ARTICLE

Community-Level Determinants of Tobacco Use Disparities in Lesbian, Gay, and Bisexual Youth

Results From a Population-Based Study

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Objective: To determine whether characteristics of the social environment surrounding lesbian, gay, and bisexual (LGB) youth contribute to their rates of tobacco use after controlling for established community-level risk factors.

Design: Cross-sectional.

Setting: Population-based study of youth.

Participants: A total of 31 852 eleventh-grade students (1413 LGB individuals [4.44%]) in Oregon completed the Oregon Healthy Teens survey in 2006-2008.

Main Exposures: We created a composite index of the social environment in 34 Oregon counties. This measure included the proportion of same-sex couples, the presence of gay-straight alliances in schools, and school policies (nondiscrimination and antibullying) that specifically protected LGB students.

Main Outcome Measures: Any tobacco use in the past 30 days.

Results: A more supportive social environment for LGB youth was significantly associated with reduced tobacco use (odds ratio, 0.92; 95% confidence interval, 0.90-0.94). This effect remained robust after controlling for sociodemographic variables and multiple community-level risk factors for tobacco use, including median county-level income, exposure to cigarette advertisements, exposure to teacher and peer smoking in schools, and school smoking rules.

Conclusion: This study documents an association between an objective measure of the social environment and sexual orientation–related disparities in tobacco use. These results highlight the need for structural-level interventions that reduce smoking behaviors in LGB youth.

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LESBIAN, GAY, AND BISEXUAL (LGB) populations have significantly higher levels of tobacco use compared with heterosexuals.[1] These tobacco-related disparities emerge early in adolescence[2-5] and persist across the life course.[6-8] Data from the Growing Up Today Study,[2] a large community-based cohort of more than 16 000 adolescents in the United States, indicated that sexual orientation–related disparities in tobacco use persisted after adjusting for established adolescent smoking risk factors, such as depressive symptoms, self-esteem, and familial smoking habits. Continued disparities after accounting for salient risk factors at the individual level suggest the need to consider whether factors at the structural level, namely, social environments with greater antigay stigma and discrimination, may account for the higher prevalence of tobacco use in LGB youth.

There is accumulating evidence that the social contexts in which youth reside shape adolescent smoking patterns because individual-level characteristics (eg, expectancies, genetic risk, and personality characteristics) do not fully explain findings that rates of youth smoking vary across different communities.[9] Schools represent one salient social context for youth, and several studies have shown that school smoking policies[10-12] and school structure (eg, exposure to teacher and peer smoking at school)[13,14] affect students' smoking rates. Another social context in which youth are embedded is their residential neighborhood. Although the effect of neighborhood characteristics (eg, concentration of poverty) on smoking prevalence has received more research attention in adults,[15,16] recent studies have indicated that neighborhoods also influence adolescent smoking rates.[17] A particularly important

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Table 1. Demographic Characteristics of the Oregon Healthy Teens Study by Self-reported Sexual Orientation: 2006-2008

Characteristic	Participants, No. (%)		
	Lesbian or Gay (n=301)	Bisexual (n=1112)	Heterosexual (n=30 439)
Sex			
Male	183 (60.80)	278 (25.00)	15 076 (49.53)
Female	118 (39.20)	834 (75.00)	15 363 (50.47)
Race/ethnicity			
White	219 (72.76)	812 (73.02)	22 368 (73.48)
Black	9 (2.99)	23 (2.07)	628 (2.06)
American Indian	10 (3.32)	42 (3.78)	741 (2.43)
Hawaiian/Pacific Islander	4 (1.33)	13 (1.17)	447 (1.47)
Asian	11 (3.65)	29 (2.61)	1120 (3.68)
Hispanic	5 (1.66)	16 (1.44)	927 (3.05)
Multiethnic	18 (5.98)	124 (11.15)	2167 (7.12)
Missing/chose not to respond	25 (8.31)	53 (4.77)	2041 (6.71)

aspect of neighborhoods with respect to the prevalence of youth tobacco use is exposure to smoking advertisements. Numerous studies[18-21] have revealed higher rates of tobacco use in youth who are exposed to more tobacco marketing and advertisements.

Together these studies demonstrate the predictive utility of incorporating measures of community context into studies of youth tobacco use and raise the possibility that characteristics of the social environment surrounding LGB youth may also contribute to their use of tobacco. Of course, many of the community-level factors reviewed previously herein are likely to predict smoking in LGB youth because schools and neighborhoods are contexts that are common to both LGB adolescents and their heterosexual peers. However, other attributes of the social environment unique to LGB youth may also confer risk for tobacco use.[22] For example, LGB individuals experience stigma due to their sexual minority status[23] and have significantly higher rates of discrimination[24] and victimization[25] than do heterosexuals. Researchers[26,27] have postulated the importance of these contextual influences in creating risk for adverse health outcomes in LGB populations. Existing research, however, has largely relied on self-report measures of the social environment,[28] which are confounded with health status and can, therefore, lead to biased estimates.[29] Few studies have attempted to link an objectively defined (ie, non–self-report) index of the social environment to rates of tobacco use in LGB adolescents.

The present study sought to address this gap in the literature by examining whether the social context in which LGB adolescents are embedded may predict tobacco use in a large population-based sample of youth (N=31 852). The 2 study aims were (1) to test whether characteristics of the social environment surrounding LGB youth (hereafter referred to as "the social environment") contribute to their rates of tobacco use and (2) to explore the role of exposure to cigarette advertisements, teacher and peer smoking in schools, and school smoking rules in confounding any observed association between the social environment and smoking.

METHODS

SAMPLE AND SETTING

Data were obtained from the Oregon Healthy Teens (OHT) study, which is based on the Youth Risk Behavior Survey. The Youth Risk Behavior Survey was designed by the Centers for Disease Control and Prevention to measure the prevalence of behaviors and risk factors associated with the leading causes of youth morbidity and mortality. Annual OHT surveys are administered to more than one-third of Oregon's 8th- and 11th-grade public school students. Sexual orientation is assessed in the survey to 11th graders. We pooled data from 2006 (when sexual orientation was first assessed) to 2008 (the most recent data) to increase the sample size of LGB participants. Almost three-quarters of the school districts (74.10%) that were initially selected chose to participate in the OHT study. Participating students came from 297 schools in 34 counties. The questionnaire was available in English and Spanish. All the participants were assured that the survey is anonymous and voluntary, and parents provided passive consent for their children to participate. The study met all the ethical obligations for research involving secondary analysis of de-identified data.

MEASURES

Demographic variables, including sex and race/ethnicity, were obtained via self-report. Sexual orientation was assessed via a single item asking respondents to indicate "which of the following best describes you." Four response options were given: heterosexual (straight), gay or lesbian, bisexual, and not sure. Of the 33 714 respondents, 30 439 (90.3%) self-identified as heterosexual, 301 (0.9%) as gay or lesbian, and 1112 (3.3%) as bisexual. We excluded 653 participants (1.9%) who indicated that they were "not sure" about their sexual orientation. An additional 1209 respondents did not complete the sexual orientation item. The final sample size was 31 852. See **Table 1** for a description of the sample.

Independent Variable

Drawing on recent research on LGB community climate,[26] we created an index of the social environment that was composed of the following 4 items: (1) the proportion of same-sex couples

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living in the counties, (2) the proportion of schools with gay-straight alliances, (3) the proportion of schools with antibullying policies that specifically protected gay students, and (4) the proportion of schools with antidiscrimination policies that included sexual orientation. Each of the 34 Oregon counties included in the 2006-2008 OHT surveys received a value for these 4 items. Data on same-sex couples were obtained from the 2000 US Census, which includes a count of same-sex partner households by county. We divided this number by the total number of households in the county to create the proportion of same-sex couples living in each county.[30] The number of gay-straight alliances in each school district was obtained from the Gay and Lesbian Education Network; we created a variable of the proportion of schools in each district that had a gay-straight alliance. The OHT study does not release data on the individual schools that participated in the survey. Consequently, we created a variable of the proportion of schools in each of the 197 Oregon school districts that had antibullying and nondiscrimination policies related to sexual orientation using data from the Oregon Department of Education. We then aggregated these school measures to the county level so that all social environment variables were consistent geographically.

A factor analysis of these data indicated that these 4 items loaded onto a single factor (range of factor loadings, 0.65-0.83) that explained 55.84% of the variance in social climate; the items demonstrated good internal consistency ($\alpha = .73$). Consequently, these values were summed to create an index of the extent to which the social environment was supportive of gay and lesbian youth in that county. Based on the mean of this sum, we created a z score that reflected the deviation of the value from the mean; the z scores ranged from –9.03 to 4.26. A value of 2.0 for the social environment variable means that the value for that county is 2 SD above the overall mean (ie, is more supportive of gay and lesbian individuals).

Outcome Variable

Participants were asked the number of days they smoked cigarettes during the past 30 days. We created a dichotomous variable indicating any tobacco use in the past 30 days. The Youth Risk Behavior Survey, on which the OHT survey was based, showed excellent test-retest reliability, with the tobacco frequency variable having a κ of 80.1.[31]

Covariates

The OHT survey includes several measures of community-level predictors of tobacco use. Participants were asked 2 questions about exposure to cigarette advertisements, including whether they had seen an advertisement promoting cigarettes on a storefront or in the store or in a magazine. These 2 items were summed to create a total score (range, 0-2). Participants were also asked 5 questions about the smoking environment in their school, including whether they had been taught about tobacco in school during the last 12 months; there was a rule against tobacco use in their school; they had seen teachers, staff, or other adults smoke on school property during the past 12 months; they had seen students smoke on school property; and they had seen teachers, staff, or other adults use chewing tobacco on school property. Finally, we included the median income in each county, obtained from the US Census, as an additional community-level covariate in all the analyses.

STATISTICAL ANALYSIS

The analysis consisted of 2 steps. First, we tested for differences in tobacco use between LGB and heterosexual youth using basic descriptive cross-tabulations. Second, we examined whether the social environment was significantly associated with tobacco use after adjusting for multiple community-level risk factors for tobacco use by using generalized estimating equations (GEEs). A *GEE* is a method developed for handling clustered data in which the observations in each cluster are correlated with each other.[32] Given that OHT study respondents were nested in their county of residence, we used GEE to account for the correlations among observations from each individual in the same county. Owing to power considerations, we combined lesbian and gay youth with bisexual youth, as well as boys and girls, similar to other population-based studies.[24,33]

RESULTS

Compared with their heterosexual peers, LGB respondents were significantly more likely to have smoked in the past 30 days. Sixty-one of 183 gay youth (33.3%), 103 of 278 bisexual male youth (37.1%), and 3351 of 15 076 heterosexual male youth (22.2%) had used tobacco in the past 30 days ($F = 46.98$, $P < .001$). Thirty-three of 118 lesbian youth (28.0%), 364 of 834 bisexual female youth (43.6%), and 2565 of 15 363 heterosexual female youth (16.7%) had used tobacco in the past 30 days ($F = 398.92$, $P < .001$).

In multivariate GEE models controlling for sociodemographic characteristics, each of the community-level risk factors for smoking except school teaching about tobacco remained significant predictors of tobacco use (**Table 2**, model 1).

Next, we ran GEE models to examine associations between the social environment and tobacco use in the past 30 days. In the unadjusted model, a 5-point increase in the supportiveness of the social environment was associated with a 10% decrease in the odds of tobacco use in the past 30 days (odds ratio [OR], 0.88; 95% confidence interval [CI], 0.87-0.89). In the model adjusted for demographics (sex, race/ethnicity, and sexual orientation), supportive social environments remained significantly associated with less tobacco use (OR, 0.88; 95% CI, 0.87-0.89). In the final model adjusted for demographics and community-level predictors of tobacco use, supportive social environments continued to be associated with lower levels of tobacco use (Table 2, model 2). A 5-point increase in the supportiveness of the social environment was associated with an 8% decrease in the odds of tobacco use in the past 30 days (OR, 0.92; 95% CI, 0.90-0.94).

COMMENT

In samples of heterosexual adolescents, there is accumulating evidence that smoking rates are driven, in part, by characteristics of the community context.[9] The central aim of the present study was to identify social/contextual factors that may explain the higher rates of tobacco use by LGB youth. Previous research[34] showed that an objective measure of the social context (ie, the presence of LGB campus resources) was associated with tobacco use in sexual minority female college students. We extend these findings by demonstrating that the social environment was associated with rates of smoking

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Table 2. Associations Between Individual- and Community-Level Characteristics and Tobacco Use in the Past 30 Days in the OHT Study Sample, 2006-2008

Variable	Model 1[a]		Model 2[b]	
	OR (SE) [95% CI]	*P* Value	OR (SE) [95% CI]	*P* Value
Individual-level characteristics				
LGB status	2.81 (0.06) [2.49-3.15]	<.001	2.80 (0.06) [2.50-3.16]	<.001
Sex	0.78 (0.03) [0.74-0.83]	<.001	0.78 (0.03) [0.74-0.83]	<.001
Race/ethnicity	0.80 (0.04) [0.74-0.83]	<.001	0.80 (0.04) [0.74-0.87]	<.001
Community-level characteristics				
Social climate	NA	NA	0.92 (0.01) [0.90-0.94][c]	.008
School exposure	1.54 (0.02) [1.48-1.60]	<.001	1.54 (0.02) [1.40-1.70]	<.001
Advertisement exposure	1.22 (0.02) [1.17-1.27]	<.001	1.22 (0.02) [1.17-1.27]	<.001
School rule	1.31 (0.02) [1.26-1.36]	<.001	1.30 (0.02) [1.25-1.35]	<.001
School teaching	0.98 (0.02) [0.94-1.02]	.34	0.98 (0.02) [0.94-1.02]	.30
Community socioeconomic status	0.89 (0.02) [0.86-0.93]	<.001	0.42 (0.02) [0.40-0.44]	<.001

Abbreviations: CI, confidence interval; LGB, lesbian, gay, and bisexual; NA, not applicable; OHT, Oregon Healthy Teens; OR, odds ratio.

[a] The generalized estimating equation model controlled for individual-level characteristics, school exposure, advertisement exposure, school rule, school teaching, and community socioeconomic status. Estimates are unweighted.

[b] The generalized estimating equation model controlled for all the variables in model 1 and for social climate.

[c] Expressed as the change in odds given a 5-point increase in the continuous measure of the social climate. Individual-level characteristics: LGB status: LGB (combined into 1 group) equals 1; heterosexual, 0; sex: female, 1 and male, 2; and race/ethnicity: white, 1 and other, 0. Community-level characteristics: social climate: social environment surrounding LGB youth entered as a continuous predictor (range, −9.03 to 4.26); community socioeconomic status: median household income in the county (data obtained from the US Census); school exposure: sum of 3 items indicating whether they had seen teachers, staff, other adults, or students smoke or use chewing tobacco on school property; advertisement exposure: sum of 2 questions about exposure to cigarette advertisements in stores and magazines; school rule: whether there was a rule against tobacco use in the students' school; and school teaching: whether students had been taught about tobacco in school during the past 12 months.

in LGB youth. Indeed, the interaction between the social environment and tobacco use approached statistical significance ($P = .07$), suggesting some specificity to the effect of the social environment on smoking rates in LGB youth. We showed that these effects are independent of established community-level risk factors for tobacco use, including exposure to tobacco advertising,[18-21] exposure to peer and adult smoking at school,[13,14] and an absence of policies against smoking.[10-12]

Although LGB youth were less likely to smoke in environments that are more supportive of homosexuality, the effect of LGB status on smoking rates changed little after adjusting for the measure of the social environment. These results indicate that there are additional mechanisms driving the disparity between LGB and heterosexual individuals that were not accounted for in the present study. For example, there are other contextual effects (eg, antigay attitudes of community residents) that were not included in this measure of the social climate that may be associated with tobacco use. Moreover, because the OHT survey examines risk factors for morbidity and mortality in all youth, measures of determinants that are unique to LGB individuals are excluded, such as experiences of minority stress, a well-documented risk factor for poor health in LGB individuals.[35] Research[36-40] has documented associations between general life stressors and smoking and has revealed physiologic mechanisms through which smoking may reduce the negative sequelae of stress. Thus, studies with more comprehensive measures of contextual factors and minority stressors are needed to identify mechanisms that link aspects of harmful social environments to smoking behaviors in LGB youth.

This study has several limitations. First, the data are cross-sectional, which precludes our ability to infer causal relationships between the social environment and tobacco use. Prospective studies that examine how the social environment affects trajectories of tobacco use are needed to establish causal inferences. Second, this study was conducted in Oregon, which could restrict the generalizability of the results. Replication of these findings in other social contexts is, therefore, warranted. Third, the OHT survey is a school-based sample of youth; consequently, runaway and homeless youth were not sampled. Lesbian, gay, and bisexual individuals are overrepresented among homeless youth[41]; consequently, this study likely missed a vulnerable subpopulation of LGB youth. On the other hand, a negative social environment is likely to be an even stronger predictor of health-risk behaviors, including tobacco use, in LGB homeless youth. As such, noninclusion of homeless youth likely biased these results toward the null. Future studies are, therefore, needed to replicate these findings using samples of youth from diverse social contexts. Fourth, research from the National Longitudinal Study of Adolescent Health has indicated that the prevalence of tobacco use in sexual minority youth differs as a function of the operationalization of sexual orientation (ie, attraction, relationships, and self-identification).[42,43] Because the OHT study assessed self-identification only, these results require replication with other measures of sexual orientation. Fifth, the OHT study does not release data on the specific schools that participated in the survey. The variables on school policies were, therefore, aggregated across the district level, which meant that they were less sensitive indicators than were measures of individual school policies. This likely reduced the power to detect a significant reduction in sexual orientation–related disparities in tobacco after adjusting for the measure of the social environment. Consequently, an important direction for future research is the development of ecologic measures that are more proxi-

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mal to LGB youth (eg, neighborhoods), which will provide an opportunity to test the sensitivity of this study's results across different spatial scales.[44] Nevertheless, the fact that we could document an association between social climate at the county level and tobacco use suggests that these results are likely conservative estimates of the effect of the social environment on the prevalence of smoking in LGB youth. Conversely, previous studies[45,46] of "place effects" and the health of LGB populations have been conducted at the state level, and, thus, areas as small as counties may not reflect all aspects of the community climate.[47] Future studies incorporating measures at multiple levels of place (state, county, neighborhood, and school) are important to comprehensively characterize the social environment in which youth are embedded.

Despite these limitations, the present study had several noteworthy advantages for studying relationships between community-level risk factors and tobacco use. The large population-based sample of Oregon youth offers a methodological strength over most studies of LGB adolescents, which rely on self-selected convenience samples,[48,49] which can lead to biased estimates of the association between sexual orientation and health.[50] In addition, many previous studies examining the mental health of LGB youth[51] have recruited LGB and heterosexual respondents from different venues, which introduces sampling biases.[52] In contrast, in the OHT study, LGB and heterosexual participants were recruited using identical sampling methods. A final methodological strength is the objective measure of the social environment. Previous studies have used self-report measures of stress appraisals, such as perceived discrimination.[24] These subjective measures may capture how LGB individuals construe their experience of living in harmful social environments, but such measures are confounded with mental health status.[29] In contrast, our objective index of the social environment occurred outside the control of the individual and could not be caused by individual-level factors that might also affect the dependent variable, which helps rule out endogeneity.

Tobacco use is the leading preventable cause of death in the United States.[53] Lesbian, gay, and bisexual adolescents smoke at significantly higher rates than do their heterosexual peers, which can place them on poor health trajectories throughout the life course. Despite myriad studies documenting this increased risk, there is a scarcity of research on determinants of tobacco-related disparities in LGB youth, particularly those at the social and structural levels, which has hindered the development of effective preventive interventions. The present study is among the first to document that aspects of the social environment that are particularly relevant to LGB youth may contribute to disparities in tobacco use in LGB adolescents beyond other community-level risk factors for smoking. Only a handful of states participating in the Youth Risk Behavior Survey assess sexual orientation, and few release data at the county level, precluding examination of contextual effects on health. The present results point to the need for better data collection efforts modeled on the OHT study.

In addition, these results have potentially important implications for understanding the etiology of sexual orientation–related disparities in tobacco use. Moreover, these findings contribute to and extend an emerging body of literature[23,27,35] highlighting the need for community- and structural-level interventions that address health disparities in LGB populations. In particular, the present data suggest that school policies that encourage supportive structures (eg, gay-straight alliances) and prohibit violent behaviors (eg, antibullying policies) can reduce the disproportionate burden of adverse health outcomes in LGB youth. Careful attention to common and unique concerns of LGB adolescents are needed to ensure that such population-based interventions attenuate, rather than exacerbate, existing sexual orientation–related disparities in tobacco use.[54]

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