



Full length article

Sexual minority youth continue to smoke cigarettes earlier and more often than heterosexuals: Findings from population-based data

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ABSTRACT

Background: An established body of research documents that sexual minority (i.e., lesbian, gay, and bisexual) populations are at higher risk for several adverse health behaviors and outcomes compared to their heterosexual counterparts. Smoking is one behavior where the gap is especially large, particularly among youth. Researchers have increasingly drawn attention to contextual determinants of health behaviors affecting sexual minority youth.

Purpose: Although these factors have evolved over time, few scholars have examined time as a contextual factor that affects sexual minority health behaviors or the level of inequality with heterosexual populations. We aimed to fill this gap.

Procedures: We used eight years of data from the Massachusetts Youth Risk Behavior Survey (MYRBS), pooled into four waves, to determine whether gaps between sexual minority and heterosexual youth have widened or narrowed for three different indicators of smoking: having ever smoked, early onset smoking, and daily cigarette smoking in the past 30 days.

Results: We find that, though rates of smoking for all youth in Massachusetts have declined since the late 1990s, significant disparities remain between sexual minority and heterosexual youth.

Conclusions: Findings may suggest that targeted tobacco control programs in Massachusetts are needed; perhaps shifts in social attitudes toward smoking have affected smoking behaviors in diverse segments of society.

1. Introduction

An extensive body of research has established that lesbian, gay, and bisexual (LGB) populations have poorer health outcomes than their heterosexual counterparts (Meyer, 2003; Lewis 2009; Hatzenbuehler et al., 2009). Recent studies have observed elevated risk in LGB populations for mental health outcomes such as anxiety and depression (Bybee et al., 1999) as well as risk behaviors such as alcohol and other substance use (Lee et al., 2009; Boehmer et al., 2012). Cigarette use has emerged as a behavior for which the disparities between LGB and heterosexual populations are consistently large. The likelihood of smoking has been estimated at up to 2.5 times higher in sexual minority compared to heterosexual populations, though studies have observed odds of smoking up to 3.5 times higher in bisexual populations (Lee et al., 2009). The scope of the tobacco problem among LGB communities in the United States is large, with smoking prevalence estimated recently at 25–30% in gay and bisexual men compared to 14–16% in heterosexual men and 25–35% in lesbian and bisexual women

compared to 13–15% in heterosexual women (Pizacani et al., 2009; Balsam et al., 2012; Fallin et al., 2015).

There are differences in smoking outcomes that depend on sexual orientation group and the indicator of smoking used. In adult studies, bisexual men and especially bisexual women are more likely to be smokers than their gay and lesbian counterparts (Balsam et al., 2012; Boehmer et al., 2012), potentially because they begin smoking earlier in life and attempt to quit less frequently (Fallin et al., 2015). While rates of *lifetime* smoking (i.e., ever having smoked) are understandably higher for all populations since the indicator captures a longer time-frame, the sexual orientation disparities for lifetime smoking tend to be smaller (Balsam et al., 2012; Boehmer et al., 2012). This tighter gap may be due to more heterosexual people and especially heterosexual men quitting smoking after early experimentation compared to LGB people (Boehmer et al., 2012; Fallin et al., 2015).

LGB youth are a population of special interest given their vulnerability to tobacco use at early developmental stages. Patterns of use across sex and sexual orientation groups are different in youth

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compared to adults. Sexual minority youth are more likely than both their heterosexual peers and sexual minority adults to be current smokers (Boehmer et al., 2012). Self-identified gay and lesbian youth also smoke at a higher rate (i.e., more cigarettes per week or month) than those who are bisexual (Newcomb et al., 2014) and may smoke with progressively greater frequency as they age through their teens and into their twenties (Marshal et al., 2009; Corliss et al., 2012). In addition, gay and bisexual boys have, in some cases, reported more tobacco use than lesbian and bisexual girls (Newcomb et al., 2014). Tobacco use behavior may therefore evolve differently across the life course depending on sex and sexual orientation. Although the gap in smoking between gay or bisexual men and heterosexual men tends to narrow progressively with age, it may persist or grow for lesbian women and especially bisexual women (Boehmer et al., 2012; Fredriksen-Goldsen et al., 2013; Newcomb et al., 2014).

Since the 1990s, explanations of health disadvantage in LGB people have focused on minority stress, or the chronic, unique, socially based stressors that non-heterosexual people experience in societies where they are stigmatized (Meyer, 2003). Many studies have measured individual and interpersonal experiences of discrimination as well as other aspects of minority stress to explain unhealthy behaviors in LGB people. For example, LGB youth who smoke also tend to report mental health symptomology, life dissatisfaction, or experiences of victimization. Increasingly, victimization and adverse mental health outcomes in LGB people are considered 'syndemic' (i.e., co-occurring and mutually reinforcing) with substance use (Stall et al., 2003). There may also be other factors associated with sexual orientation that increase the risk of smoking. Both truancy and alcohol use have been found to be associated with smoking in youth populations (Brown et al., 2001). Among LGB youth, truancy may be elevated due to being bullied at school (Baams et al., 2017). Alcohol use might also be elevated due to perceptions that bars and clubs are the only social spaces earmarked specifically for sexual minority individuals (Balsam et al., 2012). Supportive family relationships, in contrast, may reduce the risk for smoking in LGB youth (Newcomb et al., 2014; Ryan et al., 2010).

Increasingly, health researchers are seeking to measure the contextual (i.e., non-individual) determinants of minority stress that affect LGB populations. Minority stress is, to some extent, rooted in policies and social mores (Hatzenbuehler et al., 2009), and these are in turn mediated by place (Lewis, 2009). Consequently, the level of stress that LGB youth experiences may be informed by religious climate (Hatzenbuehler et al., 2012), policies that discriminate against sexual minorities (Hatzenbuehler et al., 2009), or other place-level factors. Hatzenbuehler (2014), for example, found that LGB youth were less likely to smoke in jurisdictions with policies that explicitly prohibited discrimination against sexual minorities but found no such association in heterosexual youth (Hatzenbuehler, 2014). Similarly, communities with higher concentrations of LGB people (Hatzenbuehler et al., 2011) or LGB organizations (Mustanski et al., 2013) may also have a protective effect on the mental health and substance use behaviors of LGB youth.

History is an important, but often overlooked mediator of these contextual factors. Although new legal equalities and increasing social acceptance for LGBTQ people have precipitated a more positive discourse for and about LGB youth, disparities between LGB and heterosexual youth remain for smoking and other health outcomes (Homma et al., 2016; Fish et al., 2017). At the same time, legal equalities such as same-sex marriage may have less meaning for LGB youth who are at relatively early developmental stages. Many LGB youth may carry trauma from events (e.g., school bullying or parental rejection) that occurred earlier in their lives or that are relatively uninfluenced by policy changes (Newcomb et al., 2014; Homma et al., 2016; Russell and Fish, 2016).

Policies related to smoking have also changed. In the United States, the prevalence of smoking dropped from 20.9% in 2005 to 16.8% in 2014, with the largest drop occurring in 2013–2014 (Jamal et al.,

2015). This change is attributable, at least partially, to the tobacco control efforts instituted in many states starting in 2000. California's Tobacco Control Program, which included a media campaign, bans on smoking in many public places, and targeted youth prevention efforts, was successful in reducing both smoking prevalence and cigarette consumption between 1998 and 2008 (Lightwood and Glantz, 2013). Orbell et al. (2009) found that England's 2007 ban on smoking in pubs was a particularly effective intervention, with 15.5% of survey participants quitting smoking within 6 months of the ban despite some relapse in the following year. Bans on smoking in drinking venues are thought to be particularly effective because they help smokers to dissociate the activity from alcohol use (Marshal et al., 2009; Orbell et al., 2009).

Massachusetts, the site of the current study, has taken a strong stance on tobacco use. State residents voted to increase the cigarette tax to fund the Massachusetts Tobacco Cessation and Prevention (MTCP) Program in 1992 and for all tobacco revenues to fund tobacco control in 1999. The state legislature banned smoking in all indoor workplaces in 2004 and mandated tobacco cessation coverage for all citizens receiving state-funded health care (Aldrich et al., 2015). Since many LGB youth continue to use smoking as a means of coping with the stressors of identity development or social exclusion (Rosario et al., 2011), broader tobacco control policies and school-based interventions may have less of an effect on LGB youth compared to heterosexual youth. Temporal changes in smoking across sexual orientation groups are often uneven and inconsistent rather than downwardly convergent (Newcomb et al., 2014). Homma et al., (2016) found in their study of Minnesota that the gap in smoking prevalence between gay/lesbian and bisexual youth widened between 1998 and 2004 and then persisted from 2004 to 2010. We have designed a similar study with representative data from a different state to assess whether these trends are consistent.

2. Method

2.1. Data

Data were drawn from the Massachusetts Youth Risk Behavior Survey (MYRBS), a population-based survey developed by the U.S. Centers for Disease Control and Prevention (CDC); the CDC administers a similar survey in nearly all states across the US through a systematic sampling method with probability proportional to enrollment in grades 9 through 12. We chose the Massachusetts survey because it has been one of the few to include a sexual orientation item for over fifteen years. The MYRBS was given in Massachusetts schools every two years. For more information on the MYRBS survey and sampling/weight information, see Matthews et al. (2014).

2.2. Sample

To increase numbers of sexual minorities in each wave for our study, we pooled eight bi-annual surveys from 1999 through 2013 into four analytic waves: 1999/2001 through 2011/2013. We excluded participants who did not provide responses on the item that assessed sexual orientation ($n = 991$). In sum, our sample included 26,002 participants aged 12–18 ($M = 16.06$). Participants were 72.9% White, 8.5% African American, 7.9% Hispanic/Latino, 0.5% Native American, 3.3% Asian American, and 6.9% Other race/ethnicity.

2.3. Measures

2.3.1. Age and sex

Participants indicated their age in number of years, and their sex as male or female

2.3.2. Ethnicity

Self-reported response options included American Indian or Alaska Native, Asian, Black or African American, Hispanic/Latino, Native Hawaiian or Other Pacific Islander, and White. A Multiracial category was used for youth who checked multiple non-Hispanic categories. American Indian or Alaska Native, Asian, and Native Hawaiian or Other Pacific Islander were grouped together to form an ‘Other’ category.

2.3.3. Sexual orientation

Sexual orientation was measured using a single item: “Which of the following best describes you?” Response options were “heterosexual (straight), ‘bisexual’, ‘gay or lesbian’, and “not sure”. For purposes of this trends and disparities study, we did not include youth who answered, “not sure” as research has indicated uncertainty regarding how to classify this group of youth (see French et al., 1996).

2.4. Outcome variables

2.4.1. Ever smoked cigarettes

Participants were asked, “Have you ever tried cigarette smoking, even one or two puffs?” Response options were 0 (no) and 1 (yes)

2.4.2. Early onset smoking

One item asked participants, “How old were you when you smoked a whole cigarette for the first time?” Response options were “Never smoked a cigarette”, “8 years old or younger”, “9 or 10 years old”, “11 or 12 years old”, “13 or 14 years old”, “15 or 16 years old”, and “17 years old or older”. Among those who had ever smoked a cigarette, we dichotomized this variable so that those who had smoked a cigarette before the age of 13 was coded 1, and those who had smoked a cigarette at 13 years or older was coded as 0.

2.4.3. Smoked daily in past month

One item asked participants, “During the past 30 days, on how many days did you smoke cigarettes?” Response options ranged from 0 days to all 30 days. For our analyses, we recoded this variable to 0 (0 days to 29 days) and 1 (all 30 days).

2.5. Analyses

We used SPSS Complex Samples 22™ to adjust our analyses for the complex design of the MYRBS. Analyses were adjusted for student-reported age and ethnicity (White chosen as reference group) when appropriate. As an exception, we did not adjust for ethnicity for the “smoked daily in past month” outcome due to the low prevalence of this

variable in our sample (e.g., several cell sizes were 0 and thus some models were unable to be estimated). All analyses were sex-stratified, given that preliminary results indicated significant differences in responses to tobacco use for boys and girls.

To assess the prevalence of tobacco use in different sexual orientation groups over time, we conducted crosstab analyses within each pooled survey wave. To determine the significance of changes in tobacco use between the first pooled wave (referent) and each subsequent wave, we calculated odds ratios (ORs) using logistic regressions. To determine whether sexual orientation disparities in tobacco use were significant within sex groups for each wave, we calculated ORs using age- and ethnicity-adjusted logistic regressions.

We used logistic regressions with wave-by-orientation interaction terms to test the main effects of sexual orientation (reference: heterosexual), wave (reference: 1999/2001), and orientation-by-wave to explore whether sexual orientation disparities have changed since 1999/2001. We chose the reference year as 1999/2001 for ease in interpretation of changing trends and disparities; when sensitivity analyses were conducted with 2011/2013 as the referent year for all analyses, the patterns and significance of results were consistent. To test specifically whether sexual orientation disparities in tobacco use had widened, narrowed, or remained the same over time, we divided an odds ratio for LGB tobacco use in a pooled survey wave (e.g., 2011/2013) by the same odds ratio for the 1991/2001 reference wave. When an OR interaction term is statistically significant, the gap in cigarette smoking between sexual minority and heterosexual adolescents has significantly widened or narrowed over time. In other words, we calculated a ratio of ratios to determine if the gap in a tobacco use outcome had changed over time for a particular sexual orientation subgroup compared to the heterosexual reference group of the same sex. To interpret these interactions, ORs greater than 1 indicate that a cigarette smoking behavior in a year was larger than in the reference year, indicating that the said gap is widening, and ORs less than 1 suggest the cigarette use disparity in a year was smaller than in a reference year, indicating that the said gap is narrowing.

3. Results

Table 1 presents the sample demographics disaggregated by sex and sexual orientation for each of the four pooled survey waves. In general, heterosexual youth made up most of the overall sample across all four waves, but the proportion of all sexual minority subgroups (girls and boys identifying as lesbian, gay, or bisexual) increased consistently over time after 1999/2001.

Table 2 shows the prevalence of tobacco use, disaggregated by sex

Table 1
Sample sizes* and percents** for the MYRBS data, by Wave and Sex

	1999/2001		2003/2005		2007/2009		2011/2013	
Male								
Heterosexual	4054	(95.1%)	3279	(95.4%)	2712	(94.6%)	2565	(94.4%)
Bisexual	60	(1.3%)	46	(1.3%)	52	(1.8%)	54	(2.0%)
Gay	37	(0.8%)	41	(1.2%)	64	(2.1%)	47	(1.7%)
Female								
Heterosexual	3902	(93.9%)	3306	(93.0%)	2630	(90.7%)	2397	(89.1%)
Bisexual	133	(3.3%)	153	(4.1%)	182	(6.3%)	177	(6.8%)
Lesbian	15	(0.4%)	25	(0.6%)	36	(1.2%)	35	(1.4%)
Mean Age (SE)	16.11 (0.04)		16.05 (0.04)		16.01 (0.05)		16.06 (0.05)	
% White	73.9		76.1		72.2		69.5	
% African American	7.8		8.8		8.6		8.8	
% Hispanic/Latino	10.0		10.1		5.7		6.0	
% Native American	0.7		0.6		0.4		0.3	
% Asian American	3.7		1.9		3.1		4.5	
% Other Race	3.8		2.6		10.1		10.8	

Notes: *Sample sizes are unweighted Ns; ** Percents are weighted. Within each wave and sex group, percents do not add up to 100% because youth who answered, “not sure” on the sexual identity question are not included here. SE = Standard Error.

Table 2
Trends in last 12-month tobacco use to between 1999/2001 and 2011/2013, by Sexual orientation.

	1999/2001	2003/2005	2007/2009	2011/2013	Trend 99/01–03/05	Trend 99/01–07/09	Trend 99/01–11/13
Ever Smoked Cigarettes							
Male							
Heterosexual	64.6% (2618/4054)	51.7% (1229/2379)	45.3% (1228/2712)	36.9% (946/2565)	0.58 (0.50 – 0.68)	0.45 (0.37–0.54)	0.22 (0.18–0.28)
Bisexual	83.0% (49/60)	69.5% (31/46)	68.6% (35/52)	47.3% (25/54)	0.29 (0.17–0.51)	0.45 (0.25–0.81)	0.13 (0.07–0.24)
Gay	79.7% (29/37)	61.7% (25/41)	76.7% (49/64)	43.3% (20/47)	0.41 (0.26–0.65)	0.42 (0.35–0.50)	0.13 (0.08–0.21)
Female							
Heterosexual	64.2% (2505/3902)	50.2% (1659/3306)	41.1% (1080/2630)	29.9% (716/2397)	0.56 (0.47–0.67)	0.39 (0.33–0.46)	0.23 (0.20–0.27)
Bisexual	87.3% (116/133)	81.9% (125/153)	72.9% (132/182)	61.1% (108/177)	0.66 (0.35–1.26)	0.40 (0.22–0.71)	0.23 (0.13–0.42)
Lesbian	76.3% (11/15)	97.5% (24/25)	81.1% (29/36)	61.8% (21/35)	12.56 (11.11–14.20)	1.12 (0.48–3.08)	0.44 (0.23–0.82)
Early Onset Smoking							
Male							
Heterosexual	22.3% (904/4054)	14.3% (340/2379)	11.5% (311/2712)	6.0% (153/2565)	0.67 (0.58–0.78)	0.56 (0.47–0.66)	0.41 (0.34–0.50)
Bisexual	50.2% (30/60)	22.4% (10/46)	34.0% (17/52)	12.1% (6/54)	0.58 (0.38–0.90)	0.61 (0.35–1.08)	0.26 (0.14–0.46)
Gay	55.8% (20/37)	35.0% (14/41)	34.9% (22/64)	14.0% (6/47)	0.38 (0.19–0.75)	0.36 (0.18–0.71)	0.19 (0.10–0.36)
Female							
Heterosexual	18.9% (737/3902)	12.3% (406/3306)	7.5% (197/2630)	3.9% (94/2397)	0.63 (0.53–0.76)	0.42 (0.35–0.51)	0.25 (0.20–0.31)
Bisexual	44.0% (58/133)	33.4% (51/153)	24.6% (44/182)	21.9% (38/177)	0.71 (0.47–1.06)	0.46 (0.31–0.79)	0.26 (0.18–0.39)
Lesbian	24.5% (3/15)	51.5% (13/25)	30.4% (10/36)	19.0% (6/35)	4.10 (2.20–7.66)	0.93 (0.47–1.83)	0.68 (0.33–1.38)
Smoked Daily in Past 30 days							
Male							
Heterosexual	10.9% (441/4054)	6.5% (154/2379)	5.3% (143/2712)	3.4% (87/2565)	0.36 (0.18–0.75)	0.42 (0.20–0.85)	0.29 (0.21–0.40)
Bisexual	25.8% (15/60)	16.9% (7/46)	18.7% (9/52)	12.8% (9/54)	0.60 (0.33–1.07)	0.63 (0.40–1.01)	0.47 (0.36–0.61)
Gay	34.8% (12/37)	21.2% (8/41)	24.5% (15/64)	16.9% (7/47)	0.49 (0.24–0.97)	0.59 (0.39–0.89)	0.59 (0.47–0.74)
Female							
Heterosexual	10.6% (413/3902)	5.9% (195/3306)	3.7% (97/2630)	1.9% (45/2397)	0.56 (0.22–1.41)	0.09 (0.04–0.19)	0.16 (0.11–0.24)
Bisexual	42.5% (56/133)	23.2% (35/153)	18.6% (33/182)	6.1% (10/177)	0.83 (0.53–1.29)	0.31 (0.20–0.49)	0.33 (0.26–0.69)
Lesbian	19.2% (2/15)	27.6% (6/25)	16.4% (5/36)	11.9% (4/35)	1.71 (1.10–2.66)	0.40 (0.25–0.63)	0.53 (0.41–0.69)

Note. All outcomes were weighted. aOR = adjusted odds ratio for ethnicity and age; bOR = adjusted odds ratio for age only. Due to low prevalence rates, “smoked daily in past 30 days” was adjusted for age but not race/ethnicity. aOR and bOR in bold indicates $p < .05$; CI = Confidence interval.

and sexual orientation for each survey wave. Using odds ratios adjusted by school age and ethnicity, we indicated for each survey wave whether the prevalence of tobacco use changed significantly compared to the first survey wave. The overall use of tobacco decreased fairly consistently over the four survey waves. In some cases, this decline in use was more than 300%. Among lesbian girls, there were large increases

between 1999/2001 and 2003/2005 in reporting early-age smoking and reporting a history of smoking.

Next, we examined whether or not sexual orientation disparities in tobacco use persisted despite the overall declines in use. Table 3 presents these disparities, again disaggregated by sex and sexual orientation for each survey wave. In every statistically significant comparison

Table 3
Odds ratios and 95% confidence intervals for tobacco use by year (1999–2013): Comparisons by Sexual Orientation

	1999/2001	2003/2005	2007/2009	2011/2013
Ever Smoked Cigarettes				
Male				
Heterosexual	ref	ref	ref	ref
Bisexual	2.66 (1.25–5.63)	2.04 (0.99–4.20)	3.09 (1.51–6.33)	1.59 (0.91–2.77)
Gay	2.19 (0.94–5.09)	1.46 (0.63–3.38)	3.93 (1.86–8.34)	1.18 (0.64–2.16)
Female				
Heterosexual	ref	ref	ref	ref
Bisexual	3.75 (2.19–6.42)	4.42 (2.66–7.33)	3.92 (2.75–5.58)	3.90 (2.63–5.79)
Lesbian	1.86 (0.48–7.25)	38.67 (5.32–281.11)	6.68 (2.03–22.02)	4.14 (1.97–8.70)
Early Onset Smoking				
Male				
Heterosexual	ref	ref	ref	ref
Bisexual	3.52 (1.85–6.71)	1.74 (0.69–4.42)	4.05 (2.13–7.69)	2.15 (0.89–5.20)
Gay	4.46 (2.41–8.24)	3.25 (1.47–7.18)	4.11 (2.27–7.44)	2.55 (0.91–7.15)
Female				
Heterosexual	ref	ref	ref	ref
Bisexual	3.47 (2.43–4.94)	3.64 (2.19–6.05)	4.00 (2.81–5.70)	6.99 (4.22–11.58)
Lesbian	1.38 (0.39–4.87)	7.76 (2.93–20.58)	5.36 (2.16–13.30)	5.92 (2.03–17.26)
Smoked Daily in Past 30 days				
Male				
Heterosexual	ref	ref	ref	ref
Bisexual	2.84 (1.48–5.42)	2.71 (0.99–7.41)	4.97 (2.15–11.52)	4.29 (1.63–11.27)
Gay	4.61 (1.91–11.13)	3.61 (1.29–10.11)	5.62 (2.71–11.64)	5.31 (2.04–13.86)
Female				
Heterosexual	ref	ref	ref	ref
Bisexual	6.29 (4.53–8.73)	4.63 (2.76–7.74)	5.94 (3.97–8.88)	3.46 (1.44–8.30)
Lesbian	2.07 (0.52–8.27)	5.84 (1.97–17.32)	5.84 (1.97–17.32)	7.68 (2.27–17.32)

Note. All outcomes were weighted. aOR = adjusted odds ratio for ethnicity and age; bOR = adjusted odds ratio for age only. Due to low prevalence rates, “smoked daily in past 30 days” was adjusted for age but not race/ethnicity. aOR and bOR in bold indicates $p < .05$; CI = Confidence interval.

Table 4
Trends in tobacco use: Interactions between sexual orientation and year.

	Male	Female
Ever Smoked Cigarettes		
Heterosexual by Year 1999/2001	aOR (95% CI) ref	aOR (95% CI) ref
Bisexual by Year 2003/2005	0.76 (0.27–2.11)	1.18 (0.57–2.45)
Bisexual by Year 2007/2009	1.16 (0.41–3.23)	1.04 (0.55–1.97)
Bisexual by Year 2011/2013	0.59 (0.24–1.48)	1.04 (0.54–2.01)
Gay/Lesbian by Year 2003/2005	0.66 (0.20–2.15)	20.49 (1.90–221.03)
Gay/Lesbian by Year 2007/2009	1.79 (0.59–5.47)	3.51 (0.58–21.07)
Gay/Lesbian by Year 2011/2013	0.55 (0.20–1.53)	2.18 (0.46–10.26)
Early Onset Smoking		
Heterosexual by Year 1999/2001	aOR (95% CI) ref	aOR (95% CI) ref
Bisexual by Year 2003/2005	0.65 (0.21–1.97)	1.11 (0.70–1.83)
Bisexual by Year 2007/2009	0.98 (0.39–2.43)	1.11 (0.70–1.75)
Bisexual by Year 2011/2013	0.57 (0.18–1.83)	1.06 (0.63–1.78)
Gay/Lesbian by Year 2003/2005	0.32 (0.10–1.05)	5.51 (1.36–22.23)
Gay/Lesbian by Year 2007/2009	0.52 (0.18–1.50)	2.28 (0.59–8.85)
Gay/Lesbian by Year 2011/2013	0.62 (0.21–1.82)	2.89 (0.72–11.64)
Smoked Daily in Past 30 days		
Heterosexual by Year 1999/2001	bOR (95% CI) ref	bOR (95% CI) ref
Bisexual by Year 2003/2005	0.95 (0.29–3.07)	0.74 (0.40–1.34)
Bisexual by Year 2007/2009	1.78 (0.62–5.12)	0.94 (0.57–1.57)
Bisexual by Year 2011/2013	1.49 (0.49–4.55)	0.54 (0.22–1.36)
Gay/Lesbian by Year 2003/2005	0.77 (0.20–2.93)	2.82 (0.49–16.09)
Gay/Lesbian by Year 2007/2009	1.21 (0.39–3.76)	2.57 (0.45–14.72)
Gay/Lesbian by Year 2011/2013	1.16 (0.33–4.08)	3.63 (0.58–22.57)

Note. All outcomes were weighted. aOR = adjusted odds ratio for ethnicity and age; bOR = adjusted odds ratio for age only. aOR and bOR in bold indicates $p < .05$; CI = Confidence interval; ref: Reference group 1998; Models included sexual orientation, age, ethnicity (except for smoked daily in past 30 days), survey year, and orientation-by-year interaction; CI: Confidence interval.

(indicated by adjusted odds ratios in boldface font), sexual minority subgroups were more likely to have engaged in tobacco use compared to their heterosexual counterparts. For example, in the 2007/2009 wave, sexual minority girls and boys were all more likely to have engaged in tobacco use than heterosexuals in their corresponding sex group. Sexual minority boys and girls had higher odds of early onset smoking compared to heterosexual boys and girls in most waves. In the most recent wave (2011/2013), lesbian girls were nearly 8 times more likely (confidence interval from 2.27 to 17.32) to have smoked daily compared to their heterosexual counterparts. In the same wave, bisexual boys were nearly five times more likely (confidence interval from 1.63 to 11.27) to have smoked daily in the past month compared to their heterosexual counterparts.

Our final objective was to determine whether sexual orientation disparities in tobacco use have changed over time; Table 4 presents these findings. We found no significant ratio of ORs for boys; that is, tobacco use disparities have not changed significantly for gay and bisexual boys since 1999/2001. Between 1999/2001 and 2003/2005, however, there was widening inequality between lesbian girls and heterosexual girls in terms of early onset smoking and ever smoking.

4. Discussion

The results here show that both experimentation with tobacco and entrenched daily smoking among youth have declined markedly since 2000. These declines were present in all sex and sexual orientation groups. This suggests that both tobacco control programs in Massachusetts and corresponding shifts in social attitudes toward smoking have affected smoking behaviors in diverse segments of society. At the same time, sexual orientation disparities in tobacco use among youth in Massachusetts are pervasive; LGB youth are about three to eight times more likely to report being a daily smoker depending on

their sex and sexual orientation category. The tobacco use problem is most critical among sexual minority girls. The disparities between heterosexual and lesbian or bisexual girls are not only wider than those for boys, they have also worsened over time in the case of self-identified lesbian girls. This worst-case scenario of high and increasingly unequal use among lesbian (compared to heterosexual) girls mirrors Newcomb et al.'s (2014) finding that youth who are gay or lesbian rather than bisexual have the worst tobacco use outcomes. The results also echo recent youth studies (Corliss et al., 2012) and previous adult studies reporting greater sexual orientation disparities in tobacco use among women than men (Boehmer et al., 2012; Fallin et al., 2015). While most youth populations are smoking less than they used to, sexual minority youth and especially sexual minority girls are not improving as quickly, despite the most critical need for improvement.

The fact that these patterns were observed in the state of Massachusetts is particularly telling. Massachusetts was among the first U.S. states to legalize civil partnership and then same-sex marriage. It also has generally progressive and inclusive social welfare policies and programs compared to many other states, as evidenced by early inclusion of sexual orientation in the MYRBS. These policies may represent a framework through which tobacco control programming specifically aimed at sexual minority youth can be leveraged. Several factors could explain the persistence of sexual orientation-based tobacco use disparities among Massachusetts youth. Research on other 'liberal' jurisdictions, such as the Netherlands, has revealed that legal equalities for sexual minority people are not always a good approximation of inclusivity and often elide under-the-surface forms of othering (Aggarwal and Gerrets, 2014). Recent research has suggested that microaggressions, or verbal slights that diminish sexual minority identities, play as much of a role in stress among LGB youth as structural forms of discrimination (Nadal et al., 2011). It may also be that current interventions to stop smoking in the broader population are not reaching LGB youth or are counteracted by the other stressors that LGB students are facing. For example, students may be taught in health class that they are likely to first encounter smoking in large-group social settings (e.g., parties) whereas LGB students might turn to smoking when they feel excluded from group activities (e.g., sports teams and social events) or are seeking out bars, clubs, or other spaces where smoking is prevalent as an alternative form of social connection.

4.1. Limitations

There are a few limitations to this study that must be considered. First, there are some limitations inherent in sexual orientation analyses of MYRBS despite the overall robustness of the survey. The numbers of sexual minority youth in the unweighted sample data are relatively small and should be interpreted with some caution. There are a few possible reasons for small numbers of LGB youth. Societal stigma toward sexual minorities may have led to underreporting of sexual minority status, particularly in earlier survey years. In addition, the sexual orientation variable used herein was based on self-identification rather than behavior. Self-identification may be biased toward individuals who fit into a culturally prescribed model of sexual orientation and therefore have greater self-acceptance and social support (Savin-Williams, 2001). Risk behaviors such as smoking, then, may be even more prevalent in individuals who have attraction to or sexual interaction with the same or both sexes but do not identify as lesbian, gay, or bisexual.

Second, the Massachusetts data presented here may not be generalizable to other states. Massachusetts has led the United States in terms of both tobacco control efforts and policies to protect the rights of sexual minorities. Prior to the current era of legal equalities for LGBT people, Massachusetts was one of the few states to design school programming to prevent harassment of sexual minority youth (Szalacha, 2003). Rates of smoking among LGB youth may therefore be much higher in regions (e.g., the South, the Midwest) where tobacco use is

more prevalent (Brown et al., 2001; Jamal et al., 2015) and supportive infrastructures for sexual minorities are less developed (Norman-Major, 2013).

Third, the data utilized only asked about sex assigned at birth, yet there may be distinct patterns and disparities in cigarette smoking among gender diverse youth – including those who identify as non-binary, transgender, or genderqueer. Future research should take into consideration the gender identity of participants in addition to sexual identity.

Finally, this study was not able to assess the degree to which any of the observed declines in cigarette smoking are attributable to the use of electronic cigarettes (e-cigarettes). It has been estimated that 3.7% of U.S. adults have used e-cigarettes (Jamal et al., 2015). Few studies exist on the prevalence of e-cigarette use, or vaping, across different sub-populations.

4.2. Conclusion

As health researchers begin taking stock of the contextual (i.e., non-individual) determinants of health in LGB populations, they must consider how minority stress is rooted in both place and history (Lewis, 2009; Hatzenbuehler et al., 2009; Lewis, 2017). The level of stress that LGB youth experience may be informed by religious climate (Hatzenbuehler et al., 2012), policies that discriminate against sexual minorities (Hatzenbuehler et al., 2009), or other place-level factors. Places with greater concentrations of LGB people and organizations, as well as those with policies that explicitly prohibit discrimination against sexual minorities, tend to have a protective effect on substance use and mental health in LGB youth (Hatzenbuehler et al., 2011; Hatzenbuehler, 2014; Mustanski et al., 2013).

Life course theory (Elder, 1994) may provide a useful framework for understanding differential impacts of the changing social environment on smoking in LGB youth. Life course theory argues that life trajectories, including health events and outcomes, are influenced by both age and history (Lewis, 2014). Individuals' experiences of historical contexts, in turn, are influenced by their respective life stages, the places they live in, and the institutions, policies, and practices that comprise those places. Separating these influences on LGB smoking may require statistical models that parse the temporal effects of broader tobacco control efforts on LGB people (e.g., early adoption smoking bans in the Northeast and on the West Coast) versus factors related to social environments affecting LGB people (e.g., Democratic voting patterns and early adoption of same-sex partnership and adoption rights in these same states). Studies in this vein may reveal the extent to which tobacco control efforts may continue to fail LGB people even in the context of more supportive social environments.

Contributors

All contributors to this manuscript assisted in writing and critically reviewing multiple manuscript drafts. The first author conceptualized the study. All authors have read and approve of the submission of the manuscript.

Conflict of interest

No conflict declared.

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