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State-level tobacco environments and sexual orientation disparities in tobacco use and dependence in the USA

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Abstract

Objective—To describe relationships between tobacco-related environments and disparities in smoking by sexual orientation.

Methods—We examined three aspects of state-level tobacco environments, which were derived from the ImpacTeen State Level Tobacco Control Policy and Prevalence Database: (1) tobacco price and tax data and tobacco control funding; (2) tobacco control policies and (3) tobacco prevalence and norms data. This information was linked to individual-level data on sexual orientation, tobacco use and nicotine dependence in Wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions (N=34 653; 577 LGB respondents), a cross-sectional, nationally representative survey of adults in the USA.

Results—Lesbian, gay and bisexual (LGB) adults in states with more restrictive tobacco environments were less likely to have ever smoked (AOR=0.78, 95% CI 0.62 to 1.00) and to currently smoke (AOR=0.77, 95% CI 0.60 to 0.99) than LGB adults in more permissive tobacco environments. Further, sexual orientation disparities in past and current smoking, as well as in current nicotine dependence, were lower in states with the most restrictive tobacco environments. Results were robust to adjustment for confounders at the individual and state levels.

Conclusions—Restrictive state-level tobacco environments are correlates of smoking behaviours among LGB adults in the USA; such environments could potentially reduce social inequalities in smoking based on sexual orientation.

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Contributors MLH conceived of the study idea, supervised the analysis and led the writing of the paper. AH conducted the study analysis, and KMK supervised the analysis. KMK and DSH assisted in drafting and editing the article.

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INTRODUCTION

Tobacco use is the leading preventable cause of death in the USA,[1] but the prevalence of tobacco use is not evenly distributed within the general population. Sexual orientation is one individual-level risk indicator, with lesbian, gay and bisexual (LGB) populations more likely to use tobacco and to meet criteria for nicotine dependence than heterosexuals.[2] As sexual orientation disparities in smoking emerge early in adolescence and persist across the life course,[2] understanding their determinants represents an important research priority.

At a population level, tobacco control policies contribute to patterns of tobacco use, such that those who live in areas with more restrictive policies, whether implemented in the local community (eg, workplace setting) or at the state level, have lower rates of tobacco use.[34] Researchers have begun to investigate whether tobacco control policies affect particular subgroups differentially within the population. Available evidence suggests that certain tobacco policies, including tobacco taxation, may reduce social inequalities in smoking.[56] Recent reviews have found that no studies have examined whether tobacco policy effects differ by sexual orientation,[78] although results from a French cohort of HIV-infected individuals found that cigarette prices were associated with reductions in smoking among the sample of homosexuals.[9] Consequently, limited information exists on (1) whether tobacco policies that reduce smoking rates among heterosexuals also confer benefits for LGB populations and (2) whether such policies reduce sexual orientation disparities in smoking rates. Specific minority stressors,[10] or industry efforts to target gay men and lesbians,[11] may undermine the effectiveness of tobacco control policies for LGB populations relative to heterosexuals, thereby increasing disparities in tobacco use and related outcomes by sexual orientation. Alternatively, differential impact might occur because of differences in exposure to a given policy intervention.[7] For instance, if LGB populations are more densely populated within states that have more restrictive tobacco control policies, the effect of the tobacco control policies could reduce sexual orientation disparities in tobacco use at an overall population level.

In addition to tobacco control policies, other state-level factors shape smoking environments. In particular, states differ with respect to the prevalence of smokers, as well as social attitudes regarding smoking, and these social norms strongly predict rates of smoking in general population samples.[1213] Thus, considering multiple state-level factors that contribute to smoking environments, which in turn affect individual smoking patterns, can provide important information regarding determinants of smoking behaviours among LGB populations.

Using data from a large-scale, nationally representative dataset of non-institutionalised adults in the USA, we examined three research questions related to state-level smoking environments based on comprehensive information on tobacco control policies, smoking prevalence, and smoking norms at the state level. First, we examined whether LGB adults living in states with more restrictive smoking environments (norms and policies) had lower rates of tobacco use and nicotine dependence than LGB adults in states with more permissive smoking environments. Second, we evaluated whether the effect of state-level smoking environments was stronger for LGB than heterosexual adults. Third, we determined

whether sexual orientation disparities in tobacco-related outcomes were lower in states with more restrictive smoking environments.

METHODS

Sample

Data on sexual orientation and tobacco outcomes were drawn from wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a longitudinal survey in which face-to-face interviews were conducted with participants at two waves, in 2001–2002 (N=43 093) and in 2004–2005 (N=34 653). The wave 1 response rate was 81%, and of participants eligible for wave 2, the response rate was 86.7%, leading to a cumulative response rate of 70.2%. Our data are limited to wave 2 participants because sexual orientation was only assessed in this wave; assuming stability of sexual orientation between the two waves of the NESARC, particularly for the women,[14] may have led to misclassification of a subset of respondents. The sample consisted of civilian, non-institutionalised adults aged 18 years and older at Wave 1 who were living in households and group quarters, including military off-base housing and college housing, in all 50 states. The sampling frame was based on households in the Census 2000–2001 Supplementary Survey and group quarters in the Census 2000 Group Quarters Inventory. Blacks, Hispanics, and young adults (aged 18–24 years at the time of wave 1) were oversampled, and data were weighted to adjust for oversampling and household-level and person-level non-response to represent the US population not living on military bases in the 2000 census in terms of region, age, sex, race and ethnicity. Wave 2 data were weighted for non-response, so that the sample represented wave 1 respondents who remained alive in the US and not institutionalised. Additional information on the study methods can be found elsewhere.[15]

Measures

Sexual orientation—We used a measure of sexual identity based on response to the question ‘Which of the categories best describes you?’ The four response options were: heterosexual (straight), gay or lesbian, bisexual, and not sure. Of the Wave 2 sample, 577 (1.67%) identified as gay, lesbian, or bisexual. Individuals with missing data on sexual orientation (478) were excluded from the analyses.

Tobacco use and nicotine dependence—Tobacco use was measured in several ways. Ever smoker was defined as having smoked cigarettes 100+ times over the lifetime.[16] Current smoker was defined as smoking one or more cigarettes in the past year, queried among lifetime smokers.[16] Test-retest reliability of tobacco use variables over an average of 10 months in these data ranged from 0.6 (duration of daily smoking) to 0.9 (age of onset of smoking),[15] suggesting that measures of tobacco use are highly reliable.

Our measure of the amount of cigarette use among regular smokers (those who smoked every day or nearly every day) was categorised as usual number of cigarettes smoked. This variable was not uniformly distributed in the sample. Respondents tended to report usual number of cigarettes per day in units of 10 (corresponding to half a standard pack of 20; thus, respondents would report half-a-pack per day, one pack per day, etc.). Thus, we

categorised usual number of cigarettes into the number of half-packs per day. The range is 0–6 half-packs, corresponding to ≤10 to 60 cigarettes per day.

In addition to measures of tobacco use, we also included a measure of nicotine dependence. The NESARC assessed disorder as defined by the *Diagnostic and Statistical Manual IV* (*DSM-IV*) using the Alcohol Use Disorder and Associated Disabilities Interview Schedule—DSM-IV Version (AUDADIS-IV), a structured lay interview.[17] The AUDADIS-IV used an extensive list of over 40 questions to assess nicotine dependence. Diagnoses were indicated according to criteria from the DSM-IV, in which a respondent needed at least three out of seven criteria to be diagnosed with nicotine dependence. We examined the current time frame (ie, past 12-month diagnosis). The reliability and validity of the nicotine dependence diagnosis was assessed by a random sample of 347 respondents in the NESARC who were reinterviewed with the nicotine dependence module up to 10 weeks after the initial appraisal.[18] The reliability of the previous 12-month (ie, current) diagnosis was good (κ=0.63).

Covariates—We controlled for sociodemographic characteristics associated with smoking, including sex, age, race/ethnicity, income, education and urbanicity. Additionally, we controlled for two state-level policies regarding minority sexual orientation status: whether or not the respondent lived in states that included sexual orientation as a protected class status in (1) hate crime statutes and (2) in employment non-discrimination acts in 2005 (in 2005, these policies overlapped completely with policies on same-sex relationships; thus, such variables were not included). These two protective policies are associated with reduced risk of psychiatric and substance disorders in LGB adults[19] and are correlated with state-level tobacco environments ($r=0.49$, $p<0.01$). Thus, LGBs in states with permissive state-level tobacco environments are also more likely to face structural forms of discrimination due to minority social status, which could influence smoking and thus confound the relation between tobacco environment and smoking among LGB adults.

State-level tobacco environment—We created a scale to measure the state-level tobacco environment, based on data compiled by the ImpacTeen State Level Tobacco Control Policy and Prevalence Database, which provides information for all states and the District of Columbia, using data that are available during the years 1991–2008. For the current paper, we used data from 2005 to coincide with wave 2 of the NESARC. The data and codebook were compiled by researchers at the State University of New York.[20]

The state-level tobacco environment index was created using three categories of information that prior research has shown to be strongly related to smoking patterns at a population level[5612132122]: (1) tobacco price and tax data and tobacco control funding; (2) tobacco control policies and (3) tobacco prevalence and norms data. We describe each of the 12 items that comprised these three categories below.

Tobacco price and tax data included (1) the total cigarette tax per cigarette pack (including average state excise tax and federal tax). Tobacco control funding data included: (2) total amount of state tobacco control programme funding dollars, calculated per capita based on state population; (3) funding as a percent of tobacco revenue; (4) the amount of money states

receive from settlements of major court cases; (5) the amount of money states receive from taxes placed on cigarettes and (6) the amount of money states receive from other sources, including revenues from the federal government to state health departments, the Robert Wood Johnson Foundation's (RWJF) SmokeLess States Program, and various grants from the American Legacy Foundation (ALF) to states and organisations. Tobacco control funding data were obtained from several sources, including the Centers for Disease Control and Prevention (CDC), the Research Triangle Institute, the Campaign for Tobacco Free Kids, the RWJF, the ALF, and the National Cancer Institute. Price, tax, and funding data were all inflation-adjusted to April 2008 dollars (the final year in which the database was created). Tobacco control policies included: (7) a count variable of the level of state smoke-free air protection laws across 12 possible locations (ie, level of state smoke-free air protection at healthcare facilities, private worksites, child care centres, restaurants, recreational facilities, cultural facilities, public transit, shopping malls, public schools, private schools, free-standing bars, and government worksites) and (8) a count variable of smoke-free air pre-emption laws across the same 12 specific locations. For tobacco prevalence and smoking norms data, we used four items: (9) prevalence of adults in the state who reported smoking ≥100 lifetime cigarettes, and current smoking either every day or on some days in the CDC's Behaviour Risk Factor Surveillance System (BRFSS); (10) overall percentage of persons aged 12 years and older who reported past-month cigarette use in the National Survey on Drug Use and Health (NSDUH); (11) overall percentage of persons aged 12 years and older who reported past-month tobacco use in the NSDUH and (12) overall percentage of persons aged 12 years and older who responded that persons smoking a pack or more of cigarettes per day were at 'great risk' of 'harming themselves physically and in other ways' in the NSDUH. The prevalence of smoking at the state level is a measure of the acceptability and norms toward smoking in that state; it is therefore an index of the tobacco-related environment surrounding individuals residing in that state. Previous studies have used these ecologic measures on social norms to predict individual-level substance use outcomes, including smoking,[21,22] providing support for our approach. 'Same source bias'[23] can arise in studies when the data at the state level are derived from the aggregation of individual-level data from the same source; therefore, to reduce the potential for same-source bias, the smoking prevalence at the state level was derived from the National Household Survey on Drug Use and Health (NHSDUH), which has a different sampling frame and age range from the NESARC (the dataset used for our analyses).

We conducted an exploratory factor analysis with the above 12 items, using a Geomin rotation assuming oblique correlation between factors. A single factor emerged. We then used confirmatory factor analysis to provide model fit statistics (χ^2=97.2, degrees of freedom (df) df=54, $p<0.01$, Tucker Lewis Index=0.942, Comparative Fit Index=0.952). Table 1 presents the factor score for each state and the District of Columbia; the online supplementary table S1 presents the items and corresponding factor loading.

Statistical analysis

Analyses proceeded in four steps. First, we compared the prevalence of smoking-related outcomes by sexual orientation status. Group differences were tested with χ^2 for categorical outcomes and t tests for continuous outcomes. Second, we examined associations between

the state-level tobacco environment and smoking-related outcomes, stratifying by sexual orientation. We present unadjusted models as well as models adjusted for relevant covariates. Third, in the full sample, we added a multiplicative interaction term between sexual orientation and state tobacco environment to determine whether associations between tobacco environments and smoking outcomes differed between LGB and heterosexual adults. Fourth, we examined whether state-level tobacco environments affected sexual orientation disparities in smoking outcomes. In order to accomplish this aim, we divided the tobacco environment variable into tertiles ranging from most to least restrictive, and then examined the relationship between sexual orientation and tobacco-related outcomes within each tertile, adjusting for covariates. Evidence that tobacco-related environments contribute to sexual orientation disparities would be observed if the relationship between sexual orientation and smoking outcomes was weaker (or nonsignificant) in states with the most restrictive smoking environments. Analyses for aims 2 and 3 were conducted using logistic regression for dichotomous outcomes and multinomial regression for the ordinal outcome of number of half-packs of cigarettes usually smoked per day (using a cumulative logit link function).

Our analyses were conducted using complex survey software that accounts for the linearity of individuals sampled within primary sampling units. Models provide population average estimates, which were chosen for these analyses for two main reasons. First, our research question is explicitly regarding the population average of state-level effects predicting individual-level outcomes rather than between-state variance.[24] Thus, the model better corresponds with our research question. Second, because individuals were not sampled to be representative of the state in the NESARC dataset, clustering by state is inappropriate without making problematic assumptions.[25] Thus, population average models allow us to robustly estimate SEs while assessing the relation between state-level tobacco environments and study outcomes. All analyses were conducted in SUDAAN to account for the complex sampling design of the NESARC.

RESULTS

Sexual orientation disparities in smoking-related outcomes

Table 2 presents results depicting sexual orientation disparities in smoking-related outcomes. LGB adults were significantly more likely than heterosexuals to have ever smoked (55.5% vs 47.0%; χ^2=16.26, p<0.01) and to currently smoke (33.8 vs 22.8%; χ^2=38.92, p<0.01). Among regular smokers, there were no sexual orientation differences in the number of half-packs smoked (p=0.09); however, LGB adults who smoked were significantly more likely than heterosexuals to meet criteria for nicotine dependence (66.7% vs 56.6%; χ^2=7.81, p<0.01).

Associations between state-level tobacco environment and smoking outcomes

Among LGB adults, state-level tobacco environments were associated with smoking-related outcomes (table 3). Specifically, LGB adults living in states with more restrictive tobacco environments were significantly less likely to have ever smoked (AOR=0.78, 95% CI 0.62 to 1.00) and to currently smoke (AOR=0.78, 95% CI 0.60 to 0.99), than LGB adults in more

permissive tobacco environments. Among LGB adults who were regular smokers, tobacco environments were not associated with number of cigarettes smoked. Among LGB smokers, tobacco environments were not associated with nicotine dependence. Results were similar for heterosexual adults: those living in states with more restrictive tobacco environments were significantly less likely to have ever smoked (AOR=0.94, 95% CI 0.91 to 0.97) and to currently smoke (AOR=0.88, 95% CI 0.85 to 0.91), than heterosexuals in more permissive tobacco environments. Among heterosexuals who were regular smokers, tobacco environments were not associated with number of half-packs smoked, or with current nicotine dependence.

Although the strength of the relationship between tobacco environments and smoking outcomes were all in the direction of a stronger association for LGB than for heterosexual adults (ie, the ORs indicated greater protection for LGB adults), none of the interactions between sexual orientation and state-level tobacco environment reached statistical significance.

Tobacco environments and sexual orientation disparities in smoking-related outcomes

In the NESARC sample, LGB adults were more likely than heterosexual adults to live in states with restrictive tobacco environments (M=0.68 vs M=0.45, t=−5.11, p<0.01), and these environments affected sexual orientation disparities in smoking-related outcomes (table 4). Sexual orientation disparities in all four outcomes were largest in states with the most permissive or medium permissive tobacco environments. Further, sexual orientation disparities in smoking-related outcomes were much lower in states with the most restrictive tobacco environments, with the exception of half-packs among smokers. For example, the OR indicating the association between LGB status and ever smoking was 1.87 in states with the most permissive environments, 1.65 in states with a moderate level of permissiveness, and 1.34 in states with low smoking permissiveness. Similar graded relationships were documented for current nicotine dependence among smokers (ORs of 1.96, 1.75 and 1.27 for high, moderate and low permissiveness, respectively). Although there was no evidence of a graded relationship for current smoking, sexual orientation disparities in current smoking were still lowest in states with the most restrictive environments. Importantly, these results were robust to adjustment for individual-level risk factors as well as other state-level policies affecting sexual minorities (ie, protections for sexual orientation in hate crimes and employment nondiscrimination acts), which were related to more restrictive tobacco environments. Thus, the relationship between the state-level tobacco environment and smoking outcomes among LGB adults does not appear to be confounded by these other state-level factors.

DISCUSSION

The current study evaluated state-level determinants of tobacco use and nicotine dependence among LGB populations, and examined whether these factors affected sexual orientation disparities in tobacco-related outcomes. To address this research question, we linked comprehensive information on tobacco control policies, smoking prevalence and smoking norms at the state level to individual-level data on sexual orientation and smoking outcomes,

using a nationally representative sample of US adults. The two central findings of the current study are that state-level tobacco environments (1) are correlates of smoking behaviours in LGB adults and (2) affect sexual orientation disparities in tobacco-related outcomes. Specifically, LGB adults living in states with more restrictive tobacco environments were less likely to have ever smoked and to currently smoke than LGB adults in more permissive tobacco environments. Further, sexual orientation disparities in past and current smoking, as well as in current nicotine dependence, were lower in states with the most restrictive tobacco environments. These results were robust to adjustment for confounders at the individual and state levels.

Population-level approaches to intervention may improve health outcomes at a population level, while at the same time exacerbating existing inequalities in health.[26] Thus, even though we found evidence that tobacco environments benefit both LGB and heterosexuals, it was necessary to simultaneously examine how state-level tobacco environments specifically affected sexual orientation disparities in smoking. One of the most comprehensive reviews of research on social inequalities in smoking reported that certain tobacco control policies (clean indoor air laws, cigarette prices) were effective in reducing socioeconomic inequalities in smoking.[13] We extend this research to show for the first time that state-level tobacco environments, including tobacco control policies, may also be effective in reducing sexual orientation disparities in smoking-related outcomes.

Future research is needed to understand the mechanisms that explain why restrictive tobacco environments are effective in reducing sexual orientation disparities in smoking and nicotine dependence. One possibility is differential exposure to a given policy intervention. As we noted, LGB adults may be overrepresented in states with more restrictive tobacco environments, as these states also tend to have more protective policies related to sexual orientation (eg, employment nondiscrimination acts, partner recognition). Further, to the extent that LGB adults rely on gay bars as safe spaces for socialising, they may differentially benefit from tobacco-free smoking laws in these settings.

This study had several limitations. First, these data are cross-sectional. Consequently, we cannot infer causal relationships between tobacco environments at the state level and smoking outcomes among LGB individuals in those states. In particular, it is possible that other state-level factors confound the relation between tobacco environment and smoking among LGB adults. We began to address this issue by controlling for two state-level factors, including policies that include sexual orientation as a protected class in hate crime and employment nondiscrimination laws. It was important to adjust for state policies related to sexual orientation because political ideologies that either promote or prohibit the implementation of tobacco control policies are likely to be related to ideologies surrounding the perceived necessity of protecting sexual minorities in state hate crime and employment policies. At the same time, this is an incomplete list of potential confounders. Consequently, prospective studies as well as studies that use quasiexperimental designs following the implementation of, or changes in, state smoking policies will help to improve causal inferences about relationships between tobacco environments and smoking behaviours among LGB adults.

Second, because we did not observe any statistically significant interactions between state-level tobacco environments and gender or sexual orientation subgroups (ie, lesbian/gay vs bisexual), we combined men and women as well as gays, lesbians and bisexuals. Although combining these groups might mask heterogeneous effects of tobacco environments on smoking outcomes, follow-up analyses revealed that the direction of the effect was similar for bisexuals and for lesbians/gay men. Third, we chose to create an index of tobacco environments using a factor score. One limitation is that the measure of tobacco environments does not provide information on which specific tobacco control policies are most effective in reducing sexual orientation disparities in smoking outcomes. At the same time, there are benefits to this approach, including developing a global, comprehensive index of the tobacco environment at the state level.

Despite these limitations, the current study provides important information on correlates of smoking in LGB populations, and on potential influences on sexual orientation disparities in tobacco use and nicotine dependence. Given the large and persistent disparities in these outcomes based on sexual orientation, addressing and reducing such disparities remains a public health priority. Although more research is needed, these results provide preliminary evidence that tobacco environments at the state level operate similarly for LGB and heterosexual adults. Furthermore, our study suggests that these environments may decrease —and importantly, do not exacerbate—existing tobacco disparities based on sexual orientation. This research also contributes to a growing body of evidence on the effectiveness of policy-level interventions in reducing a variety of social disparities in health.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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REFERENCES

1. Centers for Disease Control and Prevention. Cigarette smoking-attributable morbidity-United States, 2000. MMWR Morb Mortal Wkly Rep. 2003; 52:842–844. [PubMed: 12966360]
2. Lee JG, Griffin GK, Melvin CL. Tobacco use among sexual minorities in the USA, 1987 to May 2007: a systematic review. Tob Control. 2009; 18:275–282. [PubMed: 19208668]
3. Hopkins DP, Briss PA, Ricard CJ, et al. Reviews of evidence regarding interventions to reduce tobacco use and exposure to environmental tobacco smoke. Am J Prev Med. 2001; 20:16–66. [PubMed: 11173215]
4. Hopkins DP, Razi S, Leeks KD, et al. Smokefree policies to reduce tobacco use: a systematic review. Am J Prev Med. 2010; 38:S275–S289. [PubMed: 20117612]
5. Thomas S, Fayter D, Misso K, et al. Population tobacco control interventions and their effects on social inequalities in smoking: systematic review. Tob Control. 2008; 17:230–237. [PubMed: 18426867]

6. Dinno A, Glantz S. Tobacco control policies are egalitarian: a vulnerabilities perspective on clean indoor air laws, cigarette prices, and tobacco use disparities. Soc Sci Med. 2009; 68:1439–1447. [PubMed: 19282078]
7. Balbach, ED.; Hartman, C.; Barbeau, EM. The effect of tobacco control policies on inequities in smoking prevalence: social class, race/ethnicity, and gender. In: Bearman, P.; Neckerman, KM.; Wright, L., editors. After Tobacco: What Would Happen if Americans Stopped Smoking?. New York: Columbia University Press; 2011. p. 381-95.
8. Blosnich J, Lee JG, Horn K. A systematic review of the aetiology of tobacco disparities for sexual minorities. Tob Control. 2013; 22:66–73. [PubMed: 22170335]
9. Peretti-Watel P, Villes V, Duval X, et al. How do HIV-infected smokers react to cigarette price increases? Evidence from the APROCO-COPILOTE-ANRS CO8 Cohort. Curr HIV Res. 2009; 7:462–467. [PubMed: 19601784]
10. Meyer IH. Prejudice, social stress, and mental health in lesbian, gay, bisexual populations: conceptual issues and research evidence. Psychol Bull. 2003; 129:674–697. [PubMed: 12956539]
11. Dilley JA, Spigner C, Boysun MJ, et al. Does tobacco industry marketing excessively impact lesbian, gay and bisexual communities? Tob Control. 2008; 17:385–390. [PubMed: 18723561]
12. Christakis NA, Fowler JH. The collective dynamics of smoking in a large social network. N Engl J Med. 2008; 358:2249–2258. [PubMed: 18499567]
13. Van Zundert RM, Engels RC, Van den Eijnden RJ. Adolescent smoking continuation: reduction and progression in smoking after experimentation and recent onset. J Behav Med. 2006; 29:435–447. [PubMed: 16855869]
14. Diamond LM. Female bisexuality from adolescence to adulthood: results from a 10-year longitudinal study. Dev Psychol. 2008; 44:5–14. [PubMed: 18194000]
15. Grant BF, Dawson DA, Stinson FS, et al. The Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS-IV): reliability of alcohol consumption, tobacco use, family history of depression and psychiatric diagnostic modules in a general population sample. Drug Alcohol Depend. 2003; 71:7–16. [PubMed: 12821201]
16. Grant BF, Hasin DS, Chou SP, et al. Nicotine dependence and psychiatric disorders in the United States: results from the national epidemiologic survey on alcohol and related conditions. Arch Gen Psychiatry. 2004; 61:1107–1115. [PubMed: 15520358]
17. Grant, BF.; Dawson, D.; Hasin, DS., et al. The Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM IV Version (AUDADIS-IV). Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism; 2001.
18. Ruan WJ, Goldstein RB, Chou SP, et al. The alcohol use disorder and associated disabilities interview schedule-IV (AUDADIS-IV): reliability of new psychiatric diagnostic modules and risk factors in a general population sample. Drug Alcohol Depend. 2008; 92:27–36. [PubMed: 17706375]
19. Hatzenbuehler ML, Keyes KM, Hasin DS. State-level policies and psychiatric morbidity in lesbian, gay, bisexual populations. Am J Public Health. 2009; 99:2275–2281. [PubMed: 19833997]
20. http://www.impacteen.org/tobaccodata.htm.
21. Keyes KM, Schulenberg JE, O'Malley PM, et al. Birth cohort effects on adolescent alcohol use: the influence of social norms from 1976 to 2007. Arch Gen Psychiatry. 2012; 69:1304–1313. [PubMed: 22868751]
22. Keyes KM, Schulenberg JE, O'Malley PM, et al. The social norms of birth cohorts and adolescent marijuana use in the United States, 1976–2007. Addiction. 2011; 106:1790–1800. [PubMed: 21545669]
23. Diez Roux AV. Neighborhoods and health: where are we and were do we go from here? Rev Epidemiol Sante Publique. 2007; 55:13–21. [PubMed: 17320330]
24. Hubbard AE, Ahern J, Fleischer NL, et al. To GEE or not to GEE: comparing population average and mixed models for estimating the associations between neighborhood risk factors and health. Epidemiology. 2010; 21:467–474. [PubMed: 20220526]
25. Rao, JNK. Small area estimation. Hoboken, NJ: John Wiley; 2003.

26. Frohlich KL, Potvin L. Transcending the known in public health practice: the inequality paradox: the population approach and vulnerable populations. Am J Public Health. 2008; 98:216–221. [PubMed: 18172133]

What is already known on this subject

- Sexual orientation disparities in tobacco use and nicotine dependence are pronounced.
- The determinants of these disparities, especially at a social-ecological level, are not well understood.
- Previous studies have suggested that tobacco control policies may reduce social inequalities in smoking, but no such data exist with respect to sexual orientation.

What this paper adds

- Restrictive tobacco environments—including tobacco control policies, smoking prevalence and attitudes on smoking measured at the state level—were associated with lower rates of smoking among lesbian, gay and bisexual (LGB) populations.
- Further, this is the first paper to our knowledge to document that sexual orientation disparities in tobacco use and nicotine dependence were substantially lower in states with restrictive tobacco environments.

Table 1

State tobacco environment factor scores in order of least permissive to most permissive

State	Factor score	State	Factor score	State	Factor score
California	2.187	Montana	0.788	Oklahoma	−0.378
New Jersey	1.865	Alaska	0.741	North Dakota	−0.417
Massachusetts	1.671	Maine	0.738	Delaware	−0.456
Rhode Island	1.571	Nevada	0.731	Iowa	−0.555
Washington	1.571	Kansas	0.714	North Carolina	−0.656
New York	1.556	Wisconsin	0	Tennessee	−0.656
Maryland	1.415	Utah	−0.016	Minnesota	−0.716
Connecticut	1.318	Florida	−0.02	Missouri	−0.767
Illinois	1.082	Colorado	−0.045	South Carolina	−0.975
Oregon	1.046	Idaho	−0.079	Alabama	−1.206
Arizona	0.991	Virginia	−0.125	Arkansas	−1.206
Hawaii	0.865	Georgia	−0.131	Indiana	−1.206
New Mexico	0.851	New Hampshire	−0.239	Kentucky	−1.206
District of Columbia	0.848	Texas	−0.294	Louisiana	−1.206
Vermont	0.817	South Dakota	−0.312	Mississippi	−1.206
Michigan	0.802	Nebraska	−0.323	West Virginia	−1.206
Pennsylvania	0.802	Ohio	−0.357	Wyoming	−1.206

Table 2

Sexual orientation disparities in smoking-related outcomes: National Epidemiologic Survey on Alcohol and Related Conditions, 2004–2005

Smoking variable	LGB (N=577)	Heterosexual (N=33 598)	χ^2, p value
Ever smoked			
%	55.46	47.01	χ^2=16.26,
N	320	15 794	p<0.01
SE	0.02	0.01	
Current smoking*			
%	33.8	22.78	χ^2=38.92,
N	195	7653	p<0.01
SE	0.02	<0.01	
Nicotine dependence among current smokers (N=7848)			
%	66.67	56.63	χ^2=7.81,
N	130	4334	p<0.01
SE	0.03	0.01	
Half-packs among frequent smokers† (N=6985)			
Mean	1.94	1.80	t= −1.72,
N	161	6104	p=0.09
SE	0.08	0.01	
Median	2	2	

*_Current Smoking_ defined as 1+ cigarettes within the last year.

†_Half Packs_ is an ordinal variable of number of half packs typically smoked on days when respondent smoked, among those who smoked every day or nearly every day (range 0–6 half packs, corresponding to <10 to 60 cigarettes per day). Half-packs=10 cigarettes.

LGB, Lesbian, gay, bisexual.

Table 3

Association between state-level tobacco environment* and smoking-related outcomes among LGB and heterosexual individuals: National Epidemiologic Survey on Alcohol and Related Conditions, 2004–2005

Smoking outcome	OR (95% CI) LGB	OR (95% CI) Heterosexual	F, DF, p value Interactions
Ever smoked			
Unadjusted	0.79 (0.65 to 0.96)	0.89 (0.85 to 0.94)	1.78, 1, 0.19
Adjusted†	0.78 (0.62 to 1.00)	0.94 (0.91 to 0.97)	0.86, 1, 0.36
Current smoking‡			
Unadjusted	0.76 (0.64 to 0.91)	0.82 (0.79 to 0.85)	0.77, 1, 0.38
Adjusted	0.78 (0.60 to 0.99)	0.88 (0.85 to 0.91)	0.42, 1, 0.52
Current nicotine dependence among current smokers			
Unadjusted	0.82 (0.58 to 1.14)	1.01 (0.95 to 1.07)	1.47, 1, 0.23
Adjusted	0.87 (0.58 to 1.29)	1.03 (0.96 to 1.10)	1.30, 1, 0.26
Amount of smoking (in half-packs) among smokers§			
Unadjusted	0.72 (0.52 to 1.01)	0.81 (0.76 to 0.86)	0.62, 1, 0.43
Adjusted	0.85 (0.57 to 1.27)	0.99 (0.98 to 1.01)	0.08, 1, 0.78

* A factor score was created for each state, which represents the level of permissiveness in that state related to tobacco policies and smoking norms. The factor scores are based on the following state-level variables: total cigarette tax per pack, total state tobacco control programme funding, tobacco control funding per capita, tobacco settlement revenue, tobacco tax revenue, other state tobacco control funding, tax as a percentage of retail price (including generics), number of smoke-free air laws, number of smoke-free air preemption, % current smokers based on BRFSS, % past month cigarette use based on NHSDUH, % past month tobacco use based on NHSDUH, % believe that smoking 1+ packs per day poses great risk to harm overall based on NHSDUH. Monetary values were adjusted for inflation.

† Adjusted for age, sex, ethnicity/race, income, education, urbanicity and state policies that included sexual orientation as a protected class status in hate crime statutes and in employment nondiscrimination acts in 2005.

‡ *Current Smoking:* defined as 1+ cigarettes within the last year.

§ *Half-Packs* is an ordinal variable of number of half packs typically smoked on days when respondent smoked, among those who smoked every day or nearly every day (range 0–6 half packs, corresponding to <10 to 60 cigarettes per day).

BRFSS, Behavior Risk Factor Surveillance System; LGB, Lesbian, gay, bisexual; NHSDUH; National Household Survey on Drug Use and Health.

Table 4

Sexual orientation disparities in smoking-related outcomes among high, medium, and low categories of state-level tobacco environments[*] National Epidemiologic Survey on Alcohol and Related Conditions, 2004–2005

Outcome	High smoking permissiveness OR (95% CI)[†]	Medium smoking permissiveness OR (95% CI)	Low smoking permissiveness OR (95% CI)
Ever smoked	1.87 (1.27 to 2.76)	1.65 (1.14 to 2.39)	1.34 (0.95 to 1.91)
Current smoking[‡]	1.91 (1.27 to 2.85)	1.99 (1.38 to 2.86)	1.49 (1.00 to 2.22)
Current nicotine dependence among current smokers	1.96 (1.03 to 3.75)	1.75 (0.94 to 3.24)	1.27 (0.71 to 2.29)
Amount of smoking (in half-packs) among smokers[§]	0.53 (0.29 to 0.96)	1.26 (0.63 to 2.52)	0.38 (0.20 to 0.72)

[*] The states were broken up into a 3-level variable indicating the level of permissiveness of the state-level tobacco environment, based on tertiles of the factor score. The factor scores are based on the following state-level variables: total cigarette tax per pack, total state tobacco control programme funding, tobacco control funding per capita, tobacco settlement revenue, tobacco tax revenue, other state tobacco control funding, tax as a percentage of retail price (including generics), number of smoke-free air laws, number of smoke-free air preemption, % current smokers based on BRFSS, % past month cigarette use based on NHSDUH, % past month tobacco use based on NHSDUH, % believe that smoking 1+ packs per day poses great risk to harm overall based on NHSDUH. Monetary values were adjusted for inflation.

[†] OR and 95% CI comparing odds of smoking-related outcomes between lesbian, gay, and bisexual (LGB) and heterosexual individuals, adjusted for age, sex, ethnicity/race, income, education, urbanicity and state policies that included sexual orientation as a protected class status in hate crime statutes and in employment nondiscrimination acts in 2005.

[‡] *Current Smoking* defined as 1+ cigarettes within the last year.

[§] *Half-Packs* is an ordinal variable of number of half packs typically smoked on days when respondent smoked, among those who smoked every day or nearly every day (range 0–6 half packs, corresponding to <10 to 60 cigarettes per day).

BRFSS, Behavior Risk Factor Surveillance System; NHSDUH; National Household Survey on Drug Use and Health.