinking as consuming "5 or more drinks of alcohol in a row, that is, within a couple of hours."

Four variables assessed sexual risk behaviors, according to guidelines for sexually transmitted infections.^{26,27} For early sexual experience and lifetime number of partners, we coded youths who reported either (1) having sexual intercourse when younger than 16 years or (2) having sexual intercourse at age 16 years or older and reporting 2 or more lifetime partners as 1 (at risk); we coded youths who did not meet these conditions as 0 (not at risk). Additional risk variables were having more than 1 sexual partner in the past 90 days, not using a condom at last sexual intercourse, and using alcohol or drugs at last sexual intercourse. The survey did not define sexual intercourse.

Four items evaluated dietary and physical activity risks. First, the Centers for Disease Control and Prevention computed body mass index (BMI) from participants' self-reported weight and height. BMI cut points for overweight criteria during adolescence vary by age and gender.^{69,70} We classified respondents with BMI at or above the 85th percentile as overweight, as recommended by the Centers for Disease Control and Prevention. Second, we defined a diet low in fruit and vegetables as consuming fewer than 5 daily helpings during the past 7 days, according to published guidelines for youths.^{71,72} We combined daily intake of carrots and vegetables other than potatoes and salad during the past 7 days. We excluded potatoes because they are unrelated to cancer; we excluded salad because many Americans consume iceberg lettuce rather than the dark green lettuce that is recommended.⁷³ Third, the survey assessed purging of food by means of vomiting or use of laxatives during the past 30 days. Fourth, we followed recommended guidelines for adolescents to define little physical activity during the past 7 days as engaging in less than 1 hour of such activity on 5 or more days per week.⁷⁴ The survey defined physical activity as "increased your heart rate and made you breathe hard some of the time."

Statistical Analyses

Because of the weighting and pooling of the YRBS surveys, we used the SPSS module Complex Samples (SPSS Inc, Chicago, IL) for our analyses. We computed descriptive statistics consisting of means, standard errors of the means, standard deviations, and frequencies. We compared sexual minorities and heterosexuals for composites of cancer-related risk behaviors with the *t* test. If the composite across all risk behaviors and the composite for a particular risk set (e.g., substance use) were significant, we examined disparities by sexual orientation for the individual cancer-related risk behaviors in the set with odds ratios (ORs). We used this procedure to protect against Type I error.⁷⁵ Provided examination was possible of the individual cancer-related risk behavior, we stratified by gender, followed by development, and then race/ethnicity. When stratifying by 1 demographic characteristic in these analyses, we did not control for the other 2 demographic characteristics. This procedure allowed us to

witness the crude relation of each stratification variable to a cancer-related risk behavior across the other demographic characteristics.

Finally, we controlled for the other demographic characteristics by stratifying by all 3 demographic characteristics: gender, development, and race/ethnicity. We dichotomized development as early adolescence (aged < 15 years) versus middle or late adolescence (aged > 14 years). Early adolescence encompasses pubertal development,⁷⁶ a time when many individuals first become aware of their unfolding sexual orientation.⁷⁷⁻⁸¹ Thus, we hypothesized that cancer-related risk behaviors would also be apparent in early adolescence.

RESULTS

The unweighted sample comprised 65 871 youths aged 12 to 18 years or older. Sexual minorities constituted 7.6% of the sample. Of the total sample, 50.2% were male, 53.2% were White, 18.8% were Latino, 19.2% were Black, and 8.8% were Asian.

Table 1 presents sexual orientation disparities in cancer-related risk behaviors. Sexual minorities reported more risk behaviors than did heterosexuals, and more sexual minorities than heterosexuals experienced each risk behavior. The only exception was that more heterosexuals than sexual minorities failed to meet recommended daily allowances of fruit and vegetable intake.

Table 2 contains sexual orientation disparities in cancer-related risk behaviors by demographic characteristics. We found disparities in each gender, developmental period, and racial/ethnic group: more sexual minorities than heterosexuals engaged in each risk behavior, with the single exception of inadequate fruit and vegetable consumption.

Our significant findings and large sample size allowed us to stratify sexual orientation disparities by gender, age, and race/ethnicity (Tables 3 and 4). The stratified findings indicate a relatively consistent pattern: more sexual minorities than heterosexuals reported cancer-related risk behaviors, especially Whites and Latinos and particularly for substance use and sexual risk behaviors. Among Blacks and Asians, substance use and sexual risk behaviors varied with development: we

TABLE 1—Unadjusted Means and Frequencies of Cancer-Related Risk Behaviors and Demographic Characteristics of Sexual Minority and Heterosexual Youths: Youth Risk Behavior Survey, United States, 2005 and 2007

Variable	Sexual Minority, Mean (SE) or %	Heterosexual, Mean (SE) or %	r ^a	OR (95% CI) or χ ²
Cancer risk behaviors				
Total (n = 12), no.	5.3 (0.07)	3.8*** (0.03)	.14	
Substance use behaviors (total = 4)	1.3 (0.03)	0.8*** (0.01)	.12	
Sexual risk behaviors (total = 4)	2.5 (0.05)	1.5*** (0.03)	.12	
Diet and activity behaviors (total = 4)	1.9 (0.02)	1.6*** (0.01)	.08	
Substance use (past 30 d)				
Cigarettes	35.6	14.4		3.3*** (3.0, 3.6)
Other tobacco: combined	21.7	12.1		2.0*** (1.8, 2.3)
Other tobacco: chewing tobacco	8.9	4.4		2.1*** (1.7, 2.7)
Other tobacco: cigars	19.8	10.5		2.1*** (1.8, 2.4)
Alcohol	57.0	40.7		1.9*** (1.8, 2.1)
Binge drinking	34.3	22.1		1.8*** (1.7, 2.0)
Sexual risk behaviors				
Early intercourse and lifetime no. of partners	59.9	36.7		2.6*** (2.3, 2.9)
> 1 partner (past 90 d)	18.7	7.5		2.8*** (2.4, 3.3)
No condom use at last sexual intercourse	46.9	30.5		2.0*** (1.8, 2.3)
Drug use at last sexual intercourse	28.4	20.1		1.6*** (1.4, 1.8)
Diet and activity behaviors				
BMI (overweight) ^b	32.7	27.2		1.3*** (1.2, 1.4)
Diet low in fruit and vegetables (past 7 d)	93.4	95.6		0.7*** (0.5, 0.8)
Purging (past 30 d)	15.3	4.3		4.0*** (3.4, 4.7)
Little physical activity (past 7 d)	70.4	62.5		1.4*** (1.3, 1.6)
Demographic characteristics				
Male	39.2	51.1		0.6*** (0.6, 0.7)
Older (> 14 y) vs younger	89.5	87.4		1.3** (1.1, 1.4)
Race/ethnicity				
White	47.3	53.6		
Latino	22.0	18.6		
Black	21.3	19.0		
Asian	9.3	8.8		76.7***

Note. BMI = body mass index; CI = confidence interval; OR = odds ratio. We compared boys (1) to girls (0), and older (1) to younger (0) youths. A χ² test of independence of sexual orientation by race/ethnicity (2 × 4) was conducted.

^aPearson correlation, an effect size for mean differences.⁸²

^bAbove 85th percentile for age and gender.

P < .01; *P < .001.

found fewer significant disparities by sexual orientation during early adolescence, but a pattern similar to that of other racial/ethnic groups in middle and late adolescence.

The stratified findings for diet and physical activity were more complex (Tables 3 and 4). Although a higher proportion of sexual minority than heterosexual adolescent girls were overweight, especially in middle and late adolescence, we observed no significant

differences between them in recommended levels of physical activity. By contrast, among adolescent boys we found no significant weight differences by sexual orientation, but generally fewer sexual minorities than heterosexuals engaged in recommended levels of physical activity.

In addition to the significant results, the findings by effect size indicated a consistent developmental pattern in cancer-related risk

TABLE 2—Sexual Orientation Disparities in Cancer-Related Risk Behaviors by Gender, Age Group, and Race/Ethnicity: Youth Risk Behavior Survey, United States, 2005 and 2007

Risk Behavior	Sexual Minorities Compared With Heterosexuals (Ref)							
	Female, OR (95% CI) or Mean (SD)	Male, OR (95% CI) or Mean (SD)	Younger (< 15 y), OR (95% CI) or Mean (SD)	Older (> 14 y), OR (95% CI) or Mean (SD)	White, OR (95% CI) or Mean (SD)	Latino, OR (95% CI) or Mean (SD)	Black, OR (95% CI) or Mean (SD)	Asian, OR (95% CI) or Mean (SD)
Substance use (past 30 d)								
Cigarettes	4.0*** (3.5, 4.6)	2.4*** (2.0, 2.9)	5.5*** (3.9, 7.6)	3.1*** (2.8, 3.4)	3.8*** (3.3, 4.4)	3.2*** (2.7, 3.9)	3.0*** (2.1, 4.1)	3.5*** (2.4, 5.1)
Other tobacco ^a	3.3*** (2.8, 3.9)	1.8*** (1.4, 2.1)	3.6*** (2.4, 5.3)	1.9*** (1.6, 2.2)	1.8*** (1.5, 2.2)	2.2*** (1.8, 2.7)	2.7*** (2.0, 3.7)	4.7*** (2.7, 8.3)
Alcohol	2.2*** (2.0, 2.4)	1.6*** (1.3, 1.9)	2.7*** (2.0, 3.5)	1.8*** (1.6, 2.1)	2.0*** (1.7, 2.4)	2.1*** (1.8, 2.5)	1.9*** (1.6, 2.4)	2.0*** (1.5, 2.7)
Binge drinking	2.2*** (1.9, 2.5)	1.5*** (1.2, 1.8)	2.9*** (2.2, 3.9)	1.8*** (1.6, 1.9)	1.8*** (1.6, 2.0)	2.2*** (1.9, 2.7)	2.5*** (1.9, 3.2)	2.0*** (1.5, 2.8)
Sexual activity								
Early intercourse and lifetime no. of partners	3.0*** (2.7, 3.4)	2.2*** (1.8, 2.6)	3.8*** (2.8, 5.0)	2.5*** (2.2, 2.7)	3.1*** (2.7, 3.5)	2.2*** (1.8, 2.6)	2.0*** (1.5, 2.6)	2.5*** (1.8, 3.3)
> 1 partner (past 90 d)	4.1*** (3.4, 5.0)	2.4*** (1.8, 3.1)	4.6*** (2.4, 8.6)	2.7*** (2.3, 3.1)	3.9*** (3.2, 4.8)	1.9*** (1.5, 2.4)	2.0*** (1.4, 3.0)	2.8*** (1.8, 4.6)
No condom use at last sexual intercourse	1.6*** (1.4, 1.9)	2.5*** (2.0, 3.1)	2.6*** (1.5, 4.4)	2.0*** (1.7, 2.3)	2.0*** (1.7, 2.4)	2.2*** (1.7, 2.7)	2.1*** (1.6, 2.8)	1.3 (0.9, 1.9)
Drug use at last sexual intercourse	1.8*** (1.5, 2.1)	1.6*** (1.3, 1.9)	1.9* (1.1, 3.2)	1.6*** (1.3, 1.8)	1.4*** (1.1, 1.7)	1.8*** (1.4, 2.3)	2.1*** (1.5, 3.0)	1.8* (1.1, 2.9)
Diet and physical activity								
BMI (overweight) ^b	1.7*** (1.5, 1.9)	1.0 (0.9, 1.2)	1.2 (0.9, 1.7)	1.3*** (1.2, 1.5)	1.4*** (1.2, 1.7)	1.1 (1.0, 1.4)	1.2* (1.0, 1.5)	1.0 (0.7, 1.4)
Diet low in fruit and vegetables (past 7 d)	0.9 (0.7, 1.1)	0.5*** (0.4, 0.6)	0.4*** (0.2, 0.6)	0.7*** (0.6, 0.9)	0.7*** (0.5, 0.9)	0.6** (0.4, 0.9)	0.8 (0.5, 1.5)	0.6* (0.4, 1.0)
Purging (past 30 d)	2.8*** (2.2, 3.5)	6.6*** (5.2, 8.4)	7.0*** (4.8, 10.3)	3.7*** (3.2, 4.3)	3.9*** (3.2, 4.8)	3.9*** (2.7, 5.6)	3.6*** (2.3, 5.6)	5.7*** (3.8, 8.6)
Little physical activity (past 7 d)	1.1 (0.9, 1.2)	1.8*** (1.5, 2.2)	1.6*** (1.2, 2.3)	1.4*** (1.2, 1.6)	1.5*** (1.3, 1.8)	1.1 (0.9, 1.4)	1.4* (1.1, 1.7)	1.7** (1.2, 2.4)
Effect ^c	2.4 (1.1)	2.2 (1.5)	3.2 (1.9)	2.0 (0.8)	2.3 (1.1)	2.0 (0.9)	2.1 (0.8)	2.5 (1.5)

Note. BMI = body mass index; CI = confidence interval; OR = odds ratio.

^aChewing tobacco or smoking cigars.

^bAbove 85th percentile for age and gender.

^cMean of the ORs across the 12 cancer-related risk behaviors.

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

behaviors and across gender and racial/ethnic groups. Effect sizes between the sexual minorities and heterosexuals were generally greater during early than later adolescence (Tables 2–4).

DISCUSSION

Our findings show that sexual minorities may face a greater cumulative lifetime cancer risk than do heterosexuals because of their higher prevalence of cancer-related risk behaviors in adolescence. Many of the cancer-related risk behaviors we examined have been investigated in the past among adolescents, although often in isolation, and the investigations generally did not focus on the behaviors' potential risk for cancer.

We found a consistent pattern in which sexual minority youths reported more cancer-related risk behaviors than did their heterosexual peers across almost all risk behaviors and in risk factor categories—substance use, sexual behaviors, and diet and physical activity. In addition, we found sexual orientation disparities for each cancer-related risk behavior (except a diet low in fruit and vegetables) and across gender, development, and race/ethnicity.

Implications for Research

The sexual orientation disparities in cancer-related risk behaviors documented in this large study of adolescents in the United States have several implications. First, many were apparent across genders (substance use, sexual risk, and purging), although some interesting gender-related findings emerged. Adolescent girls had a BMI disparity (more sexual minorities than heterosexuals were overweight), but adolescent boys did not. We observed no significant disparity by sexual orientation among adolescent girls for physical activity, but sexual minority boys engaged in less physical activity than did heterosexual boys. These seemingly contradictory findings may be explained by gender-nonconforming behaviors, which are more common among sexual minorities than heterosexuals.⁸³ Gender-nonconforming behaviors are behaviors or characteristics that are culturally or socially more often associated with the other gender.⁸⁴ For example, because adolescent girls are more conscious than adolescent boys of maintaining a normal weight, but are less

TABLE 3—Sexual Orientation Disparities in Cancer-Related Risk Behaviors Among Adolescent Girls, Stratified by Age Group and Race/Ethnicity: Youth Risk Behavior Survey, United States, 2005 and 2007

Risk Behavior	Sexual Minority Girls Compared With Heterosexual Girls (Ref)									
	Younger Whites, OR (95% CI) or Mean (SD)	Older Whites, OR (95% CI) or Mean (SD)	Younger Latinas, OR (95% CI) or Mean (SD)	Older Latinas, OR (95% CI) or Mean (SD)	Younger Blacks, OR (95% CI) or Mean (SD)	Older Blacks, OR (95% CI) or Mean (SD)	Younger Asians, OR (95% CI) or Mean (SD)	Older Asians, OR (95% CI) or Mean (SD)		
Substance use (past 30 d)										
Cigarettes	6.3*** (3.6, 10.9)	4.7*** (3.9, 5.7)	4.2*** (1.8, 9.5)	3.7*** (2.9, 4.8)	5.1* (1.1, 25.1)	3.3*** (2.2, 5.0)	1.8 (0.4, 9.0)	3.7*** (2.4, 5.7)		
Other tobacco ^a	3.2** (1.3, 7.6)	3.7*** (2.9, 4.8)	3.7*** (1.5, 9.0)	2.8*** (2.0, 4.1)	4.4 (0.7, 27.6)	2.4** (1.4, 4.2)	8.3 (0.8, 83.5)	4.3*** (1.8, 10.4)		
Alcohol	3.6*** (2.1, 6.1)	2.0*** (1.7, 2.4)	2.4** (1.3, 4.2)	2.3*** (1.9, 2.8)	3.6* (1.1, 11.4)	2.2*** (1.6, 3.0)	1.7 (0.7, 4.3)	3.1*** (2.0, 4.8)		
Binge drinking	3.4*** (1.9, 6.2)	1.9*** (1.7, 2.3)	2.2* (1.2, 3.9)	2.7*** (2.1, 3.5)	3.3* (1.1, 10.3)	2.6*** (1.8, 3.7)	2.1 (0.6, 7.8)	2.8*** (1.7, 4.7)		
Sexual activity										
Early intercourse and lifetime no. of partners	4.5*** (2.6, 7.8)	3.1*** (2.6, 3.8)	2.6** (1.3, 5.1)	2.7*** (2.2, 3.4)	7.5*** (2.9, 19.2)	2.7*** (2.0, 3.6)	0.9 (0.2, 4.5)	2.4*** (1.5, 4.0)		
> 1 partner (past 90 d)	4.4** (1.4, 13.7)	4.9*** (3.8, 6.3)	3.4* (1.3, 8.5)	3.5*** (2.5, 5.1)	1.5 (0.3, 7.5)	3.2*** (2.0, 5.1)	5.4* (1.1, 27.3)	3.7*** (1.7, 8.2)		
No condom use at last sexual intercourse	1.6 (0.7, 3.8)	1.7*** (1.3, 2.2)	2.1 (0.7, 6.9)	1.7*** (1.3, 2.3)	0.3 (0.1, 1.3)	1.5* (1.1, 2.2)	1.1 (0.1, 8.8)	1.2 (0.7, 2.1)		
Drug use at last sexual intercourse	1.1 (0.4, 2.8)	1.6*** (1.3, 2.1)	1.5 (0.5, 4.4)	2.0*** (1.4, 2.8)	0.4 (0.1, 3.0)	3.1*** (1.9, 5.1)	2.8 (0.5, 15.7)	2.5* (1.1, 5.6)		
Diet and physical activity										
BMI (overweight) ^b	2.4** (1.3, 4.6)	2.0*** (1.6, 2.5)	1.2 (0.7, 2.3)	1.4* (1.1, 1.8)	0.6 (0.2, 2.0)	1.4* (1.1, 1.9)	1.7 (0.6, 4.3)	1.3 (0.8, 2.3)		
Diet low in fruit and vegetables (past 7 d)	0.4* (0.2, 0.8)	1.0 (0.6, 1.6)	2.5 (0.8, 7.9)	0.6* (0.4, 0.9)	0.2 (0.02, 1.1)	2.4** (1.3, 4.5)	0.4 (0.9, 1.4)	0.9 (0.4, 1.8)		
Purging (past 30 d)	6.6*** (2.8, 15.3)	2.4*** (1.8, 3.1)	4.3*** (1.7, 10.4)	3.0*** (1.9, 4.8)	0.2* (0.03, 0.8)	3.0*** (1.7, 5.0)	4.7*** (2.0, 11.0)	2.6** (1.4, 4.8)		
Little physical activity (past 7 d)	1.8 (0.9, 3.7)	1.2* (1.02, 1.5)	1.1 (0.6, 2.3)	0.7*** (0.6, 0.9)	0.9 (0.2, 4.0)	0.9 (0.6, 1.2)	1.4 (0.6, 3.2)	1.2 (0.8, 2.0)		
Effect ^c	3.3 (2.0)	2.5 (1.3)	2.6 (1.1)	2.3 (1.0)	2.3 (2.4)	2.4 (0.8)	2.7 (2.3)	2.5 (1.1)		

Note. BMI = body mass index; CI = confidence interval; OR = odds ratio. Younger adolescents were aged < 15 y; older adolescents were aged > 14 years.

^aChewing tobacco or smoking cigars.

^bAbove 85th percentile for age and gender.

^cMean of the ORs across the 12 cancer-related risk behaviors.

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

TABLE 4—Sexual Orientation Disparities in Cancer-Related Risk Behaviors Among Adolescent Boys, Stratified by Age Group and Race/Ethnicity: Youth Risk Behavior Survey, United States, 2005 and 2007

Risk Behavior	Sexual Minority Boys Compared With Heterosexual Boys (Ref)							
	Younger Whites, OR (95% CI) or Mean (SD)	Older Whites, OR (95% CI) or Mean (SD)	Younger Latinos, OR (95% CI) or Mean (SD)	Older Latinos, OR (95% CI) or Mean (SD)	Younger Blacks, OR (95% CI) or Mean (SD)	Older Blacks, OR (95% CI) or Mean (SD)	Younger Asians, OR (95% CI) or Mean (SD)	Older Asians, OR (95% CI) or Mean (SD)
Substance use (past 30 d)								
Cigarettes	7.5*** (3.3, 16.9)	2.2*** (1.6, 2.9)	3.3* (1.1, 10.1)	2.4*** (1.7, 3.4)	16.9*** (3.0, 95.8)	1.9** (1.2, 3.0)	4.8* (1.2, 19.7)	3.3*** (1.9, 5.9)
Other tobacco ^a	5.3*** (2.3, 11.9)	1.2 (0.9, 1.6)	1.7 (0.4, 6.3)	2.0*** (1.4, 2.9)	6.1* (1.03, 36.6)	3.1*** (2.1, 4.8)	9.2* (1.3, 62.7)	5.5*** (2.5, 12.0)
Alcohol	3.8*** (1.9, 7.8)	1.6** (1.2, 2.2)	1.4 (0.5, 3.8)	1.8*** (1.3, 2.6)	1.3 (0.2, 8.7)	1.4 (0.98, 1.9)	1.2 (0.5, 2.7)	1.3 (0.9, 2.2)
Binge drinking	3.5*** (1.7, 7.4)	1.3 (0.98, 1.8)	2.4 (0.9, 6.7)	1.7*** (1.2, 2.4)	1.2 (0.2, 7.4)	2.4*** (1.5, 3.7)	1.1 (0.3, 4.0)	1.5 (0.8, 2.5)
Sexual activity								
Early intercourse and lifetime no. of partners	7.1*** (3.7, 13.7)	2.5*** (1.9, 3.2)	4.1* (1.3, 13.2)	1.6** (1.1, 2.3)	6.5* (1.2, 36.0)	1.1 (0.7, 1.8)	5.2** (1.5, 17.3)	2.4*** (1.4, 4.2)
> 1 partner (past 90 d)	24.6*** (10.8, 55.9)	2.7*** (1.7, 4.2)	2.7 (0.8, 9.4)	1.5* (1.0, 2.4)	19.1** (2.6, 138.1)	1.5 (0.9, 2.7)	0.9 (0.2, 5.2)	3.2** (1.5, 6.6)
No condom use at last sexual intercourse	3.7* (1.1, 12.3)	2.3*** (1.7, 3.2)	10.4*** (2.6, 42.6)	1.9** (1.2, 3.0)	14.0** (2.1, 93.4)	3.3*** (1.9, 5.6)	3.7 (0.98, 13.8)	1.2 (0.6, 2.3)
Drug use at last sexual intercourse	5.2** (1.6, 17.0)	1.2 (0.8, 1.6)	2.1 (0.5, 8.1)	1.8** (1.2, 2.9)	0.7 (0.1, 4.2)	2.0* (1.1, 3.8)	0.6 (0.1, 4.0)	1.6 (0.7, 3.3)
Diet and physical activity								
BMI (overweight) ^b	0.9 (0.4, 2.3)	1.1 (0.8, 1.4)	2.4 (0.9, 6.4)	1.0 (0.7, 1.4)	0.5 (0.1, 1.8)	1.1 (0.8, 1.5)	0.6 (0.2, 2.2)	0.8 (0.5, 1.4)
Diet low in fruit and vegetables (past 7 d)	0.2** (0.09, 0.6)	0.5** (0.3, 0.8)	8.8* (1.1, 71.4)	0.4** (0.2, 0.8)	0.1* (0.01, 0.7)	0.7 (0.4, 1.2)	0.4 (0.1, 1.2)	0.7 (0.4, 1.2)
Purging (past 30 d)	26.5*** (7.6, 92.4)	5.9*** (4.1, 8.4)	5.3** (1.6, 17.1)	5.3*** (3.1, 9.1)	22.8*** (5.3, 96.9)	5.4*** (2.5, 11.5)	19.7*** (6.0, 65.2)	7.6*** (3.9, 14.7)
Little physical activity (past 7 d)	1.3 (0.5, 3.1)	1.6** (1.2, 2.3)	1.4 (0.5, 4.1)	1.6* (1.1, 2.3)	6.3** (1.5, 25.8)	2.1** (1.3, 3.4)	3.1* (1.02, 9.6)	1.9* (1.1, 3.4)
Effect ^c	7.5 (8.8)	2.0 (1.4)	3.8 (2.9)	1.9 (1.2)	8.0 (8.1)	2.2 (1.3)	4.2 (5.5)	2.6 (2.1)

Note. BMI = body mass index; CI = confidence interval; OR = odds ratio. Younger adolescents were aged < 15 y; older adolescents were aged > 14 years.

^aChewing tobacco or smoking cigars.

^bAbove 85th percentile for age and gender.

^cMean of the ORs across the 12 cancer-related risk behaviors.

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

physically active, gender-nonconforming behaviors would produce, as we found, more overweight among sexual minority than heterosexual adolescent girls and fewer physically active sexual minority than heterosexual adolescent boys. The mitigating role of gender nonconformance in risk behaviors^{85,86} requires careful examination in future studies.

Second, sexual orientation disparities in cancer-related risk behaviors were already apparent from early to late adolescence, underscoring the magnitude of the concern. In fact, these disparities were larger during early than later adolescence, as shown by the mean effect sizes across the cancer-related risk behaviors. This is unsurprising in light of neurocognitive development, in which the ability of the prefrontal cortex (the center of rationality and logical reasoning) to regulate the amygdala (the center of emotion and impulsivity) is attenuated during early as compared with later adolescence.⁸⁷ The negative implications of this inequality have been elucidated (1) for coping with the cognitively demanding and emotionally charged task of developing a minority sexual orientation in relative isolation from guidance by parents or other adults and (2) for experiencing many of the risk behaviors we examined.⁸⁸

Third, sexual orientation disparities in cancer-related risk behaviors occurred across all racial/ethnic groups, indicating that no group was differentially exposed or protected from the underlying factors that accounted for the disparities. Although we found fewer significant sexual orientation disparities among Black and Asian than White and Latina adolescent girls during early adolescence, this difference disappeared by late adolescence. For example, 4 of 12 risk behaviors were significantly elevated among younger (< 15 years) Black sexual minority than heterosexual adolescent girls, but 11 sexual orientation disparities were significant among older Black adolescent girls (> 14 years). Even if the smaller number of significant disparities in early adolescence were attributable to power, the findings by middle and late adolescence suggest that the belief that some racial/ethnic groups may be protected from risk behaviors may not be true, at least with respect to sexual orientation disparities and the behaviors we examined.

Fourth, risk for cancer undoubtedly increases as risk behaviors become part of the behavioral repertoire, are repeated over time, become habitual, and possibly influence the development of other cancer-related behaviors. Some risk behaviors (e.g., smoking^{89,90}) may be ways of coping with challenges that, because of society's continued stigmatization of homosexuality and young people's developmentally limited coping strategies,⁸⁸ may be particularly attractive and prevalent for sexual minority youth.⁹⁰ Other behaviors may naturally lead to an increase in related behaviors that heighten cancer risk. For example, a younger age at initiating alcohol use has been found to contribute to and explain subsequent sexual orientation disparities in binge drinking among youths.¹⁵ Of course, it is possible that any risk behavior may moderate and decrease over time.⁹¹ However, the reinforcing aspects of many of the risk behaviors we examined make them likely to persist over time for many individuals.^{92,93} If sexual minority youths continue to engage in these risk behaviors during adulthood, their likelihood of cancer morbidity will likely be elevated. Long-term longitudinal studies are needed to follow youths from adolescence into and through adulthood to assess the extent of this risk.

Fifth, risk behaviors are more likely to co-occur among sexual minorities, elevating their risk for multiple kinds of cancer. For example, alcohol has been implicated in sexual risk behaviors.^{94,95} Alcohol also has been related to HIV infection,⁹⁶ suggesting a relatively persistent practice of unprotected sexual intercourse, perhaps with multiple partners, while under the influence of alcohol. It is essential that future research continues to expand its focus from a single behavior to multiple behaviors that may individually add to risk or may interact in ways that amplify risk for poor health outcomes.⁹⁷ Such research may also help to elucidate how higher prevalence of cancer risk behaviors contributes to the etiology of various cancers and to suspected cancer disparities for sexual minorities later in life.

Implications for Interventions and Policy

The documented disparities in cancer-related risk behaviors among sexual minority

youths suggest the need for intervention. Developmental findings suggest that interventions should be implemented during early adolescence, when many of the behaviors are unfolding. Basic research is needed to identify the factors that contribute to the higher prevalence of cancer-related risk behaviors among sexual minorities, because these should inform intervention design. Other YRBS articles in the *Journal* provide additional context by which to better understand some of the environmental dynamics that may contribute to elevated risk behaviors among sexual minority youths (e.g., the forthcoming article about victimization⁹⁸). Other factors should be considered, such as other markers of gay-related⁹⁹ or minority stress,¹⁰⁰ coping with minority stress,⁹⁰ and the process of sexual identity development.¹⁰¹ Finally, existing cancer prevention programs need to ensure that they are inclusive of sexual minorities and, when needed, are made culturally appropriate for sexual minorities. The effectiveness of such programs for sexual minorities should be examined, regardless of their purported cultural sensitivity.

Our findings, along with the 2011 Institute of Medicine report on sexual minorities' health,¹ underscore the need for questions about sexual orientation to become standard demographic items in health surveys. For cancer research, a first step would be to ensure that such questions are included as core demographic variables in the Surveillance Epidemiology and End Results database of the National Cancer Institute, which is the premier source of cancer statistics in the United States. Including questions on sexual orientation would begin to provide much-needed cancer prevalence data for sexual minorities and document suspected disparities. Sexual orientation questions should also be included in all federally funded national health surveys to better understand the cumulative effects that different cancer-related risk behaviors have for sexual minorities. Although some may worry that adding such questions could reduce the response rate, studies can be conducted to assess, quantify, and weight samples by any potential bias that may be encountered. An investigation of the Nurses' Health Study II found that asking about sexual orientation did not affect the response

rate (< 0.1% did not answer) or lead to participants dropping out of the cohort in subsequent assessments.¹⁰² Although adding questions about sexual orientation may increase survey expenses, the amount is unlikely to equal the cost of ignoring potential cancer morbidity and mortality.

Limitations

The study design of the YRBS is cross-sectional, precluding estimation of the incidence of cancer-related risk behaviors in adolescence or the occurrence of such risk behaviors into adulthood. Some duplication of cases was possible if a state and a city within the same state were in the sampling pool or if the same school was examined in 2005 and 2007. Across jurisdictions, not all aspects of sexual orientation were measured, and wording of comparable items varied. We also could not assess all potential cancer-related risks (e.g., exposure to natural or manufactured ultraviolet radiation).

We obtained responses to questions about sexual orientation from 14 jurisdictions. Of these, 11 were located on the northeastern and western coasts of the United States, which represent the more liberal areas of the country for sexual minorities.¹⁰³ Therefore, the data were not representative of all adolescents in the United States. Nevertheless, even in our more privileged sample, we found disparities by sexual orientation in cancer-related risk behaviors among US adolescents.

Conclusions

The elevated prevalence of cancer-related risk behaviors among sexual minority youths has serious implications for cancer morbidity and mortality. Consequently, it is imperative to track the prevalence and incidence of such behaviors over the life span and to assess sexual orientation disparities in cancer morbidity and mortality. ■

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Contributors

M. Rosario conceptualized and directed all aspects of the study. M. Birkett supervised data management and assisted with data analysis. All authors contributed to writing and editing the article.

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Human Participant Protection

Protocol approval was not necessary because we obtained de-identified data from secondary sources. We obtained data use agreements from all departments of health that required them for access to Youth Risk Behavior Survey data at the time of the data request, including the Vermont Department of Health and the Rhode Island Department of Health.

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