

Sexual Orientation Disparities in Adolescent Cigarette Smoking: Intersections With Race/Ethnicity, Gender, and Age

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Cigarette smoking continues to be the leading cause of preventable morbidity and premature mortality in the United States.^{1,2} Preventing adolescent smoking is essential to reducing the burden of cigarettes because smoking typically begins during adolescence.^{3,4} Approximately 88% of adult daily smokers began smoking before their 18th birthday.⁵ Research has shown that adolescents with a minority sexual orientation (i.e., lesbian, gay, and bisexual [LGB] youths and other adolescents who report same-sex attractions or behavior) are more likely than heterosexual adolescents to smoke cigarettes.^{6–12} In addition to variation in adolescent smoking by sexual orientation, research has documented variation by race/ethnicity, gender, and age–developmental period.^{13–17} For instance, national data from the United States collected in 2009 found that White (19.4%) and Hispanic (19.1%) high school students reported higher prevalence of current smoking than Asian (9.7%) and Black (9.1%) students.¹⁸ Risk for smoking is typically higher in male than female adolescents and in older than younger adolescents.^{16,19}

Although research has shown how sexual orientation, race/ethnicity, gender, and age separately influence variations in adolescent smoking, limited data exist on how sexual orientation differences in adolescent smoking vary across sociodemographic factors such as race/ethnicity, gender, and age. A report published in 2011 by the Institute of Medicine, *The Health of Lesbian, Gay, Bisexual, and Transgender People: Building a Foundation for Better Understanding*, argued for the importance of examining the health of sexual minorities in the context of sociodemographic diversity to provide a more complete understanding of health disparities.²⁰ Empirical evidence of this nature can improve understanding of the burden of smoking in specific population subgroups and

Objectives. We examined sexual orientation differences in adolescent smoking and intersections with race/ethnicity, gender, and age.

Methods. We pooled Youth Risk Behavior Survey data collected in 2005 and 2007 from 14 jurisdictions; the analytic sample comprised observations from 13 of those jurisdictions ($n = 64\,397$). We compared smoking behaviors of sexual minorities and heterosexuals on 2 dimensions of sexual orientation: identity (heterosexual, gay–lesbian, bisexual, unsure) and gender of lifetime sexual partners (only opposite sex, only same sex, or both sexes). Multivariable regressions examined whether race/ethnicity, gender, and age modified sexual orientation differences in smoking.

Results. Sexual minorities smoked more than heterosexuals. Disparities varied by sexual orientation dimension: they were larger when we compared adolescents by identity rather than gender of sexual partners. In some instances race/ethnicity, gender, and age modified smoking disparities: Black lesbians–gays, Asian American and Pacific Islander lesbians–gays and bisexuals, younger bisexuals, and bisexual girls had greater risk.

Conclusions. Sexual orientation, race/ethnicity, gender, and age should be considered in research and practice to better understand and reduce disparities in adolescent smoking. (*Am J Public Health.* 2014;104:1137–1147. doi:10.2105/AJPH.2013.301819)

identify high-risk subgroups to target for research, prevention, and cessation efforts.

Existing research to understand how smoking patterns of sexual minority youths vary across gender, age, and race/ethnicity is inconclusive and sometimes contradictory. In addition, few studies have used large, representative samples, which limits the ability to draw inferences about the entire population of sexual minority youths.²¹ Studies examining how sexual orientation differences in adolescent smoking vary by gender have been the most conclusive and have typically found larger disparities between sexual minority and heterosexual adolescent girls than between sexual minority and heterosexual adolescent boys.^{6,9,22,23} However, studies examining how sexual orientation differences in adolescent smoking vary by age have been inconclusive. One study of mostly White youths followed between ages 12 and 24 years found that

smoking disparities were larger between sexual minorities and heterosexuals during younger than older ages.⁶ However, a study of Asian Americans and Pacific Islanders (APIs) found that smoking disparities were not present in adolescence but emerged in young adulthood.⁹

In addition, scant data exist on how sexual orientation and race/ethnicity jointly influence risk for adolescent smoking. This is an especially difficult area to investigate because studies with a sample size large enough to examine this question are rare. Some evidence suggests that sexual minority youths who belong to racial/ethnic minority groups are more likely to smoke cigarettes than their heterosexual peers of their same race/ethnicity. For instance, a study of college students found that Black, Asian, Hispanic, and multiracial LGB persons were more likely to smoke than their heterosexual racial/ethnic peers.²⁴ This study also found that Black and Asian LGB persons

were less likely to smoke than their White LGB peers, but the same was not true for Hispanics and multiracial LGB persons. However, the study did not describe statistical testing to examine whether race/ethnicity modified sexual orientation disparities in smoking.

Another important consideration is the multidimensional nature of sexual orientation (e.g., identity, attractions, behaviors), which in research with adolescents has most often been assessed as how respondents identify or the gender of their sexual attractions or partners. How sexual orientation is operationalized in studies may influence findings and conclusions, but studies infrequently include more than 1 dimension. Studies with adults^{12,25–27} and adolescents^{10,23,28} have shown differences in the magnitude of the sexual orientation disparities observed depending on which dimension is considered. For example, a study of Mexican youths aged 18 to 29 years found that self-identified LGB participants had approximately twice the odds of reporting current smoking than did heterosexuals, but differences between participants reporting only same-sex partners and those reporting only opposite-sex partners were negligible.²³ Such disparate findings are likely to occur because the dimensions capture somewhat different populations with differing risk and protective factors.²⁹

It is especially important to assess multiple dimensions of sexual orientation in adolescence because a same-sex orientation commonly develops during this period, and many adolescents with a same-sex orientation may not identify as LGB.³⁰ In addition, when gender of sexual partners is used as an indicator of sexual orientation, only adolescents who have initiated sexual intercourse (approximately 48% of high school students in 2007¹⁹) can be identified. Because adolescent smoking is a robust correlate of sexual activity,³¹ the degree to which the selection of a sexually active subgroup may influence sexual orientation findings warrants consideration. Finally, the extent to which the different dimensions may affect conclusions drawn about smoking disparities arising from sexual orientation when also considering intersections with race/ethnicity, gender, and age remain uncertain. To address these questions, we compared sexual orientation differences in smoking

during adolescence with 2 dimensions of sexual orientation (identity and gender of lifetime sexual partners) and investigated how these differences were modified by race/ethnicity, gender, and age in Youth Risk Behavior Survey (YRBS) data pooled from 13 jurisdictions and 2 years.

METHODS

The YRBS is conducted biennially in high schools across the United States. A 2-stage, cluster sampling design is used to generate a representative sample of students in grades 9 through 12 in each jurisdiction in which the survey is administered. We pooled YRBS data collected in 2005 and 2007 from 14 jurisdictions. The analytic sample included observations from the 13 jurisdictions that asked questions on sexual orientation identity or gender of lifetime sexual partners (Boston, MA; Chicago, IL; Connecticut; Delaware; Maine; Massachusetts; Milwaukee, WI; New York City, NY; Rhode Island; San Diego, CA; San Francisco, CA; Vermont; and Wisconsin). Additional information about the characteristics of each jurisdiction and the procedures for pooling data are available elsewhere.³²

We analyzed data from respondents aged 13 years or older who answered 1 or more questions about their sexual orientation identity or the gender of their lifetime sexual partners. After we excluded the few participants who were younger than 13 years and those who could not be classified on their sexual orientation, the unweighted analytic sample was 64 397. Of these participants, 58 319 (weighted percentage = 90.2%) were heterosexual and 6067 (weighted percentage = 9.8%) were sexual minority (i.e., LGB, unsure of sexual orientation identity, or reported same-sex or both-sex partners).

Measures

Sexual orientation. We used 2 sexual orientation measures. We assessed sexual orientation identity with the question, “Which of the following best describes you?” Response options were heterosexual, gay or lesbian, bisexual, and unsure. We assessed self-reported gender of lifetime sexual partners with the question, “During your life, with whom have you had sexual contact?” (Some questionnaires

used “intercourse” in place of “contact.”) Response options were never had sexual contact, females, males, and females and males. We used this question and participants’ self-reported gender to create a sexual orientation indicator with 3 categories: opposite-sex partners only, same-sex partners only, and both-sex partners. Only individuals who reported sexual partners were able to be classified on their sexual orientation with the gender of sexual partners variable, but the sexual orientation identity variable included all respondents who answered the identity question regardless of whether they reported sexual partners.

Smoking. We evaluated 5 smoking variables. The survey asked, “How old were you when you smoked a whole cigarette for the first time?” Response options were never smoked a whole cigarette, 8 years or younger, 9 or 10 years, 11 or 12 years, 13 or 14 years, 15 or 16 years, and 17 years or older. We dichotomized ever smoked a whole cigarette into never versus ever smoked. We categorized age at first smoking cigarettes in accordance with methods necessary for survival analysis. We censored students who had not smoked a whole cigarette at their current age. Coding for the other response options was 7.5 for the 8 years or younger response, the midpoint for the responses spanning 2 years (e.g., 9.5 for the 9–10 years category), and 17.5 for the 17 years or older response. To assess whether participants had ever smoked daily, we used the question, “Have you ever smoked cigarettes daily, that is, at least one cigarette every day for 30 days.”

We calculated number of cigarettes smoked in the past 30 days by multiplying responses from questions assessing number of days when respondents smoked and number of cigarettes smoked per day. We assessed number of days smoked with the question, “During the past 30 days, on how many days did you smoke cigarettes?” Response options were 0, 1 or 2, 3 to 5, 6 to 9, 10 to 19, 20 to 29, and all 30 days. We assessed number of cigarettes smoked per day with the question, “During the past 30 days, on the days you smoked, how many cigarettes did you smoke per day?” Response options were did not smoke cigarettes during the past 30 days and less than 1 (coded as 0.5), 1, 2 to 5, 6 to 10, 11 to 20, and more than 20 cigarettes per day. We first assigned midpoint

values to categories with ranges (e.g., 1.5 for the 1- or 2-day response option). We then multiplied the 2 values to get a continuous measure of the total number of cigarettes smoked (range = 0.8–630; mean = 95.6; SE = 2.6).

Covariates. Variables for examining statistical interactions with sexual orientation were age (13–18 years or older); race/ethnicity, coded as non-Hispanic White, non-Hispanic Black, Hispanic, API, or other (which included non-Hispanic multiracial and American Indian/Alaskan Native, collapsed because of small sample sizes); and gender (male vs female).

Statistical Analyses

Descriptive analyses compared percentages and means of the smoking variables by the 2 sexual orientation dimensions and the intersecting factors of race/ethnicity, gender, and age. We examined sexual orientation identity and gender of sexual partners in separate analyses because 5 of the 13 jurisdictions assessed only 1 dimension, and we wanted to use all available data. For age at first smoking, we generated cumulative incidence plots. We used multivariable regression models to estimate the main effects of sexual orientation and the interactive effects of sexual orientation with race/ethnicity, gender, and age. For age at first smoking, we used Cox proportional hazards regression to estimate hazard ratios (HRs). For binary variables (ever smoking, ever smoking daily, smoking in the past month), we used logistic regression to estimate odds ratios (ORs). For number of cigarettes smoked in the past month, which was continuous, we used linear regression to estimate unstandardized regression parameters. We restricted analyses estimating the number of cigarettes smoked in the past month to adolescents who reported smoking in the past month. We included age at first sexual intercourse in the multivariable statistical models to evaluate associations between gender of sexual partners and the smoking variables because of the potential confounding effects of general sexual activity.

To account for the YRBS sampling design and for the pooling of data across 13 locations and 2 years, we performed analyses with SAS-callable SUDAAN version 11.0.1 (Research Triangle Institute, Research Triangle Park, NC), a software program that uses Taylor

series linearization to adjust for design effects of complex sample surveys. Analyses took into account all stages of clustering (location, year, stratum, and primary sampling unit). We applied sample weights to all analyses. We estimated confidence intervals (CIs) with 95% certainty. We excluded approximately 14.5% of the sample because respondents' sexual orientation could not be classified.

In any particular analysis, we excluded participants if they were missing data on covariates or smoking variables, either because they did not answer a question or because it was not asked in a particular jurisdiction. Missing data from unanswered questions were generally minimal and ranged from 0.6% for age to 5.4% for age at first smoking. Sexual minority youths (8.4%) were more likely than sexual majority youths (5.3%), adolescent boys (6.2%) were more likely than adolescent girls (4.6%), and racial/ethnic minorities (Blacks = 8.5%; Hispanics = 7.4%; APIs = 6.5%) were more likely than Whites (3.1%) not to report their age at first smoking (all, $P < .001$). Those who did not answer the age at first smoking question were less likely than other respondents to report that they smoked in the past month ($P < .001$); this association was similar for heterosexuals and sexual minorities.

RESULTS

Table 1 displays the weighted percentages, means, and standard errors of the smoking variables in the overall sample and by subgroups according to race/ethnicity, gender, and age across the 2 sexual orientation measures. In the vast majority of cases, smoking was more prevalent among sexual minorities than heterosexuals both overall and across race/ethnicity, gender, and age subgroups.

Sexual Orientation Identity

Main effects. Models including only main effects and adjusting for age, race/ethnicity, and gender showed that lesbians–gays (HR = 2.14; 95% CI = 1.75, 2.61), bisexuals (HR = 2.33; 95% CI = 2.13, 2.55), and those unsure of their sexual orientation (HR = 1.27; 95% CI = 1.05, 1.54) reported a younger age at first smoking (Figure 1). Lesbians–gays (OR = 3.16; 95% CI = 2.24, 4.47), bisexuals (OR = 3.65;

95% CI = 3.11, 4.27), and unsure respondents (OR = 1.32; 95% CI = 1.04, 1.68) were also more likely than heterosexuals to report ever smoking. Odds of ever smoking daily and of past-month smoking were also higher among lesbian–gay (ever, OR = 4.80; 95% CI = 3.29, 7.00; past month, OR = 3.15; 95% CI = 2.28, 4.34), bisexual (ever, OR = 4.19; 95% CI = 3.46, 5.08; past month, OR = 4.41; 95% CI = 3.74, 5.19), and unsure (ever, OR = 1.47; 95% CI = 1.05, 2.04; past month, OR = 1.50; 95% CI = 1.15, 1.95) adolescents than among heterosexuals. Among past-month smokers, lesbian–gay ($b = 60.8$; 95% CI = 18.7, 102.9), bisexual ($b = 40.6$; 95% CI = 23.1, 58.1), and unsure ($b = 30.9$; 95% CI = 1.8, 60.0) adolescents smoked more cigarettes than did heterosexuals.

Interactions with race/ethnicity, gender, and age. Tests for interactions of sexual orientation identity with race/ethnicity, gender, and age revealed novel patterns (models with interaction terms displayed in Table 2). Three of 5 smoking indicator disparities between lesbian–gay and heterosexual Black adolescents were larger than those between lesbian–gay and heterosexual White adolescents. Disparities between LGB and heterosexual adolescents also appeared to be larger among API than White adolescents across most of the smoking indicators, although not all were statistically significant. In addition, bisexual female youths appeared to be at relatively greater risk for smoking on several indicators. Age at first smoking was relatively younger and ever smoking and smoking in the past month were relatively more prevalent in female than male bisexuals, but the reverse was true for female and male heterosexuals. Smoking disparities between bisexuals and heterosexuals were larger at younger than older ages.

Gender of Sexual Partners

Main effects. The magnitude of sexual orientation disparities was smaller for gender of sexual partners than for sexual orientation identity. Sexual minority adolescents reported a younger age for first smoking (Figure 1) and a greater likelihood of ever smoking than sexual majority adolescents: respondents who reported only same-sex partners had an HR of 1.31 (95% CI = 1.17, 1.47) for age and an OR

TABLE 1—Smoking Variables Across Sexual Orientation Dimensions Overall and by Race/Ethnicity, Gender, and Age: Youth Risk Behavior Survey, United States, 2005 and 2007

Variable	Sexual Orientation Identity				Gender of Lifetime Sexual Partners		
	Heterosexual	Lesbian/Gay	Bisexual	Unsure	Opposite Sex Only	Same Sex Only	Both Sexes
Ever smoked a whole cigarette							
Total, no.	51 613	664	1992	1421	28 120	1057	1921
Total, % (SE)	31.9 (0.6)	59.8 (3.8)	62.0 (1.8)	36.4 (2.5)	44.6 (0.7)	55.7 (2.4)	68.6 (1.9)
Race/ethnicity, % (SE)							
API	21.5 (1.3)	66.9 (7.4)	65.8 (6.2)	22.7 (4.6)	44.0 (2.3)	68.6 (7.7)	64.5 (8.3)
Black	23.4 (0.9)	61.2 (7.9)	47.8 (4.4)	37.3 (7.4)	30.1 (1.1)	39.6 (5.2)	47.6 (5.1)
Hispanic	34.6 (1.1)	62.4 (6.7)	62.5 (3.4)	43.5 (4.5)	45.2 (1.3)	51.8 (4.9)	71.5 (3.0)
Other	31.4 (1.9)	46.1 (13.2)	66.1 (8.5)	26.1 (8.6)	45.7 (2.3)	62.4 (8.7)	58.2 (8.6)
White	36.1 (0.9)	57.4 (6.5)	67.3 (2.8)	38.7 (3.6)	50.0 (0.9)	64.8 (3.3)	75.1 (2.2)
Gender, % (SE)							
Female	30.5 (0.7)	64.4 (5.0)	65.6 (2.1)	33.7 (3.1)	44.7 (0.9)	55.6 (3.4)	72.2 (2.0)
Male	33.3 (0.7)	57.1 (5.1)	50.1 (3.9)	39.1 (3.8)	44.5 (0.8)	55.7 (3.2)	57.7 (3.6)
Age, y, % (SE)							
13	NA	NA	NA	NA	NA	NA	NA
14	20.3 (1.1)	45.0 (11.4)	58.1 (5.6)	25.6 (6.1)	36.8 (1.9)	47.9 (9.0)	59.2 (8.6)
15	27.5 (0.9)	55.4 (7.6)	61.1 (3.7)	36.0 (4.7)	39.9 (1.2)	51.6 (5.1)	63.3 (3.8)
16	34.2 (0.9)	62.2 (6.8)	59.3 (3.6)	36.3 (4.6)	44.8 (1.1)	52.9 (4.6)	65.2 (3.2)
17	36.9 (0.9)	58.6 (6.0)	63.5 (3.8)	39.0 (5.7)	46.8 (1.0)	63.4 (4.4)	72.8 (3.1)
≥ 18	40.9 (1.5)	69.1 (9.6)	73.5 (5.1)	42.4 (7.0)	50.5 (1.5)	57.7 (6.2)	82.6 (3.7)
Smoked in the past month							
Total, no.	52803	655	1961	1437	28455	1020	1903
Total, % (SE)	13.7 (0.4)	33.1 (3.5)	40.2 (2.0)	17.9 (1.9)	21.7 (0.5)	29.6 (2.1)	49.6 (2.1)
Race/ethnicity, % (SE)							
API	7.6 (0.8)	36.6 (10.1)	37.3 (7.1)	12.9 (4.1)	19.9 (1.9)	33.3 (9.8)	47.1 (9.0)
Black	6.8 (0.6)	17.3 (5.7)	21.9 (4.4)	7.5 (2.9)	9.5 (0.8)	15.8 (4.0)	25.1 (4.7)
Hispanic	11.6 (0.6)	37.6 (6.2)	31.7 (3.3)	22.3 (4.3)	17.4 (0.8)	27.1 (4.2)	45.3 (3.7)
Other	15.5 (1.2)	27.6 (10.5)	43.4 (8.2)	18.1 (7.9)	26.0 (1.8)	30.9 (9.3)	40.6 (7.4)
White	18.8 (0.6)	39.3 (6.5)	52.3 (3.0)	23.1 (3.1)	28.4 (0.7)	36.7 (3.3)	59.7 (2.6)
Gender, % (SE)							
Female	13.2 (0.5)	33.0 (5.2)	42.3 (2.2)	16.9 (2.3)	21.9 (0.7)	28.5 (3.5)	52.8 (2.2)
Male	14.3 (0.5)	33.1 (4.7)	32.6 (4.2)	18.8 (3.0)	21.6 (0.6)	30.5 (3.0)	39.8 (3.7)
Age, y, % (SE)							
13	NA	NA	NA	NA	NA	NA	NA
14	7.4 (0.6)	24.7 (11.1)	32.8 (5.8)	7.1 (3.1)	15.7 (1.4)	30.3 (7.8)	40.9 (9.1)
15	11.6 (0.6)	36.1 (7.1)	40.5 (4.3)	15.8 (3.3)	19.0 (0.9)	28.1 (5.0)	46.3 (4.2)
16	14.8 (0.6)	24.8 (5.5)	40.0 (3.5)	19.9 (3.8)	21.5 (0.9)	23.8 (4.1)	44.7 (3.3)
17	16.1 (0.6)	31.9 (5.6)	38.9 (4.5)	19.3 (3.9)	23.3 (0.8)	32.8 (4.2)	55.9 (3.5)
≥ 18	18.9 (1.0)	48.0 (12.0)	50.3 (5.5)	23.2 (5.7)	26.1 (1.2)	33.4 (5.2)	58.9 (4.4)

Continued

of 1.73 (95% CI = 1.41, 2.12) for smoking, and respondents with partners of both sexes had an HR of 1.78 (95% CI = 1.62, 1.95) for age and an OR of 2.61 (95% CI = 2.17, 3.13) for smoking in models including only main effects and adjusting for age, gender,

race/ethnicity, and age at first sexual intercourse. Ever smoking daily and past-month smoking were also more prevalent among adolescents who reported only same-sex partners (daily smoking, OR = 1.47; 95% CI = 1.09, 2.00; past month,

OR = 1.56; 95% CI = 1.26, 1.93) or both-sex partners (daily smoking, OR = 2.98; 95% CI = 2.47, 3.60; past month, OR = 3.31; 95% CI = 2.77, 3.95) than among adolescents who reported only opposite-sex partners. Among past-month smokers, number of cigarettes

TABLE 1—Continued

	Ever smoked daily						
Total, no.	35534	503	1422	947	20825	841	1402
Total, % (SE)	8.7 (0.3)	29.7 (3.6)	27.1 (1.8)	10.9 (1.5)	13.9 (0.4)	18.9 (2.1)	34.5 (2.1)
Race/ethnicity, % (SE)							
API	5.8 (0.7)	32.2 (9.9)	31.6 (7.4)	6.0 (2.5)	13.7 (1.7)	30.0 (7.9)	35.3 (9.5)
Black	4.0 (0.4)	32.6 (8.0)	8.5 (3.1)	7.1 (2.7)	5.8 (0.7)	10.8 (3.5)	14.6 (3.9)
Hispanic	6.2 (0.5)	19.8 (4.9)	19.7 (2.8)	11.5 (2.9)	9.6 (0.7)	12.2 (3.2)	24.6 (3.1)
Other	7.3 (0.7)	13.6 (7.0)	26.0 (7.0)	15.0 (7.5)	15.6 (1.8)	5.1 (2.9)	29.7 (7.3)
White	10.2 (1.2)	34.8 (6.6)	40.7 (3.4)	16.2 (3.6)	20.0 (0.8)	26.3 (3.9)	46.3 (3.0)
Gender, % (SE)							
Female	8.0 (0.4)	33.9 (5.9)	28.0 (2.4)	9.2 (1.7)	13.6 (0.6)	18.3 (3.4)	36.4 (2.5)
Male	9.4 (0.4)	27.3 (4.6)	23.4 (3.8)	12.7 (2.4)	14.1 (0.6)	19.3 (3.0)	28.9 (3.5)
Age, y, % (SE)							
13	NA	NA	NA	NA	NA	NA	NA
14	4.7 (0.5)	27.2 (14.6)	20.0 (5.1)	4.1 (2.4)	9.5 (1.1)	6.8 (4.6)	28.8 (6.7)
15	6.0 (0.4)	35.7 (8.1)	25.2 (3.5)	7.4 (2.5)	10.8 (0.8)	23.8 (5.3)	29.5 (3.8)
16	9.1 (0.6)	18.6 (5.5)	28.6 (3.7)	13.7 (3.1)	13.3 (0.8)	18.6 (3.9)	32.0 (3.2)
17	11.4 (0.5)	25.6 (5.8)	27.6 (3.6)	8.3 (2.5)	15.9 (0.7)	16.7 (3.6)	36.5 (3.6)
≥ 18	12.8 (1.0)	47.6 (8.6)	34.5 (6.1)	17.2 (5.6)	17.8 (1.2)	23.9 (5.8)	50.7 (5.7)
No. cigarettes smoked ^a							
Total, no.	6899	217	744	271	6319	227	918
Total, mean (SE)	86.4 (3.2)	148.6 (21.1)	117.2 (9.0)	116.4 (13.7)	97.1 (2.9)	111.3 (14.3)	142.4 (8.3)
Race/ethnicity, mean (SE)							
API	122.1 (17.9)	101.6 (34.9)	177.0 (81.9)	38.5 (17.3)	116.0 (21.3)	94.8 (34.3)	241.2 (76.9)
Black	59.3 (7.2)	116.4 (32.8)	70.7 (25.0)	177.9 (68.1)	79.2 (11.6)	54.3 (20.4)	88.6 (21.6)
Hispanic	46.5 (5.1)	152.2 (35.8)	81.7 (14.4)	78.8 (24.2)	61.5 (5.7)	106.7 (39.8)	105.4 (15.6)
Other	90.9 (8.6)	122.5 (39.2)	83.4 (16.4)	173.0 (54.8)	96.3 (9.3)	47.4 (21.9)	127.8 (18.7)
White	100.4 (4.1)	155.0 (34.7)	135.7 (11.2)	131.4 (23.9)	106.8 (3.3)	124.1 (20.7)	155.8 (10.8)
Gender, mean (SE)							
Female	72.9 (3.1)	128.6 (24.3)	104.0 (8.8)	89.7 (18.5)	79.7 (3.2)	141.3 (25.7)	123.1 (8.7)
Male	98.7 (4.9)	162.1 (29.1)	166.1 (27.9)	141.1 (23.6)	112.6 (4.3)	88.3 (16.9)	213.7 (24.5)
Age, y, mean (SE)							
13	NA	NA	NA	NA	NA	NA	NA
14	62.7 (10.0)	135.3 (67.9)	90.8 (22.7)	NA	69.1 (11.4)	47.8 (19.7)	111.0 (18.6)
15	71.2 (5.4)	154.3 (38.7)	92.5 (16.9)	62.1 (20.2)	79.3 (5.6)	131.4 (43.8)	114.1 (16.4)
16	93.3 (5.3)	117.7 (25.8)	129.9 (17.7)	100.0 (23.1)	96.2 (5.8)	127.5 (27.8)	133.0 (14.7)
17	105.3 (5.0)	149.9 (45.8)	111.9 (16.3)	138.5 (34.7)	104.4 (4.4)	79.7 (14.0)	154.6 (15.6)
≥ 18	95.9 (8.7)	164.9 (51.2)	169.7 (27.0)	175.2 (39.7)	113.5 (8.2)	164.6 (46.9)	187.7 (20.4)

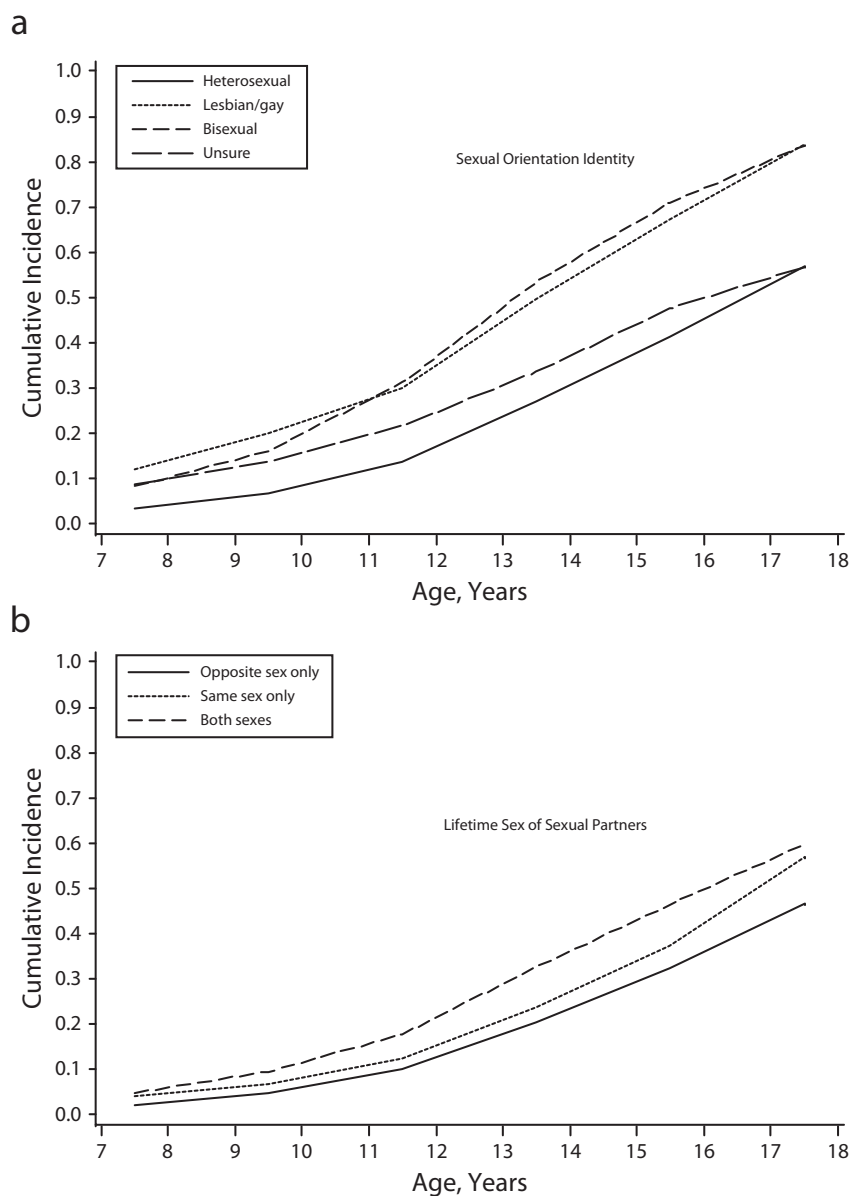
Note. API = Asian/Pacific Islander; NA = not available (too few participants to reliably estimate). Numbers are unweighted. Percentages are weighted. Data came from 13 jurisdictions that asked questions on sexual orientation identity or gender of lifetime sexual partners: Boston, MA; Chicago, IL; Connecticut; Delaware; Maine; Massachusetts; Milwaukee, WI; New York City, NY; Rhode Island; San Diego, CA; San Francisco, CA; Vermont; and Wisconsin.

^aAmong past-month smokers.

smoked was greater in adolescents reporting both-sex partners ($b = 42.3$; 95% CI = 27.7, 56.9), but lower among adolescents reporting only same-sex partners ($b = 11.6$; 95% CI = -0.7, 22.2) than among adolescents reporting only opposite-sex partners.

Interactions with race/ethnicity, gender, and age. We observed few significant interactions of gender of sexual partners with race/ethnicity or age (Table 3). The only consistent findings concerned gender. Adolescents girls with both-sex partners were at relatively greater risk for smoking on most indicators.

In addition, among past-month smokers, female respondents with same-sex partners smoked a disproportionately larger number of cigarettes than did male respondents with same-sex partners; gender differences among adolescents with only opposite-sex partners were much smaller.



Note. Data came from 13 jurisdictions that asked questions on sexual orientation identity or gender of lifetime sexual partners: Boston, MA; Chicago, IL; Connecticut; Delaware; Maine; Massachusetts; Milwaukee, WI; New York City, NY; Rhode Island; San Diego, CA; San Francisco, CA; Vermont; and Wisconsin.

FIGURE 1—Cumulative incidence plots of age at first smoking by (a) sexual orientation identity and (b) lifetime sex of sexual partner: Youth Risk Behavior Survey, United States, 2005 and 2007.

DISCUSSION

The etiology of adolescent smoking is complex and involves many risk and protective factors across individual, family, peer, and societal contexts.³³ Thus, several theoretical frameworks have been applied to explain

diversity in adolescent smoking.³¹ In regard to sexual minorities, researchers have applied stress theory, which argues that sexual minorities smoke to cope with difficulties arising from their stigmatized sexual orientation.^{34–37} In support of this model, studies have found that stressors such as discrimination and

victimization,^{38–42} negative reactions from others to disclosing a same-sex orientation,⁴³ concealing a same-sex orientation,⁴⁴ and living in communities lacking LGB-supportive policies⁴⁵ are linked with greater smoking prevalence among sexual minority youths.

More generally, researchers have applied several other theories to explain adolescent smoking (e.g., social learning theory,^{46,47} ecological systems theory,^{48,49} theory of planned behavior,^{49,50} problem behavior theory,^{51,52} and self-medication theory^{53,54}). Evidence suggests that multiple theories in conjunction, rather than any 1 in isolation, more fully explain adolescent smoking.⁵⁵ Evidence also suggests that exposure to risk and protective factors identified by these theories, and their influence on adolescent smoking, vary across race/ethnicity, gender, and age.^{17,56–68} Consequently, future research to improve understanding of how sexual orientation, race/ethnicity, gender, and age intersect to influence adolescent smoking will benefit from integrating these multiple theories.

Our finding that sexual minority adolescents were more likely than heterosexuals to smoke cigarettes corroborates previous literature.^{6,7,9–12} We extended the literature by examining how race/ethnicity, gender, and age modified sexual orientation disparities in adolescent smoking in data pooled from 13 jurisdictions across the United States. For both sexual orientation dimensions examined, we found elevated smoking risk for sexual minorities across race/ethnicity, gender, and age subgroups. However, relative risk between these groups varied, and it appeared that bisexual adolescent girls, younger bisexuals, Black gays and lesbians, API sexual minorities, and adolescent girls reporting both-sex partners were at especially elevated risk. Although smoking was more prevalent among White than racial/ethnic minority adolescents, in some instances sexual orientation disparities were accentuated in Black lesbian–gay and API sexual minority adolescents. In other words, the smoking patterns of these youths were higher than or more similar to their White sexual minority peers and less comparable to their heterosexual peers of the same race/ethnicity. In support of this finding, a community study found that Black lesbians were more likely than Black heterosexual women and White lesbians to smoke.⁶⁹ Future

TABLE 2—Results of Multivariate Analyses of Interactions of Sexual Orientation Identity With Race/Ethnicity, Gender, and Age on Cigarette Smoking: Youth Risk Behavior Survey, United States, 2005 and 2007

Variable	Model 1: Age First Smoked, HR ^a (95% CI)	Model 2: Ever Smoked, OR ^b (95% CI)	Model 3: Ever Smoked Daily, OR ^b (95% CI)	Model 4: Smoked in Past Month, OR ^b (95% CI)	Model 5: No. Cigarettes Smoked in Past Month, ^c b ^d (95% CI)
Sexual orientation					
Heterosexual (Ref)	1.00	1.00	1.00	1.00	1.00
Lesbian/gay	2.54 (1.14, 5.66)	2.40 (0.69, 8.39)	6.20 (1.38, 27.83)	3.99 (1.08, 14.69)	67.8 (-114.3, 249.9)
Bisexual	2.51 (1.74, 3.62)	3.79 (1.93, 7.46)	6.72 (2.89, 15.61)	5.86 (2.76, 12.44)	50.1 (-24.6, 124.8)
Unsure	1.95 (1.12, 3.39)	2.24 (1.11, 4.51)	1.33 (0.66, 8.11)	1.42 (0.62, 3.23)	36.0 (-109.3, 181.2)
Race/ethnicity					
White (Ref)	1.00	1.00	1.00	1.00	1.00
API	0.58 (0.51, 0.66)	0.49 (0.42, 0.58)	0.41 (0.32, 0.53)	0.36 (0.29, 0.45)	20.8 (-16.1, 57.6)
Black	0.63 (0.57, 0.69)	0.54 (0.48, 0.61)	0.28 (0.21, 0.36)	0.31 (0.26, 0.38)	-38.7 (-54.0, -23.4)
Hispanic	0.98 (0.89, 1.08)	0.97 (0.85, 1.10)	0.45 (0.36, 0.55)	0.58 (0.51, 0.66)	-51.5 (-63.6, -39.4)
Other	0.93 (0.82, 1.05)	0.88 (0.74, 1.05)	0.82 (0.64, 1.05)	0.85 (0.70, 1.04)	-7.9 (-24.8, 9.1)
Female	0.91 (0.86, 0.97)	0.90 (0.84, 0.97)	0.87 (0.77, 0.99)	0.95 (0.87, 1.04)	-25.7 (-35.7, -15.7)
Age	0.94 (0.91, 0.97)	1.27 (1.23, 1.32)	1.33 (1.25, 1.40)	1.26 (1.20, 1.31)	8.7 (3.4, 14.1)
Orientation × race/ethnicity					
Lesbian/gay × API	2.31 (1.37, 3.92)	2.76 (1.19, 6.43)	1.92 (0.61, 6.06)	2.13 (0.72, 6.25)	-67.9 (-167.0, 31.2)
Lesbian/gay × Black	1.64 (1.00, 2.68)	2.06 (0.88, 4.81)	3.13 (1.21, 8.05)	1.00 (0.36, 2.80)	4.4 (-89.2, 98.0)
Lesbian/gay × Hispanic	1.15 (0.76, 1.72)	1.34 (0.64, 2.81)	1.06 (0.56, 2.46)	1.65 (0.80, 3.42)	53.6 (-43.0, 150.2)
Lesbian/gay × Other	0.93 (0.36, 2.40)	0.77 (0.25, 2.40)	0.38 (0.10, 1.49)	0.68 (0.21, 2.20)	-43.5 (-153.5, 66.4)
Bisexual × API	1.62 (1.13, 2.33)	2.07 (1.06, 4.03)	1.64 (0.74, 3.60)	1.53 (0.75, 3.09)	2.5 (-154.1, 159.0)
Bisexual × Black	0.96 (0.74, 1.24)	0.82 (0.54, 1.25)	0.49 (0.22, 1.11)	0.82 (0.48, 1.39)	-28.0 (-84.3, 28.3)
Bisexual × Hispanic	0.85 (0.70, 1.04)	0.82 (0.56, 1.19)	0.79 (0.49, 1.29)	0.71 (0.49, 1.02)	-5.2 (-41.4, 31.0)
Bisexual × other	1.12 (0.80, 1.56)	1.17 (0.57, 2.39)	0.67 (0.33, 1.38)	0.89 (0.44, 1.81)	-44.3 (-91.0, 2.4)
Unsure × API	0.78 (0.46, 1.31)	0.85 (0.45, 1.62)	0.70 (0.22, 2.22)	1.13 (0.47, 2.72)	-121.8 (-196.1, -47.6)
Unsure × Black	1.51 (0.84, 2.71)	1.62 (0.79, 3.30)	1.28 (0.54, 3.00)	0.74 (0.33, 1.64)	68.8 (-64.0, 201.7)
Unsure × Hispanic	1.17 (0.81, 1.69)	1.26 (0.77, 2.05)	1.48 (0.63, 3.52)	1.58 (0.83, 3.02)	4.3 (-65.5, 74.1)
Unsure × other	0.72 (0.32, 1.62)	0.64 (0.27, 1.54)	1.15 (0.33, 3.99)	0.85 (0.27, 2.65)	54.3 (-69.6, 178.3)
Orientation × gender					
Lesbian/gay × female	1.22 (0.87, 1.71)	1.47 (0.80, 2.69)	1.52 (0.67, 3.46)	1.31 (0.68, 2.52)	-5.8 (-75.6, 64.0)
Bisexual × female	1.43 (1.11, 1.84)	2.12 (1.43, 3.14)	1.53 (0.79, 2.97)	1.66 (1.06, 2.61)	-35.2 (-85.3, 14.8)
Unsure × female	0.78 (0.57, 1.08)	0.81 (0.53, 1.22)	0.73 (0.41, 1.30)	0.74 (0.46, 1.20)	-19.4 (-79.7, 41.0)
Orientation × age					
Lesbian/gay × age	0.91 (0.77, 1.07)	0.95 (0.73, 1.24)	0.84 (0.62, 1.13)	0.89 (0.66, 1.19)	-3.6 (-38.9, 31.7)
Bisexual × age	0.92 (0.86, 1.00)	0.87 (0.76, 1.00)	0.85 (0.71, 1.00)	0.87 (0.75, 1.00)	6.0 (-9.3, 21.4)
Unsure × age	0.91 (0.79, 1.05)	0.88 (0.74, 1.03)	0.91 (0.67, 1.24)	1.03 (0.86, 1.25)	1.6 (-27.8, 31.1)

Note. API = Asian/Pacific Islander; CI = confidence interval; HR = hazard ratio; OR = odds ratio. Data came from 13 jurisdictions that asked questions on sexual orientation identity or gender of lifetime sexual partners: Boston, MA; Chicago, IL; Connecticut; Delaware; Maine; Massachusetts; Milwaukee, WI; New York City, NY; Rhode Island; San Diego, CA; San Francisco, CA; Vermont; and Wisconsin.

^aEstimated from Cox proportional hazards regression.

^bEstimated from logistic regression.

^cAmong past-month smokers.

^dEstimated from linear regression.

research should examine smoking in Black lesbian–gay, API sexual minority, bisexual female, and younger bisexual adolescents to verify these findings as well as to identify reasons for this potentially elevated risk.

Our finding that risk for adolescent smoking varied across sexual orientation, race/ethnicity, gender, and age underscores the importance of considering risk and protective factors that are specific to subgroups. Future research should

test the extent to which minority stress theory and other theories relevant to adolescent smoking explain disparities arising from sexual orientation and intersecting sociodemographic characteristics. Although our sample size was

TABLE 3—Results of Multivariate Analyses of Interactions of Gender of Lifetime Sexual Partners With Race/Ethnicity, Gender, and Age on Cigarette Smoking: Youth Risk Behavior Survey, United States, 2005 and 2007

Variable	Model 1: Age First Smoked, HR ^a (95% CI)	Model 2: Ever Smoked, OR ^b (95% CI)	Model 3: Ever Smoked Daily, OR ^b (95% CI)	Model 4: Smoked in Past Month, OR ^b (95% CI)	Model 5: No. Cigarettes Smoked in Past Month, ^c b ^d (95% CI)
Gender of lifetime sexual partners					
Opposite sex only (Ref)	1.00	1.00	1.00	1.00	1.00
Same sex only	1.11 (0.71, 1.75)	1.65 (0.74, 3.69)	2.10 (0.70, 6.63)	1.86 (0.75, 4.60)	-15.8 (-110.5, 79.0)
Both sexes	1.16 (0.81, 1.68)	1.32 (0.68, 2.58)	2.70 (1.11, 6.60)	2.53 (1.16, 5.51)	76.7 (3.7, 149.7)
Race/ethnicity^f					
White (Ref)	1.00	1.00	1.00	1.00	1.00
API	0.85 (0.74, 0.97)	0.78 (0.64, 0.95)	0.60 (0.44, 0.82)	0.61 (0.48, 0.78)	6.6 (-33.9, 47.1)
Black	0.43 (0.39, 0.47)	0.31 (0.27, 0.35)	0.16 (0.12, 0.20)	0.19 (0.15, 0.23)	-50.2 (-71.4, -29.0)
Hispanic	0.74 (0.68, 0.80)	0.65 (0.58, 0.74)	0.31 (0.26, 0.38)	0.41 (0.36, 0.47)	-55.1 (-66.4, -43.9)
Other	0.80 (0.70, 0.92)	0.71 (0.57, 0.87)	0.58 (0.43, 0.77)	0.74 (0.60, 0.91)	-12.1 (-28.9, 4.7)
Female	1.03 (0.98, 1.09)	1.08 (0.99, 1.18)	1.06 (0.93, 1.21)	1.09 (0.99, 1.21)	-23.4 (-33.3, -13.4)
Age	0.88 (0.85, 0.91)	1.20 (1.14, 1.25)	1.31 (1.23, 1.39)	1.20 (1.15, 1.27)	15.2 (10.0, 20.3)
Gender of partners × race/ethnicity					
Same sex × API	1.39 (0.93, 2.08)	1.58 (0.71, 3.51)	2.02 (0.75, 5.43)	1.37 (0.53, 3.54)	-56.3 (-147.0, 34.4)
Same sex × Black	1.12 (0.78, 1.60)	0.89 (0.52, 1.52)	1.61 (0.64, 4.04)	1.14 (0.57, 2.30)	-26.8 (-86.3, 32.7)
Same sex × Hispanic	0.92 (0.67, 1.25)	0.70 (0.41, 1.18)	0.95 (0.44, 2.03)	1.24 (0.72, 2.14)	14.0 (-64.9, 92.8)
Same sex × other	0.96 (0.66, 1.41)	1.01 (0.44, 2.32)	0.18 (0.05, 0.63)	0.81 (0.32, 2.02)	-85.9 (-147.8, -24.0)
Both sexes × API	1.14 (0.73, 1.78)	0.73 (0.35, 1.54)	0.93 (0.40, 2.19)	1.07 (0.50, 2.28)	32.5 (-95.1, 160.1)
Both genders × Black	0.99 (0.73, 1.34)	0.75 (0.47, 1.22)	0.89 (0.44, 1.79)	0.90 (0.52, 1.56)	-39.4 (-87.5, 8.6)
Both genders × Hispanic	1.10 (0.92, 1.32)	1.14 (0.77, 1.68)	1.01 (0.64, 1.60)	1.19 (0.81, 1.74)	-10.5 (-45.8, 24.8)
Both genders × other	0.90 (0.56, 1.44)	0.57 (0.26, 1.28)	0.71 (0.32, 1.58)	0.54 (0.27, 1.08)	-31.1 (-72.9, 10.8)
Gender of partners × gender					
Same sex × female	1.10 (0.87, 1.39)	1.06 (0.70, 1.62)	1.17 (0.60, 2.27)	0.96 (0.58, 1.56)	73.7 (11.1, 136.3)
Both genders × female	1.29 (1.05, 1.60)	2.08 (1.45, 2.98)	1.72 (1.05, 2.82)	1.87 (1.34, 2.62)	-39.5 (-86.9, 7.9)
Gender of partners × age					
Same sex × age	1.02 (0.92, 1.14)	1.02 (0.85, 1.23)	0.89 (0.70, 1.12)	0.95 (0.78, 1.15)	0.4 (-21.0, 21.7)
Both genders × age	1.05 (0.97, 1.14)	1.06 (0.90, 1.23)	0.94 (0.78, 1.13)	0.96 (0.82, 1.12)	0.9 (-10.9, 12.7)

Note. API = Asian/Pacific Islander; CI = confidence interval; HR = hazard ratio; OR = odds ratio. Models adjusted for age at first sexual intercourse. Data came from 13 jurisdictions that asked questions on sexual orientation identity or gender of lifetime sexual partners: Boston, MA; Chicago, IL; Connecticut; Delaware; Maine; Massachusetts; Milwaukee, WI; New York City, NY; Rhode Island; San Diego, CA; San Francisco, CA; Vermont; and Wisconsin.

^aEstimated from Cox proportional hazards regression.

^bEstimated from logistic regression.

^cAmong past-month smokers.

^dEstimated from linear regression.

not adequate for comparing the experiences of subgroups at the intersections of multiple factors (e.g., Hispanic, young, bisexual), future research will benefit from an intersectional approach, which seeks to explain how multiple social statuses and inequalities operate jointly to influence health and argues that identities are better understood in combination.⁷⁰ As an example, because acculturation is known to affect smoking risk differently for male and female adolescents,^{71–74} acculturation would be important to consider in future research to

understand influences of sexual orientation, race/ethnicity, and gender in ethnic minorities.

Our study also extended the literature by examining how findings varied across 2 dimensions of sexual orientation. In general, smoking disparities were larger when we categorized respondents by sexual orientation identity rather than gender of sexual partners. We found differences in how race/ethnicity, gender, and age modified sexual orientation disparities in smoking depending on the dimension examined (e.g., disparities were

relatively larger in younger adolescents identifying as bisexual, but not among younger adolescents reporting both-sex partners). These findings support the importance of considering multiple dimensions of sexual orientation to understand how sexual orientation affects adolescent smoking risk. Our disparate findings derived from the sexual orientation dimension likely occurred because the gender of sexual partners variable excluded the approximately 40% of the sample who reported no sexual partners, whereas the sexual orientation

identity variable included all respondents who answered the question regardless of their sexual experience. In addition, a subanalysis with the 8 jurisdictions that included both sexual orientation indicators on the questionnaire showed that self-identified heterosexuals were more likely to be excluded from the gender of sexual partners analyses because they were more likely to report no sexual partners (43%) than were lesbian–gay (24%) and bisexual (20%) participants ($P < .001$).

Limitations

Because some racial/ethnic subgroups were small, power was limited, and we had to collapse groups. Research with larger sample sizes is necessary to confirm our findings and provide more detailed information about intersections of sexual minority and racial/ethnic minority statuses. In addition, most jurisdictions that included questions about sexual orientation were located in the Northeast or the western region of the United States, where civil rights for sexual minorities are more widespread than in other regions. Urban locations were also overrepresented, because 6 of the 13 jurisdictions were large metropolitan cities. Thus, findings may not be representative of the entire country.

Because data were self-reported, bias could have been introduced if accuracy of reporting smoking was related to sexual orientation, if misclassification of heterosexuals into a sexual minority category was significant, or if nonresponse was differentially related to sexual orientation and smoking. Nonetheless, the YRBS is a methodologically rigorous and long-standing surveillance system that is an important source for understanding health behaviors during adolescence.

Conclusions

Our findings provide more evidence that sexual minority adolescents of all races/ethnicities, genders, and ages are more likely than their heterosexual peers to smoke cigarettes and that they should be the focus of research, prevention, and cessation efforts. A multipronged approach is needed to reach adolescents displaying the full spectrum of smoking behaviors—from nonsmokers at risk for initiating smoking to daily smokers. Despite compelling epidemiological

evidence of disparities in smoking risk among sexual minority youths, the 2012 surgeon general's report *Preventing Tobacco Use Among Youth and Young Adults*⁵ overlooks this population, and few smoking prevention and cessation programs specifically target this group.

A qualitative study of 30 diverse LGB and transgender youths (aged 16–24 years) and 30 adults knowledgeable about LGB and transgender youths suggested strategies to address smoking in this population.⁷⁵ Participants emphasized that youths should be involved in planning and implementing interventions and that interventions should go beyond smoking and address positive identity formation and adjustment, healthy coping strategies, and social support. To reduce the burden of smoking, it is imperative that prevention and cessation efforts targeting the general population of youths be evaluated for effectiveness among sexual minority youths. In addition, specific programs targeting this population should be designed and evaluated.

Evaluation of cessation programs for LGB and transgender adults have revealed quit success rates similar to or better than programs targeting the general population.^{76–78} Although research shows that LGB and transgender-specific programs are effective, it is unclear how findings generalize to youths. Smoking prevention and cessation interventions that consider the specific psychosocial and cultural experiences of subgroups of sexual minority youths may be most effective,⁷⁶ but empirical evidence is necessary to clarify this issue. ■

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Contributors

H. L. Corliss conceptualized and designed the study, analyzed and interpreted the data, and wrote the first draft of the article. All other authors contributed to study design and conceptualization, data interpretation, and writing and editing the article.

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Human Participant Protection

Institutional review board approval was not necessary because de-identified data were used. Data use agreements were obtained from all departments of health that required them for access to YRBS data.

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