

## Smoking behaviours among heterosexual and sexual minority youth? Findings from 15 years of provincially representative data

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### Abstract

**Introduction and Aims.** Sexual identity disparities in smoking behaviours are well established; however, there is limited research on whether these disparities have diminished as the social and political landscape has changed for lesbian, gay and bisexual people. Thus, we examined changes in prevalence and sexual identity disparities in three smoking behaviours among Canadian adolescents from 1998 to 2013. **Design and Methods.** Data are from the provincially representative British Columbia Adolescent Health Survey (N = 99 373). Using sex-stratified, age-adjusted logistic regression models, we estimated: (i) trends in lifetime cigarette use, early onset, and past 30-day use for heterosexual and three subgroups of sexual minority (i.e. mostly heterosexual, bisexual and gay/lesbian) youth; (ii) sexual identity disparities in these cigarette-related behaviours within each survey year (1998, 2003, 2008, 2013); and (iii) whether the size of the disparity has changed from 1998 to 2013. **Results.** Smoking has declined for all youth from 1998 to 2013, although less consistently for sexual minority youth. Within-year disparity estimates indicated elevated prevalence of cigarette use for sexual minority compared to heterosexual youth, particularly among females. Trends in sexual identity and smoking behaviours indicated that the degree of differences between heterosexual and sexual minority youth have remained stable or, in some cases, widened. Heterosexual and sexual minority youth differences widened for early onset among sexual minority boys and lifetime and past 30-day use for sexual minority girls. **Discussion and Conclusions.** Efforts to prevent smoking behaviours among youth should continue. Tailored preventive strategies for sexual minority youth might help address existing disparities. [Fish JN, Watson RJ, Gahagan J, Porta CM, Beaulieu-Prévost D, Russell ST. Smoking behaviours among heterosexual and sexual minority youth? Findings from 15 years of provincially representative data. *Drug Alcohol Rev* 2019;38:101–110]

**Key words:** LGB, adolescents, smoking behaviours, tobacco use, sexual minority.

### Introduction

Tobacco use is the leading cause of preventable death in the USA and Canada [1,2]. Though rates of adolescent tobacco use have declined [3], sexual minority (e.g. lesbian, gay, bisexual [LGB] and same-sex attracted) youth and adults remain at elevated risk for cigarette use relative to heterosexual peers [4–6]. Nearly two decades of research suggest that sexual minority youth are more likely to be current smokers, start smoking at earlier ages, and smoke more frequently than their heterosexual peers [4,5]. In a meta-

analysis on sexual minority youth substance use, Marshal *et al.* [7] noted that sexual minority youth were over four times as likely as heterosexual youth to report lifetime cigarette use and over 2.75 times as likely to indicate cigarette use in the past 30 days. Though limited, longitudinal studies suggest that, along with elevated prevalence of cigarette use during adolescence, sexual minority youth demonstrate a greater increase in smoking frequency across the transition to adulthood [8], leaving them vulnerable to nicotine dependence and smoking related morbidity and mortality across the life course [9,10].

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It is well understood that a complex array of determinants of health, including age, socioeconomic status, sex, gender, among others, can impact health outcomes across the life course [11]. However, there is a lack of understanding about the ways in which key determinants of health impact the health disparities and inequalities between heterosexual and sexual minority youth. For example, higher rates of substance use among sexual minority youth are often attributed to experiences with anti-LGB stigma [12,13], including elevated rates of harassment and victimisation. Indeed, sexual minority youth are more likely than heterosexual youth to report experiences of bullying, harassment and victimisation [14,15]. Yet, paradoxically, there has been unprecedentedly swift changes in the social acceptance for LGB people in the USA and Canada: In 2017, 62% of US adults supported same-sex marriage compared 35% in 2002 [16]. Furthermore, younger cohorts express greater acceptance of LGB people than do older generations [16]. Nearly 75% of Millennials favour same-sex marriage, compared to 56% of baby boomers. Along with changes in social acceptance, multiple states in the US and many provinces in Canada have instituted laws and policies protecting the rights of LGB youth and adults [17,18]. In this paper we hypothesize that these changes in the social acceptance of and legal protections for sexual minority youth contribute to a subsequent decline in smoking behaviour disparities between heterosexual and sexual minority youth.

In the current study, we used a provincially representative sample of Canadian youth to assess whether disparities in smoking behaviours between heterosexual and sexual minority youth have changed amid growing social acceptance and protections for LGB people. Specifically, we assessed trends in the prevalence of lifetime cigarette use, early onset and past 30-day use for heterosexual youth and three subgroups of sexual minority youth on the basis of identity: mostly heterosexual, bisexual and lesbian/gay youth. We then estimated sexual identity disparities in these three smoking behaviours between heterosexual and sexual minority youth during the four survey periods. Finally, we tested whether smoking behaviour disparities between heterosexual and sexual minority youth have increased, decreased or remained stable since 1998. Data analyses were stratified by sex given previous research demonstrating more consistent tobacco-related disparities among women and to adhere to the Sex and Gender Equity in Research international guidelines [19].

## Methods

### Design

Data are from the British Columbia Adolescent Health Survey (BCAHS). Conducted by the McCreary

Centre Society, the BCAHS is a provincially-based cluster-stratified random classroom survey of Canadian public school students in grades 7–12 (aged 12 to 19;  $M_{\text{age}} = 15$ ) to assess a variety of health and risk behaviours among youth in British Columbia. Data collected from participating school districts are stratified by grade and health service delivery area in the five health authorities to be regionally and provincially representative. Data are not longitudinal but are collected from a new cohort of youth at each wave. Data were weighted to account for non-response and differential probability of sampling and scaled to replicate provincial enrollment [20]. The University of British Columbia Behavioral Research Ethics Board approved the study under which these specific analyses were conducted (certificate # H12-00477).

Data were pooled from the 1998 ( $n = 22\,858$ ), 2003 ( $n = 29\,323$ ), 2008 ( $n = 25\,254$ ) and 2013 ( $n = 21\,938$ ) surveys to assess trends in cigarette use behaviours. The original sample included a total of 115 573 youth. In this study, we analysed data from students in schools that participated in at least three of the four survey years and who provided a valid response to sexual identity and cigarette use items, which brought the final analytic sample to  $N = 99\,373$  across all four waves ( $n = 48\,410$  boys;  $n = 50\,963$  girls). Most of the 16 200 students not part of the final analytic sample were excluded for having attended a school that did not participate in at least three of the four survey waves. Prevalence of sexual identity by survey year is presented in Table 1.

### Measures

**Sex.** Participants indicated whether they self-identified as male or female.

**Sexual identity.** For the purpose of our study, we assessed sexual minority status with a single item that assessed sexual identity: ‘People have different feelings about themselves when it comes to questions of being attracted to other people. Which of the following best describes your feelings?’ Response options in 1998–2008 were 100% heterosexual (attracted to persons of the opposite sex); Mostly heterosexual; Bisexual (attracted to both boys and girls); Mostly homosexual; 100% homosexual (gay/lesbian; attracted to persons of the same sex); and Not sure. The 2013 survey response options included: Completely heterosexual; Mostly heterosexual; Bisexual; Mostly homosexual; Completely homosexual; Questioning; and I don’t have attractions. Following recommendations based on previous psychometric evaluation with the BCAHS, [21,22] we merged those

**Table 1.** Sample by sexual identity and survey year in the British Columbia adolescent health survey<sup>a</sup>

	1998		2003		2008		2013	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
<i>Boys</i>								
Heterosexual	10 223	94.20	13 880	95.57	11 573	94.27	10 024	93.18
Mostly heterosexual	418	3.85	432	2.97	459	3.74	463	4.30
Bisexual	127	1.17	122	0.84	141	1.15	153	1.42
Gay	84	0.77	89	0.61	104	0.85	118	1.10
<i>Girls</i>								
Heterosexual	10 829	90.20	13 013	87.93	11 268	86.83	9601	85.88
Mostly heterosexual	919	7.65	1304	8.81	1200	9.25	1019	9.11
Bisexual	217	1.81	428	2.89	444	3.42	468	4.19
Lesbian	41	0.34	55	0.37	65	0.50	92	0.82

<sup>a</sup>Sample sizes are unweighted Ns; percents are weighted.

reporting ‘not sure’ (1998–2008), ‘questioning’ (2013), and ‘I do not have attractions’ (2013) with heterosexual identified youth. Depending on the survey year, those who reported being ‘mostly homosexual’ were combined with individuals who reported ‘100% homosexual’ or ‘completely homosexual’ identities.

*Lifetime cigarette use.* Youth reported lifetime use by responding *no* = 0 or *yes* = 1 to ‘Have you ever tried cigarette smoking, even one or two puffs?’

*Age at first cigarette use.* Participants who indicated cigarette use were asked, ‘How old were you when you smoked a whole cigarette for the first time?’ Responses were recoded to reflect those who had used cigarettes at *12 or younger* = 1 and those who stated that their first use was *after the age of 12* = 0.

*Past 30-day cigarette use.* Youth responded to the question ‘During the past 30 days, on how many days did you smoke cigarettes?’ Responses were recoded to reflect youth who had (*yes* = 1) or had not (*no* = 0) smoked in the past 30 days.

*Age.* Participants’ indicated their age in years.

#### *Analytic approach*

Data analyses were conducted using *SPSS Complex Samples 22* in order to apply survey weights and account for the complex sampling design. Our data analysis began with crosstabs to assess whether the prevalence of cigarette use changed across years of analysis (i.e. 1998, 2003, 2008 and 2013) within sexual identity subgroups. This preliminary investigation provided valuable

information on the stability or change in trends within-groups that inform later interpretation of comparative analyses. Next, we estimated disparities in cigarette use outcomes by sexual identity within each data collection year, adjusted for age. Finally, we used logistic regression with year-by-sexual identity interaction terms to test whether the disparity between heterosexual and sexual minority youth widened, narrowed or stay the same in the survey years since 1998. Comparing absolute measures of disparities can be misleading because age variability across samples can influence changes in trends across years [23]. Yet, odds ratios cannot be compared across samples [21], and cannot track the scope of a disparity across years. Therefore, to test whether trends of smoking behaviours have changed over time, we computed an interaction term between the year of survey administration and sexual identity in a logistic regression framework, while adjusting for age. This year-by-sexual-identity product term is presented as an odds ratio (OR), which estimates the OR of a smoking behaviour for a particular subgroup in a given year, relative to the same identity in 2013 (our reference year). In each of our models, the reference year reflects the most recent survey collection to allow us to infer changes in smoking behaviour from a historical perspective. To do this, however, we had to invert the estimated OR to reflect changes from past to present. In this framework, an estimated OR for the interaction term above 1 indicates a widening disparity from earlier years relative to the reference year, and an OR below 1 indicates a declining disparity for that behaviour from earlier years for that specific sexual identity, relative to the reference year. Essentially, this modelling technique produces an age-adjusted year-by-sexual identity product term that estimates the change or stability in the disparity of the smoking behaviour over time. A more detailed outline of this approach is available elsewhere [24].

## Results

### Prevalence and trends by sexual identity

Age-adjusted prevalence of lifetime cigarette use, age of first use and past 30-day use statistically declined across all survey years for heterosexual boys and girls (see Table 2; Figure 1 presents unadjusted prevalence comparisons). Comparatively, mostly heterosexual, bisexual and self-identified gay boys showed less consistent declines between preceding years and 2013: exceptions include past 30-day use for bisexual and gay boys and lifetime use for gay boys. Notably, there was an increase in the proportion of gay boys indicating early onset from 2003 to 2013. Sexual minority girls also demonstrated consistent declines in lifetime tobacco use, though these declines were less robust compared to heterosexual girls. Bisexual and lesbian

girls also demonstrated statistical declines in early onset from 1998 to 2013. Overall, sexual minority girls showed relatively little decline in past 30-day use.

### Disparities in smoking behaviours between heterosexual and sexual minority youth across years

Within-year estimates of sexual identity differences in smoking behaviours for boys indicated that mostly heterosexual and bisexual boys were at higher risk for lifetime cigarette use relative to heterosexual boys in 2008 and 2013 (see Table 3). Compared to heterosexual boys, gay and bisexual boys were statistically more likely to try cigarettes before the age of 13 in 2008 and 2013. Bisexual and gay boys were also more likely than heterosexual boys to indicate past 30-day cigarette use

**Table 2.** Trends in lifetime cigarette use, early onset and past 30-day use from 1998 to 2013 among students grades 7–12 by sexual identity

	Unadjusted prevalence comparison				Trend comparison		
	1998 %	2003 %	2008 %	2013 %	1998 vs. 2013 aOR <sup>a</sup> (95% CI)	2003 vs. 2013 aOR <sup>a</sup> (95% CI)	2008 vs. 2013 aOR <sup>a</sup> (95% CI)
<b>Boys</b>							
<i>Lifetime use</i>							
Heterosexual	53.7	31.0	25.0	22.4	<b>0.21 (0.19, 0.23)</b>	<b>0.64 (0.58, 0.69)</b>	<b>0.87 (0.80, 0.94)</b>
Mostly heterosexual	58.8	31.3	34.7	28.6	<b>0.22 (0.16, 0.30)</b>	0.84 (0.56, 1.25)	0.75 (0.55, 1.03)
Bisexual	53.1	41.5	42.7	39.9	<b>0.49 (0.31, 0.78)</b>	0.93 (0.56, 1.54)	0.88 (0.55, 1.42)
Gay	60.1	37.9	39.2	22.7	<b>0.19 (0.12, 0.30)</b>	<b>0.49 (0.26, 0.92)</b>	<b>0.46 (0.28, 0.74)</b>
<i>Early onset (&lt;13)</i>							
Heterosexual	55.1	43.8	27.3	19.8	<b>0.24 (0.20, 0.27)</b>	<b>0.29 (0.25, 0.35)</b>	<b>0.69 (0.59, 0.81)</b>
Mostly heterosexual	47.4	45.6	23.5	21.4	<b>0.30 (0.18, 0.50)</b>	<b>0.30 (0.16, 0.56)</b>	0.90 (0.52, 1.55)
Bisexual	62.7	25.9	51.7	31.0	<b>0.36 (0.21, 0.61)</b>	1.41 (0.73, 2.70)	<b>0.48 (0.29, 0.81)</b>
Gay	67.8	37.8	51.2	56.0	0.82 (0.33, 2.04)	<b>2.87 (1.26, 6.52)</b>	1.45 (0.53, 3.97)
<i>Past 30-day use</i>							
Heterosexual	22.0	11.5	11.7	9.7	<b>0.34 (0.30, 0.39)</b>	<b>0.84 (0.74, 0.96)</b>	<b>0.81 (0.72, 0.90)</b>
Mostly heterosexual	28.0	12.8	17.0	13.5	<b>0.35 (0.24, 0.53)</b>	1.06 (0.67, 1.67)	0.78 (0.52, 1.18)
Bisexual	33.4	25.2	26.7	23.1	<b>0.51 (0.30, 0.86)</b>	<b>0.89 (0.51, 1.53)</b>	<b>0.83 (0.52, 1.32)</b>
Gay	37.1	23.6	23.5	14.7	<b>0.29 (0.17, 0.49)</b>	<b>0.57 (0.26, 1.23)</b>	<b>0.57 (0.31, 1.02)</b>
<b>Girls</b>							
<i>Lifetime use</i>							
Heterosexual	56.3	34.8	24.8	17.6	<b>0.14 (0.13, 0.15)</b>	<b>0.37 (0.34, 0.41)</b>	<b>0.65 (0.60, 0.71)</b>
Mostly heterosexual	64.2	53.6	44.5	34.4	<b>0.27 (0.22, 0.34)</b>	<b>0.43 (0.35, 0.54)</b>	<b>0.63 (0.52, 0.76)</b>
Bisexual	71.2	62.5	57.3	44.5	<b>0.32 (0.22, 0.46)</b>	<b>0.48 (0.34, 0.68)</b>	<b>0.58 (0.45, 0.76)</b>
Lesbian	68.6	48.6	44.8	36.2	<b>0.16 (0.09, 0.29)</b>	<b>0.46 (0.23, 0.92)</b>	<b>0.69 (0.43, 1.12)</b>
<i>Early onset (&lt;13)</i>							
Heterosexual	52.4	43.7	26.9	17.9	<b>0.23 (0.20, 0.27)</b>	<b>0.28 (0.24, 0.33)</b>	<b>0.63 (0.53, 0.75)</b>
Mostly heterosexual	52.6	47.8	25.6	20.7	<b>0.22 (0.16, 0.32)</b>	<b>0.28 (0.20, 0.39)</b>	0.81 (0.58, 1.15)
Bisexual	66.5	51.2	45.9	31.8	<b>0.20 (0.13, 0.31)</b>	<b>0.43 (0.31, 0.61)</b>	<b>0.55 (0.38, 0.80)</b>
Lesbian	86.1	49.1	41.9	20.1	<b>0.04 (0.02, 0.10)</b>	<b>0.30 (0.22, 0.42)</b>	<b>0.32 (0.23, 0.45)</b>
<i>Past 30-day use</i>							
Heterosexual	26.1	12.9	10.2	8.3	<b>0.24 (0.21, 0.27)</b>	<b>0.60 (0.53, 0.67)</b>	<b>0.81 (0.72, 0.91)</b>
Mostly heterosexual	36.4	22.9	22.5	19.2	<b>0.41 (0.32, 0.53)</b>	0.80 (0.63, 1.01)	0.81 (0.64, 1.02)
Bisexual	49.7	33.4	38.7	29.0	<b>0.41 (0.28, 0.60)</b>	0.82 (0.60, 1.11)	<b>0.64 (0.48, 0.86)</b>
Lesbian	39.3	16.1	28.1	21.4	<b>0.35 (0.17, 0.71)</b>	1.26 (0.72, 2.18)	0.70 (0.42, 1.19)

<sup>a</sup>Data were weighted and adjusted for age. aOR in bold indicates  $P < 0.05$ . aOR, adjusted odds ratio; CI, confidence interval.

**Table 3.** Odds ratios and 95% confidence intervals for cigarette use by year (1998–2013) among students grades 7–12: Comparisons by sexual identity<sup>a</sup>

	Boys				Girls			
	1998 aOR (95% CI)	2003 aOR (95% CI)	2008 aOR (95% CI)	2013 aOR (95% CI)	1998 aOR (95% CI)	2003 aOR (95% CI)	2008 aOR (95% CI)	2013 aOR (95% CI)
<i>Lifetime use</i>								
Heterosexual <sub>[ref]</sub>	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Mostly heterosexual	1.09 (0.86, 1.37)	0.88 (0.64, 1.21)	1.37 (1.10, 1.70)	1.13 (0.89, 1.43)	1.11 (0.94, 1.30)	1.78 (1.51, 2.09)	2.17 (1.88, 2.49)	2.02 (1.72, 2.37)
Bisexual	1.01 (0.62, 1.63)	1.38 (0.84, 2.27)	1.98 (1.28, 3.05)	1.96 (1.34, 2.86)	1.62 (1.13, 2.34)	2.63 (1.83, 3.77)	3.86 (3.07, 4.84)	3.28 (2.62, 4.11)
Gay/lesbian	1.17 (0.66, 2.05)	0.99 (0.53, 1.87)	1.56 (0.96, 2.51)	0.75 (0.47, 1.19)	1.82 (0.82, 4.22)	1.83 (0.89, 3.76)	2.17 (1.22, 3.84)	2.26 (1.45, 3.53)
<i>Early onset</i>								
Heterosexual <sub>[ref]</sub>	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Mostly heterosexual	0.97 (0.62, 1.50)	1.17 (0.69, 1.98)	0.90 (0.56, 1.45)	1.19 (0.76, 1.87)	1.46 (1.09, 1.95)	1.35 (1.03, 1.76)	1.01 (0.77, 1.32)	1.35 (0.99, 1.85)
Bisexual	1.26 (0.70, 2.25)	0.42 (0.17, 1.06)	2.78 (1.46, 5.30)	1.94 (1.13, 3.33)	2.56 (1.60, 4.11)	1.35 (0.98, 1.87)	2.39 (1.70, 3.36)	2.08 (1.49, 2.91)
Gay/lesbian	1.92 (0.84, 4.36)	0.72 (0.27, 1.89)	3.12 (1.45, 6.71)	6.36 (2.73, 14.80)	6.69 (2.26, 19.81)	1.25 (0.42, 3.77)	2.53 (1.02, 6.24)	1.39 (0.62, 3.10)
<i>Past 30-day use</i>								
Heterosexual <sub>[ref]</sub>	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Mostly heterosexual	1.23 (0.94, 1.62)	0.98 (0.65, 1.48)	1.29 (0.95, 1.75)	1.23 (0.92, 1.64)	1.34 (1.11, 1.63)	1.67 (1.39, 2.01)	2.29 (1.85, 2.73)	2.25 (1.85, 2.73)
Bisexual	1.91 (1.15, 3.17)	2.35 (1.35, 4.09)	2.39 (1.55, 3.67)	2.43 (1.58, 3.74)	2.46 (1.69, 3.58)	2.89 (2.15, 3.89)	5.23 (4.16, 6.58)	3.97 (3.09, 5.09)
Gay/lesbian	1.94 (1.05, 3.57)	1.76 (0.79, 3.91)	1.82 (1.07, 149)	1.27 (0.75, 2.14)	1.95 (0.94, 4.06)	1.29 (0.61, 2.69)	3.04 (1.62, 5.69)	2.63 (1.54, 4.47)

<sup>a</sup>Data were weighted and adjusted for age. 95% confidence intervals are in parentheses. Odds ratio in bold indicates  $P < 0.05$ . aOR, adjusted odds ratio; CI, confidence interval.

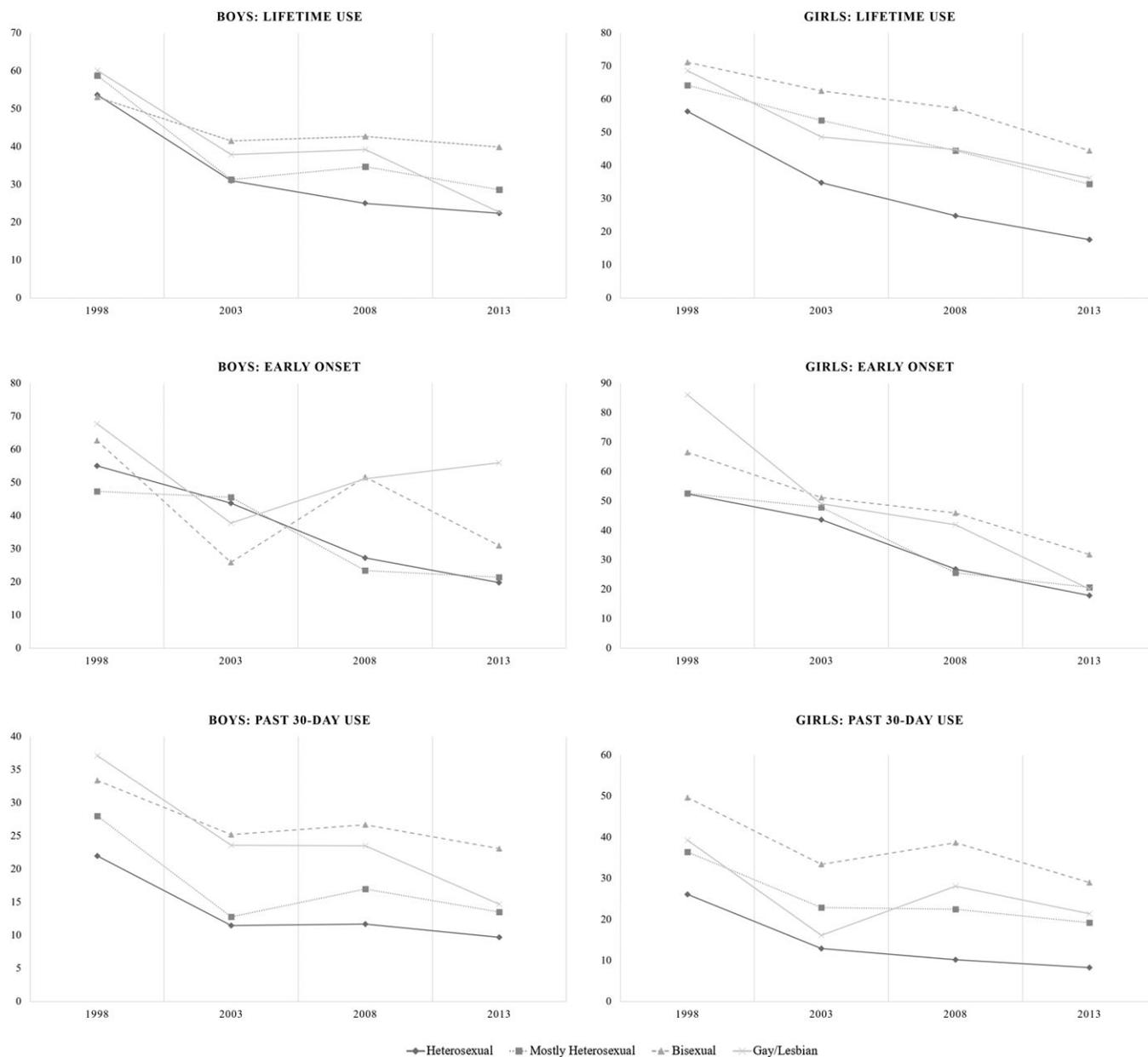
across all survey years, with the exception of gay boys in 2003 (Figure 1).

Bisexual girls had greater odds of all smoking behaviours compared to heterosexual girls for all survey years with the exception of early onset in 2003. Lesbian and mostly heterosexual girls were more likely than heterosexual girls to report lifetime cigarette use and past 30-day use in 2008 and 2013. Lesbian girls were also more likely to report earlier age of onset than heterosexual girls in 1998 and 2008, whereas mostly heterosexual girls indicated lower age of first use in 1998 and 2003. At no point across survey years did

sexual minority boys or girls indicate statistically lower odds of smoking behaviours.

*Trends in smoking behaviour disparities over time*

Sexual identity by year age-adjusted odds ratios are presented in Table 4. For bisexual boys, the disparities in lifetime cigarette use increased from 1998 to 2013. Early onset disparities increased from 2003 to 2013 for gay and bisexual boys, as well as for gay boys from 1998 to 2013.



**Figure 1.** Unadjusted trends in smoking behaviours among students grades 7–12 from 1998 to 2013. [Correction added on 3 December 2018, after first online publication: figure 1 legend has been updated.]

**Table 4.** Trends in cigarette use among students grades 7–12: Interactions between sexual identity and year<sup>a</sup>

	Male aOR (95% CI)	Female aOR (95% CI)
<i>Lifetime use</i>		
Heterosexual × Year 2013 [ref]		
Mostly heterosexual × Year 2008	0.87 (0.63, 1.19)	0.96 (0.78, 1.18)
Mostly heterosexual × Year 2003	1.32 (0.90, 1.96)	1.14 (0.91, 1.43)
Mostly heterosexual × Year 1998	1.11 (0.80, 1.53)	<b>1.90 (1.51, 2.38)</b>
Bisexual × Year 2008	1.01 (0.57, 1.79)	0.85 (0.62, 1.17)
Bisexual × Year 2003	1.43 (0.78, 2.63)	1.25 (0.82, 1.89)
Bisexual × Year 1998	<b>1.97 (1.06, 3.65)</b>	<b>2.06 (1.34, 3.16)</b>
Gay/lesbian × Year 2008	0.52 (0.27, 1.01)	1.07 (0.52, 2.22)
Gay/lesbian × Year 2003	0.79 (0.37, 1.68)	1.26 (0.55, 2.92)
Gay/lesbian × Year 1998	0.70 (0.34, 1.45)	1.12 (0.48, 3.09)
<i>Early onset</i>		
Heterosexual × Year 2013 [ref]		
Mostly heterosexual × Year 2008	1.32 (0.69, 2.53)	1.32 (0.88, 1.96)
Mostly heterosexual × Year 2003	0.98 (0.48, 2.00)	0.95 (0.63, 1.44)
Mostly heterosexual × Year 1998	1.26 (0.68, 2.34)	0.93 (0.62, 1.41)
Bisexual × Year 2008	0.69 (0.30, 1.57)	0.87 (0.55, 1.39)
Bisexual × Year 2003	<b>4.75 (1.54, 14.65)</b>	1.53 (0.96, 2.43)
Bisexual × Year 1998	1.51 (0.69, 3.31)	0.83 (0.47, 1.47)
Gay/lesbian × Year 2008	2.01 (0.66, 6.15)	0.54 (0.16, 1.78)
Gay/lesbian × Year 2003	<b>9.00 (2.42, 33.45)</b>	1.03 (0.28, 4.15)
Gay/lesbian × Year 1998	<b>3.31 (1.05, 10.49)</b>	<b>0.21 (0.06, 0.79)</b>
<i>Past 30-day use</i>		
Heterosexual × Year 2013 [ref]		
Mostly heterosexual × Year 2008	0.07 (0.64, 1.47)	0.99 (0.77, 1.28)
Mostly heterosexual × Year 2003	1.26 (0.77, 2.05)	<b>1.33 (1.02, 1.73)</b>
Mostly heterosexual × Year 1998	1.03 (0.69, 1.53)	<b>1.70 (1.29, 2.23)</b>
Bisexual × Year 2008	1.03 (0.56, 1.88)	0.76 (0.54, 1.07)
Bisexual × Year 2003	1.04 (0.53, 2.07)	1.36 (0.93, 1.99)
Bisexual × Year 1998	1.27 (0.65, 2.48)	<b>1.63 (1.04, 2.55)</b>
Gay/lesbian × Year 2008	0.72 (0.34, 1.50)	0.88 (0.38, 2.00)
Gay/lesbian × Year 2003	0.72 (0.29, 1.81)	2.05 (0.83, 5.08)
Gay/lesbian × Year 1998	0.68 (0.30, 1.51)	1.35 (0.54, 3.34)

<sup>a</sup>Data were weighted and adjusted for age. Odds ratios in bold indicates  $P < 0.05$ . Ref.: Reference group 2013; Models included sexual identity, age, ethnicity, survey year and identity-by-year interaction. aOR, adjusted odds ratio; CI, confidence interval.

Disparities in lifetime alcohol use increased from 1998 to 2013 for mostly heterosexual and bisexual girls. Sexual identity disparities in early onset declined for lesbian girls from 1998 to 2013. Disparities in past 30-day cigarette use increased for mostly heterosexual girls from 1998 and 2003 to 2013, as well as for bisexual girls from 1998 to 2003.

## Discussion

This study presents, to our knowledge, the longest running examination of disparities in smoking behaviour between heterosexual and sexual minority youth using a provincially-representative sample of British Columbia adolescents between 1998 and 2013. Overall, findings suggest that, despite growing social and political acceptance of LGB people in North America,

sexual minority youth demonstrate worrisome disparities in smoking behaviour. Particularly concerning is that some of our comparisons indicate that sexual identity differences in specific smoking behaviours have widened from past to present; namely lifetime use and early onset for bisexual boys from 1998 and 2003 to 2013, respectively, early onset for gay boys from 1998 and 2003 to 2013, and lifetime use and past 30-day use for mostly heterosexual (from 1998 and 2003 to 2013) and bisexual girls (from 1998 to 2013).

Not unlike previous studies [24,25], our results suggest promising declines in the prevalence of lifetime cigarette use, early onset and past 30-day use among adolescents. Results, however, also indicate that the declines in these behaviours over the last 15 years are more prominent for heterosexual relative to sexual minority youth. That is, despite overall declines in smoking behaviours across years, sexual minority males and females had smaller declines than their

heterosexual peers. Interestingly, Deacon and Mooney-Somers [26] presented similar findings regarding the dampened reduction in smoking among young Australian sexual minority women (aged 16–24). Furthermore, we noted that when significant within-sexual-identity prevalence declines were present, the size of the effect of these declines were less robust for sexual minority relative to heterosexual youth. Age-adjusted trends, for example, indicated that heterosexual boys were 66% less likely to report past 30-day use in 2013 relative to 1998, whereas bisexual boys were only 49% less likely to report recent use.

Based on a growing body of research which demonstrates the association between anti-LGB stigma and substance use among sexual minority youth [27,28] and the changing social and political landscape with regards to LGB people in North America, we hypothesized that sexual identity differences in smoking behaviours would diminish from 1998 to 2013. Yet, our results do not support this hypothesis. Instead, our findings suggest that differences between heterosexual and sexual minority youth in lifetime cigarette use, early onset and past 30-days cigarette use have, by and large, remained stable, and in some cases widened. Out of a total 54 sexual identity disparities, 44 did not change, 10 increased—five among sexual minority boys and five among sexual minority girls—and one disparity decreased (age of onset between heterosexual and lesbian girls from 1998 to 2013).

These findings suggest that while we are experiencing greater social acceptance, changing attitudes and policies regarding LGB people in North America, these advances have not translated into a decline in health disparities for sexual minority youth. A key consideration in this regard is to better understand the ways in which health and social policies are specifically evaluated in relation to their intended (or unintended) impacts on LGB youth health outcomes, such as tobacco policies [27,29,30]. Accordingly, both environmental and social determinants of health—such as LGB youth engagement with community, neighbourhoods, health and social programs—need to be contextualised. Such approaches would further understanding of the types of tobacco cessation interventions that address fundamental disparities and marginalisation facing sexual minority populations.[31].

Although not directly testable with our data, one possible explanation for the persistence of sexual-orientation-related disparities in tobacco use is the collision between increased societal acceptance of LGB people and the developmental timing of social regulation among peers [32]. Specifically, research demonstrates a decline in the age at which LGB youth first disclose their sexual identities [32], in part due to greater social acceptance and visibility of LGB people in broader society: a trend

supported by the decline in the prevalence of heterosexuality in our data (see Table 1). Young adolescents, however, are more likely than older adolescents to espouse prejudicial attitudes, homophobic behaviour, and the regulation of sexuality and gender expression [33–35]. Thus, despite greater social acceptance of LGB people, youth remain vulnerable to these prejudiced experiences and associated consequences [32].

Interestingly, with the exception of early onset, bisexual and mostly heterosexual boys and girls are those who demonstrated greater disparities in lifetime and past 30-day cigarette use. Indeed, studies have identified higher risk for substance use among bisexual relative to both heterosexual and gay/lesbian youth [7]. Importantly, our findings suggest that the relative risk for bisexual and mostly heterosexual youth is increasing over time, a fact which justifies focused research and programming efforts. Youth and adults who identify as bisexual often report biphobia from both the heterosexual majority as well as their gay/lesbian peers [36]. Therefore, these experiences of biphobia and stigma may translate into greater substance use. Alternatively, it may be that social acceptance of sexual minorities may differentially benefit those who identify as gay or lesbian compared to those who identify as mostly heterosexual and bisexual.

Ultimately, our findings point to the need for focused research and programs on the mechanisms that drive smoking behaviour disparities between heterosexual and sexual minority youth. Recent meta-analytic studies indicate an increase in sexual minority youth experiences of school-based victimisation [14] and that sexual minority youth substance use is largely driven by these experiences [28]. Thus, health and social programs and policies that specifically address the contextual factors contributing to anti-LGB discrimination and homophobic bullying in school may help to reduce these experiences and subsequent smoking [37,38]. One clinical-control trial conducted on young adult gay men indicated that treatment approaches focused on reducing minority stress led to improved mental health and reduced substance use [39]; therefore, it may be beneficial to have focused programs for sexual minority youth where issues of discrimination, victimisation and health coping strategies are discussed.

Our findings should be considered in relation to several study limitations. First, we used a single item to measure sexual orientation, yet sexual identity health disparities have been known to vary across measures of sexual minority status (reports of sexual identity, attraction and behaviour are not always aligned). Thus, trends using other measures of sexual orientation or patterns across measures of sexual minority status [40] could offer important insights about trends in smoking behaviours among sexual minority youth. Second, data

were collecting using Statistics Canada's measure for ethnicity, which precludes the ability to adjust models for race/ethnicity. These data also reflect the experience of youth within one Canadian province; given that LGB-related laws and policies vary across provinces, and countries, findings may not be generalisable to youth in other Canadian provinces or other countries. Finally, the BCAHS is a school-based survey, thus youth who were not enrolled—youth disproportionately likely to be LGB (i.e. youth experiencing homelessness [41,42], school pushout [43] and who skip school because they feel unsafe [44])—were not represented in these data.

Overall, our findings demonstrate that smoking is declining among Canadian youth. However, despite growing social acceptance of LGB people in North America, sexual identity disparities in smoking have remained largely unchanged, and in some cases have widened, suggesting that sexual minority youth health disparities remain a significant public health concern. The continued inclusion of sexual identity measures in studies of youth may help to elucidate the impact of these social changes over time. Researchers should continue to explore how these contextual changes can impact health behaviours and related health outcomes among sexual minority youth. In the meantime, the implementation of LGB youth-focused policies and interventions that consider the intrapersonal, interpersonal, contextual and environmental determinants of health in reducing sexual orientation disparities in smoking behaviours are warranted.

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### Conflict of Interests

The authors have no conflicts of interest.

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