

## Original quantitative research

# Initiation or cessation: what keeps the prevalence of smoking higher in Quebec than in the rest of Canada?

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### Abstract

**Introduction:** We compared smoking initiation and cessation in Quebec versus the rest of Canada as possible underpinnings of the continued higher cigarette smoking prevalence in Quebec.

**Methods:** Data were drawn from the Canadian Community Health Survey (CCHS). We compared average and sex-stratified prevalence estimates of (1) current cigarette smoking in persons aged 15 years and older; (2) past-year initiation of cigarette smoking in those aged 12 to 17 and 18 to 24 years; and (3) past-year cessation in adults aged 25 years and older in Quebec versus the other nine Canadian provinces in each two-year CCHS cycle from 2007/08 to 2017/18.

**Results:** The prevalence of current smoking decreased from 25% to 18% among adults aged 15 years and older in Quebec from 2007/08 to 2017/18, and from 22% to 16% in the rest of Canada. Initiation among those aged 12 to 17 years decreased from 9% to 5% in Quebec, and from 7% to 3% in the rest of Canada. Neither initiation among people aged 18 to 24 (at 6% and 7%, respectively) nor cessation among adults aged 25 and older (approximately 8%) changed over time in Quebec or in the rest of Canada. In each two-year CCHS cycle, past-year initiation among those 12 to 17 years of age was consistently higher in Quebec than in the rest of Canada, but there were no substantial or sustained differences in initiation among people aged 18 to 24 or in past-year cessation. Findings were similar when stratified by sex.

**Conclusion:** Higher levels of smoking initiation among youth aged 12 to 17 years could be a proximal underpinning of the continuing higher prevalence of smoking in Quebec versus the rest of Canada.

**Keywords:** *Canada, Quebec, smoking, Canadian Community Health Survey*

### Introduction

Cigarette smoking is a primary driver of avoidable death<sup>1</sup> as well as an important underpinning of social inequalities in morbidity and mortality.<sup>2</sup> Historically, and despite marked declines over four decades in both Quebec and the rest of Canada

(i.e. the other nine provinces), the smoking prevalence in Quebec consistently surpasses the Canadian average.<sup>3-5</sup> In 2000/01, the prevalence was 30% in Quebec compared to 26% in Canada overall. Two decades later, in 2019, 17% of Quebecers smoked compared to 15% of all Canadians.<sup>6</sup> Previous studies have attributed this

### Highlights

- Between fiscal years 2007/08 and 2017/18, the prevalence of cigarette smoking decreased in both Quebec and the rest of Canada.
- The percent of youth aged 12 to 17 years who initiated smoking was consistently higher in Quebec compared to the rest of Canada from 2007/08 to 2017/18.
- Initiation among those aged 18 to 24 years and cessation among adults aged 25 and older did not differ between Quebec and the rest of Canada.
- The continuing higher smoking prevalence in Quebec could relate in part to continuing higher levels of initiation in adolescents.

differential to lower incomes in Quebec,<sup>5</sup> to greater cigarette tax reductions in Quebec in 1994 to prevent contraband tobacco,<sup>5,7</sup> and to antismoking messages not being optimally adapted for francophones.<sup>8</sup> Reflective of these differences are the 10 400 tobacco-related deaths that occur annually in Quebec,<sup>1</sup> and the age-standardized lung cancer mortality rate (66 deaths per 100 000 in Quebec vs. 52 deaths per 100 000 in Canada). In fact, Quebec has one of the highest provincial lung cancer mortality rates in Canada.<sup>9</sup>

Key proximal drivers of smoking prevalence that can be targeted for intervention

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include the number of young people who initiate smoking and the number of smokers who quit. Historically, higher prevalence is also contributory but cannot in and of itself be targeted for intervention. The first puff on a cigarette is a critical milestone in the natural course of smoking onset<sup>10</sup> and existing data suggest that initiation is higher in Quebec than in Canada overall. In 2017, 9% of Grades 7 to 9 students in Canada had tried smoking compared to 15% in Quebec, which is almost double the national average.<sup>4</sup> The average age at initiation is 13 years,<sup>11</sup> and 99% of adult smokers in the US initiated their first cigarette by age 26.<sup>12</sup>

Although initiation is typically viewed as an adolescent phenomenon, there is growing concern that the tobacco industry is now targeting young adults because of increasingly restrictive tobacco control legislation protecting youth, and several reports support that the incidence of initiation in young adults is increasing.<sup>13-15</sup> Gagné and Veenstra<sup>16</sup> reported that initiation among youth aged 5 to 17 years in Canada decreased from 2003 to 2013, but did not change among young adults aged 18 to 25.

Cessation is also a proximal driver of smoking prevalence.<sup>17</sup> It improves chronic disease incidence, reduces second-hand smoke exposure and decreases mortality. Cessation rates are similar in Quebec and Canada overall. In 2000, 8% of former smokers in Quebec had quit in the previous two years—the same as the Canadian average of 8%.<sup>18</sup> Data from the longitudinal National Population Health Survey showed that 16% of Quebecers who smoked in 1995 were nonsmokers in 2010/11, compared to 12% nationally.<sup>19</sup> More recent data on differences in cessation across provinces are scarce.

Although reports on smoking prevalence, initiation and cessation in Canada are released regularly, no publication to date has studied initiation and cessation as proximal contributors to smoking prevalence in Quebec versus the rest of Canada. Our objective was to compare these two indicators in Quebec versus the rest of Canada in each of six consecutive two-year cycles of the Canadian Community Health Survey (CCHS), between 2007/08 and 2017/18. We hypothesized that if either or both indicators differed between Quebec and the rest of Canada consistently

over time, they might represent targets for more intense intervention to facilitate faster decreases in smoking prevalence in Quebec to better align with that in the rest of Canada.

Accordingly, we report prevalence of past-year initiation of a first whole cigarette among youth aged 12 to 17 years in Quebec versus the rest of Canada. We also report past-year initiation among young adults aged 18 to 24 years because of concerns that the incidence of smoking initiation in young adults is increasing.<sup>13-15</sup> Finally, because sustained cessation is relatively rare in smokers aged under 25 years,<sup>4</sup> we present past-year cessation among smokers aged 25 years and older in Quebec versus the rest of Canada. The rest of Canada is used as a comparative because of similar country-wide tobacco control legislation.

## Methods

We used data from the CCHS, the largest health surveillance dataset in Canada.<sup>20</sup> CCHS content covers health status, health care utilization and determinants of health in the Canadian population aged 12 years and older. The CCHS provides reliable estimates of health indicators at the health region level (i.e. geographical units) within provinces every two years. Questionnaires were administered using computer-assisted interviews in English or French in 2001, 2003 and 2005, and then annually since 2007.

Approximately 130 000 Canadians (10 000 aged 12–17 years and 120 000 aged ≥ 18), including 20 000 to 24 000 Quebecers, were recruited into the CCHS in each two-year cycle between 2007/08 and 2017/18. National response proportions were 76.4% in 2007/08, 72.3% in 2009/10, 68.4% in 2011/12, 66.2% in 2013/14, 59.5% in 2015/16, and 60.8% in 2017/18. Details of the sampling methods are available elsewhere.<sup>20</sup> This study did not require ethics review because the data are legally accessible to the public and appropriately protected by law.

## Study variables

*Current smoking* was assessed with the question, “Have you smoked more than 100 cigarettes (about 4 packs) in your life?” Participants who responded “no” were coded as never smokers. Those who responded “yes” were asked, “At the

present time, do you smoke cigarettes every day, occasionally or not at all?” Participants who responded “every day” or “occasionally” were coded as current smokers.

*Past-year initiation* of a first cigarette among participants aged 12 to 17 and 18 to 24 was measured by asking, “Have you ever smoked a whole cigarette?” and “At what age did you smoke your first whole cigarette?” We categorized participants as “past-year initiators” if they had smoked their first whole cigarette at or in the year prior to their current age. Participants who had never smoked a whole cigarette and past-year initiators were included in the denominator used to compute the prevalence of past-year initiation. Those who had initiated their first cigarette two or more years prior to their current age were not included in the denominator since they were no longer eligible to initiate a first cigarette in the past year.

*Past-year cessation* was assessed based on respondents’ smoking history. Former smokers included daily or non-daily smokers who had quit smoking completely. In former smokers who had never smoked daily, past-year cessation was measured with the question, “When did you stop smoking?” In former smokers who had smoked daily and stopped completely, it was assessed with the question, “When did you stop smoking daily?” Finally, in former smokers who had smoked daily, stopped smoking daily, but continued smoking on a non-daily basis before stopping completely, past-year cessation was assessed with the question, “When did you stop smoking completely?” Response options ranged from “less than one year ago” to “3 or more years ago.” We categorized former smokers as “past-year quitters” if they reported quitting smoking “less than a year ago.” Current smokers and past-year quitters were included in the denominator of the computation of the prevalence of past-year cessation.

## Statistical analyses

We described prevalence estimates and 95% confidence intervals for both sexes combined and then in males and females separately for (1) current smoking among persons aged 15 years and older (as is commonly reported in other Canadian surveys);<sup>21,22</sup> (2) past-year initiation of a first cigarette among persons aged 12 to 17 and aged 18 to 24; and (3) past-year

cessation among persons aged 25 years and older in the province of Quebec and in the other nine provinces in the rest of Canada across two-year periods between 2007/08 and 2017/18.

Also, to check for differences within the rest of Canada compared to Quebec, we stratified the rest-of-Canada data into four provinces or regions (i.e. the Atlantic provinces, Ontario, the Prairies, British Columbia). Two-year periods were examined because the CCHS is designed to be analyzed in two-year cycles and, because the sample size for any single year is relatively small, to improve the precision of our estimates.

According to the 2017/18 CCHS, there were no missing data on sex or province of residence. Missing data on current smoking (among participants aged ≥ 15 years) was less than 0.1%, on past-year initiation (among participants aged ≥ 12) was 3.7% and on past-year cessation (among participants aged ≥ 25) was 3.4%.<sup>23</sup>

We report the statistical significance of differences in the proportions estimated between Quebec and the rest of Canada (i.e. the other nine Canadian provinces) in each two-year cycle. Sensitivity analyses

comparing estimates for occasional and daily smoking separately are available on request. We used the survey and bootstrap weights developed by Statistics Canada to account for the CCHS sampling strategy<sup>24</sup> and produce representative estimates, using the `svy:prop` command in Stata<sup>25</sup> to estimate proportions and the `lincom` command to test differences in proportions. Aligned with Statistics Canada's Remote Submit Pilot Project reporting guidelines, estimates are reported without decimals. Analyses were undertaken using a listwise deletion approach in Stata 16.<sup>25</sup>

## Results

### Current smoking

The prevalence of current smoking among persons aged 15 years and older declined steadily across all 10 provinces from 2007/08 to 2017/18 (Table 1). In Quebec, the proportion of current smokers decreased from 25% in 2007/08 to 18% in 2017/18, and in the rest of Canada it declined from 22% to 16% (*p*-values for the differences between estimates in Quebec vs. the rest of Canada were statistically significant at the 0.05 level at all time points). Absolute rates of decline were similar in Quebec and the rest of

Canada (i.e. 7% vs. 6%, respectively) as was the relative decline (i.e. 28% in Quebec vs. 27% in the rest of Canada). This finding was consistent across sex (Table 1). The declines were driven primarily by decreases in daily rather than occasional smoking (data available on request).

A comparison of Quebec with the rest of Canada divided into four provinces and regions suggests that the pattern of decline in Quebec resembles the patterns in the Atlantic provinces and the Prairies. In 2007/08, the prevalence of current smoking was lower in Ontario and British Columbia, and since the absolute declines were similar across provinces, the prevalence in these two provinces remained lower over time. These data suggest that overall, the prevalence of current smoking outside Quebec in the rest of Canada is driven by the lower prevalence in Ontario and the markedly lower prevalence in British Columbia.

### Past-year initiation among adolescents

The prevalence of past-year smoking initiation among adolescents aged 12 to 17 years declined from 9% in 2007/08 to 5% in 2017/18 in Quebec, an absolute

**TABLE 1**  
Prevalence of current smoking among persons aged 15 years and older in Quebec versus the rest of Canada,<sup>a</sup> CCHS, 2007 to 2018

	Current smoking					
	2007/08	2009/10	2011/12	2013/14	2015/16	2017/18
	% <sup>b</sup> (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
<b>Total</b>						
Quebec	25 (24–26)*	24 (23–25)*	23 (22–24)*	21 (20–22)*	19 (18–20)*	18 (18–19)*
Rest of Canada	22 (21–22)*	20 (20–21)*	20 (20–21)*	19 (18–19)*	18 (17–18)*	16 (16–16)*
Atlantic provinces <sup>c</sup>	25 (24–26)	24 (23–25)	24 (22–25)	22 (21–23)	20 (19–21)	18 (17–19)
Ontario	21 (21–22)	20 (19–20)	20 (19–21)	18 (18–19)	17 (17–18)	16 (15–17)
Prairies <sup>d</sup>	24 (23–25)	23 (22–24)	22 (21–23)	20 (19–21)	19 (19–20)	18 (17–19)
British Columbia	19 (18–20)	17 (16–19)	16 (15–17)	16 (15–17)	15 (14–16)	13 (12–14)
<b>Males</b>						
Quebec	28 (26–29)*	26 (25–28)*	26 (24–27)*	24 (22–25)	21 (19–22)	21 (20–22)*
Rest of Canada	25 (24–26)*	24 (23–24)*	23 (22–24)*	22 (21–23)	21 (20–21)	19 (18–20)*
<b>Females</b>						
Quebec	23 (22–24)*	21 (20–23)*	21 (19–22)*	19 (18–20)*	17 (16–18)*	16 (15–17)*
Rest of Canada	19 (18–19)*	17 (17–18)*	17 (17–18)*	15 (15–16)*	15 (15–16)*	13 (12–13)*

**Abbreviations:** CCHS, Canadian Community Health Survey; CI, confidence interval.

<sup>a</sup> Rest of Canada includes nine Canadian provinces (i.e. British Columbia, Alberta, Saskatchewan; Manitoba, Ontario, New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador).

<sup>b</sup> Percentages were rounded to the nearest integer.

<sup>c</sup> New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador.

<sup>d</sup> Alberta, Saskatchewan and Manitoba.

\* Indicates that differences between estimates for Quebec vs. the rest of Canada were statistically significant at the 0.05 level.

difference of 4% (Table 2). The absolute difference was also 4% in the rest of Canada (i.e. the prevalence declined from 7% to 3%). Apart from 2007/08, *p*-values for the differences between estimates for Quebec versus the rest of Canada were statistically significant at all time points. This pattern was consistent across sex (Table 2), and comparison of Quebec with the rest of Canada divided into four regions did not alter interpretation of the data.

### Past-year initiation among young adults

Past-year initiation among young adults aged 18 to 24 did not decline in Quebec or in the rest of Canada over time—it remained relatively stable at 6% and 7%, respectively (Table 3). None of the differences between estimates for Quebec versus the rest of Canada at the six time points investigated were statistically significant. Initiation in young adulthood was consistently higher in males than females in both Quebec and the rest of Canada. Comparison of Quebec with the rest of Canada divided into four regions did not alter interpretation of the data.

### Past-year cessation

The prevalence of past-year cessation among adults aged 25 years and older remained

steady over time at approximately 8% in both Quebec and the rest of Canada (Table 4). Apart from the difference in 2011/12, none of the differences between estimates for Quebec versus the rest of Canada were statistically significant at any of the six time points investigated. This pattern was similar across sex (Table 4), as well as in Quebec compared to four provinces or regions in the rest of Canada.

## Discussion

Cigarette smoking has decreased in both Quebec and the rest of Canada over the past decade, underscoring continuing progress in the fight against smoking across the country. Specifically, prevalence declined by 7% in Quebec (i.e. from 25% to 18%) and by 6% in the rest of Canada (i.e. from 22% to 16%). Our results suggest that, in addition to its historically higher prevalence, the generally higher prevalence of smoking in Quebec versus the rest of Canada relates to the consistently higher initiation rate among Quebec youth aged 12 to 17 over the past decade. The identification of proximal drivers of smoking prevalence in Quebec that are amenable to intervention could signal where changes or intensification in policy and programs might accelerate

declines, thus rendering the prevalence of smoking in Quebec more comparable to that in the rest of Canada. In particular, the low prevalence of cigarette smoking in British Columbia and Ontario represents an attainable target for Quebec.

In this current study, we compared initiation and cessation in Quebec and the rest of Canada to identify proximal drivers of smoking prevalence in Quebec. Three key findings emerged. First, cessation among adults aged 25 years and older remained virtually unchanged, at 8% over the past decade in both Quebec and the rest of Canada. Second, smoking initiation among young adults aged 18 to 24 years did not differ between Quebec and the rest of Canada or change over time. Third, smoking initiation among adolescents was consistently higher in Quebec than in the rest of Canada, suggesting that adolescent initiation may be an actionable driver of the continued higher smoking prevalence in Quebec.

Despite previous efforts<sup>5,7,8</sup> to understand variations in Quebec versus other Canadian provinces, this persistent gap in initiation may be the result of differences in underlying and more distal drivers of prevalence

**TABLE 2**  
Prevalence of past-year smoking initiation among youth aged 12 to 17 years in Quebec versus the rest of Canada,<sup>a</sup> CCHS, 2007 to 2018

	Past-year smoking initiation					
	2007/08 % <sup>b</sup> (95% CI)	2009/10 % (95% CI)	2011/12 % (95% CI)	2013/14 % (95% CI)	2015/16 % (95% CI)	2017/18 % (95% CI)
<b>Total</b>						
Quebec	9 (7–10)	9 (7–12)*	10 (7–12)*	7 (5–9)*	6 (5–7)*	5 (4–7)*
Rest of Canada	7 (6–8)	6 (6–7)*	5 (5–6)*	5 (4–6)*	4 (3–5)*	3 (2–4)*
Atlantic provinces <sup>c</sup>	7 (5–9)	7 (5–9)	7 (5–9)	6 (5–8)	5 (3–6)	3 (2–4)
Ontario	6 (5–8)	5 (4–6)	4 (4–5)	5 (4–6)	4 (2–5)	4 (2–5)
Prairies <sup>d</sup>	8 (7–10)	8 (6–10)	7 (5–9)	6 (5–8)	5 (5–8)	2 (2–3)
British Columbia	7 (5–9)	6 (4–8)	5 (3–6)	4 (2–5)	3 (2–4)	3 (2–4)
<b>Males</b>						
Quebec	9 (7–12)	10 (7–13)	9 (6–12)*	8 (6–10)*	6 (4–8)	6 (4–8)
Rest of Canada	8 (7–9)	7 (6–8)	6 (5–7)*	5 (4–6)*	4 (3–5)	4 (3–5)
<b>Females</b>						
Quebec	8 (6–11)	9 (6–12)	10 (7–13)*	6 (4–8)	6 (4–8)*	5 (3–7)*
Rest of Canada	6 (5–7)	6 (5–7)	5 (4–5)*	5 (4–6)	4 (3–5)*	2 (2–3)*

**Abbreviations:** CCHS, Canadian Community Health Survey; CI, confidence interval.

<sup>a</sup> Rest of Canada includes nine Canadian provinces (i.e. British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador).

<sup>b</sup> Percentages were rounded to the nearest integer.

<sup>c</sup> New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador.

<sup>d</sup> Alberta, Saskatchewan and Manitoba.

\*Indicates that differences between estimates for Quebec vs. the rest of Canada were statistically significant at the 0.05 level.



**TABLE 3**  
Prevalence of past-year smoking initiation among young adults aged 18 to 24 years in Quebec versus the rest of Canada,<sup>a</sup> CCHS, 2007 to 2018

	Past-year smoking initiation					
	2007/08	2009/10	2011/12	2013/14	2015/16	2017/18
	% <sup>b</sup> (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
<b>Total</b>						
Quebec	6 (4–8)	6 (4–8)	8 (5–11)	6 (4–9)	6 (4–8)	6 (4–9)
Rest of Canada	7 (6–8)	7 (6–9)	7 (6–8)	7 (6–8)	6 (5–7)	7 (6–9)
Atlantic provinces <sup>c</sup>	4 (2–6)	8 (5–10)	7 (4–9)	10 (7–13)	4 (2–6)	8 (4–12)
Ontario	8 (6–9)	8 (6–10)	8 (6–9)	6 (5–8)	7 (5–8)	8 (5–10)
Prairies <sup>d</sup>	6 (5–8)	7 (5–9)	5 (4–7)	6 (4–8)	6 (4–8)	8 (6–10)
British Columbia	7 (5–10)	6 (4–8)	5 (3–6)	6 (3–9)	7 (4–9)	6 (4–9)
<b>Males</b>						
Quebec	6 (3–10)	8 (5–12)	9 (5–14)	8 (5–12)	8 (5–12)	8 (4–12)
Rest of Canada	8 (6–9)	9 (7–11)	8 (7–10)	10 (8–11)	7 (5–8)	9 (7–11)
<b>Females</b>						
Quebec	6 (2–9)	3 (1–5)	8 (4–12)	5 (1–8)	5 (2–7)	5 (1–8)
Rest of Canada	6 (5–8)	6 (4–7)	5 (4–6)	4 (3–5)	6 (4–8)	6 (4–8)

**Abbreviations:** CCHS, Canadian Community Health Survey; CI, confidence interval.

<sup>a</sup> Rest of Canada includes nine Canadian provinces (i.e. British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador).

<sup>b</sup> Percentages were rounded to the nearest integer.

<sup>c</sup> New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador.

<sup>d</sup> Alberta, Saskatchewan and Manitoba.

**Note:** None of the differences between estimates for Quebec vs. the rest of Canada were statistically significant at the 0.05 level.

**TABLE 4**  
Prevalence of past-year cessation among adults aged 25 years and older in Quebec versus the rest of Canada,<sup>a</sup> CCHS, 2007 to 2018

	Past-year cessation					
	2007/08	2009/10	2011/12	2013/14	2015/16	2017/18
	% <sup>b</sup> (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
<b>Total</b>						
Quebec	8 (7–9)	7 (6–9)	10 (8–11)*	9 (8–10)	9 (8–10)	8 (7–9)
Rest of Canada	8 (8–9)	7 (7–8)	8 (7–8)*	8 (7–9)	8 (7–9)	8 (7–9)
Atlantic provinces <sup>c</sup>	9 (8–11)	8 (6–9)	8 (7–10)	9 (7–10)	10 (8–11)	9 (8–11)
Ontario	8 (7–9)	6 (5–7)	7 (6–8)	7 (6–8)	8 (7–9)	7 (6–8)
Prairies <sup>d</sup>	8 (7–9)	7 (6–9)	8 (7–10)	7 (6–9)	8 (7–9)	7 (6–9)
British Columbia	8 (7–9)	9 (8–11)	9 (7–11)	10 (8–13)	8 (6–10)	11 (9–14)
<b>Males</b>						
Quebec	7 (6–9)	8 (6–10)	9 (7–11)	10 (8–11)	8 (7–10)	9 (7–11)
Rest of Canada	8 (7–9)	7 (6–8)	8 (7–8)	8 (7–9)	8 (7–9)	8 (7–9)
<b>Females</b>						
Quebec	9 (7–10)	7 (5–8)	10 (8–12)	8 (7–10)	9 (7–11)	7 (6–9)
Rest of Canada	8 (8–9)	8 (7–9)	8 (7–9)	7 (6–9)	8 (7–10)	7 (6–9)

**Abbreviations:** CCHS, Canadian Community Health Survey; CI, confidence interval.

<sup>a</sup> Rest of Canada includes nine Canadian provinces (i.e. British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador).

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<sup>c</sup> New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador.

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\*Indicates that differences between estimates for Quebec vs. the rest of Canada were statistically significant at the 0.05 level.

including population characteristics and government investment in public health and in particular, in tobacco control initiatives. The next few paragraphs discuss three possible underpinnings for this latter finding, including differences in the prevalence of specific risk factors for cigarette smoking initiation, timing of tobacco control legislation and differential availability of tobacco control programs in Quebec versus the rest of Canada.

### **Prevalence of risk factors for initiation**

In a systematic review, Wellman et al.<sup>26</sup> identified 98 conceptually different predictors of cigarette smoking initiation in 53 population-based longitudinal studies. An increased risk of smoking onset has consistently been found for increased age and grade, lower socioeconomic status, poor academic performance, low self-esteem, low parental supervision, sensation-seeking and rebelliousness, intention to smoke in the future, receptivity to tobacco promotion efforts, susceptibility to smoking, family members' smoking, having friends who smoke and exposure to films. This evidence base has methodological challenges, and research identifying predictors of adolescent smoking in more recent years remains critical.

However, juxtaposition of the strength of the associations and the prevalence of each predictor across jurisdictions (i.e. in Quebec vs. in other Canadian provinces) could provide actionable evidence on specific predictors relevant for new or intensification of existing tobacco control policies and interventions. For example, if the prevalence of school dropouts or perceived frequency of friends smoking is higher in Quebec than elsewhere, public health planners and policy makers will need to reflect on whether tobacco control interventions in Quebec should address these issues specifically. Further, reflection on the feasibility and effectiveness of preventive intervention addressing each potential predictor (in addition to the strength of the association with initiation and its prevalence) could permit assessment of where the "biggest bang for the buck" might be achieved in terms of programs or policy.

### **Tobacco control legislation**

Beyond underlying population characteristics, sociocultural norms related to smoking are strongly associated with

smoking behaviour,<sup>27,28</sup> and population-level tobacco control policies are critical reflections as well as drivers of these norms.<sup>29,30</sup> Quebec has been actively engaged in tobacco control for several decades and has implemented smoking bans similar to those in the other provinces. Relatively recent legislation (i.e. *An Act to amend the Tobacco Act and other legislative provisions* [2005] and *An Act to bolster tobacco control* [2015]) has included provisions to prevent smoking among adolescents, such as prohibiting smoking on school grounds, eliminating sales to minors and banning flavoured tobacco products.<sup>31</sup>

However, despite the similarity in legislative objectives across Canada, the timing of certain specific legislation has lagged in Quebec. For example, Quebec has lagged in tobacco taxation,<sup>32</sup> a measure known to be effective in reducing smoking prevalence in young people.<sup>33</sup> In addition, whereas other Canadian provinces began prohibiting smoking in cars with minors in 2008, Quebec was the last province to do so, only banning it in 2016.<sup>31</sup> It is possible that these timing differences reflect that antismoking social norms evolve differently across provinces and contribute to the persistent differences in youth initiation.

### **Tobacco control programs**

In addition to variability in risk factors for smoking initiation and lags in tobacco legislation across provinces, differences in the number, content and effectiveness of tobacco prevention interventions across provinces could influence the prevalence of youth initiation.

To date, the evidence for community and school-based smoking prevention programs is mixed. For example, in a 2011 review of 25 controlled trials examining the effectiveness of community interventions using coordinated, multicomponent programs in reducing smoking uptake in young people, the authors concluded that there is some evidence to support effectiveness, but the evidence is not strong and contains methodological flaws.<sup>34</sup> A 2013 Cochrane review of 49 randomized controlled trials of interventions aiming to prevent children who had never smoked from becoming smokers found a significant effect of the interventions in preventing young people from starting smoking at longer than one year after completion of

the intervention.<sup>35</sup> Programs that used a social competence approach and those that combined a social competence with a social influence approach were more effective than other programs. However, at one year or less there was no overall effect, except for programs that taught young people to be socially competent and to resist social influences.

A more recent (2015) review of 16 controlled trials found no evidence that school-based smoking prevention programs have a significant effect on preventing adolescent girls from smoking.<sup>36</sup> The authors suggested that additional research should focus on combining school-based programs with mass media interventions, and on developing girl-specific interventions, as potentially more effective than school-based intervention programs alone.<sup>36</sup>

Despite the mixed evidence on effectiveness, it might be informative to enumerate and compare the array of community and school-based smoking prevention programs available across provinces to assess whether differences in availability could underpin the persistent higher prevalence of smoking initiation in Quebec. For example, tobacco preventive interventions that target youth, such as *La gang allumée* in Quebec, aim to create awareness about tobacco consumption among youth aged 11 to 17 years.<sup>37</sup> However, tobacco education is not part of the Quebec elementary school curriculum, as it is in several other Canadian provinces. Because of the high smoking prevalence, the Government of Quebec has recently released a new plan known as the "*Stratégie pour un Québec sans tabac 2020–2025*," which among other objectives aims to prevent tobacco use in youth by implementing new mass media campaigns and school-based programs.<sup>38</sup>

### **Strengths and limitations**

This is the first study to study initiation and cessation as proximal contributors to smoking prevalence in Quebec compared to the rest of Canada.

However, this study does have certain limitations. First, it relies on self-reports of cigarette smoking initiation and cessation, which could have resulted in misclassification. Second, participant response proportions decreased over time, which could indicate a potential for selection bias. Finally, CCHS sampling methodology changed in 2015 to update sample allocation

between regions and include a second sampling list to enable more representative estimates of the youth population aged 12 to 17. Statistics Canada advises that estimates before and after 2015 should be compared with caution, although these changes are unlikely to have resulted in differences in smoking prevalence.

## Conclusion

Although the prevalence of current smoking has declined in Quebec since 2007/08, it remains higher than in the rest of Canada. The prevalence of both smoking cessation and initiation among young adults was similar in Quebec and the rest of Canada. However, smoking initiation remains higher among Quebec adolescents, likely contributing to the higher prevalence of current smoking in Quebec.

Even if no new interventions are implemented or if current tobacco control efforts are not intensified, Quebec may attain the lower prevalence estimates observed in other provinces as Quebecers continue to positively respond to current norms and tobacco control efforts, and as the prevalence of smoking stabilizes at a very low level in the rest of Canada.

However, continuing declines in the future are not guaranteed, and the time frame in which Quebec might achieve the prevalence estimates observed in the rest of Canada is unknown. Because youth initiation was the only proximal indicator in our study that was higher in Quebec than in the rest of Canada, prioritizing efforts to prevent youth initiation is likely to help ensure continuing declines in smoking prevalence in Quebec. It may also accelerate the rate of decline in smoking so that Quebec attains a prevalence similar to the rest of Canada in a shorter time frame.

Further investigation is needed to identify more distal factors underpinning the higher prevalence of smoking initiation, including the identification of differences in Quebec and the rest of Canada in risk factors for smoking initiation, in tobacco control legislation and in the availability of smoking prevention programs.

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## Conflicts of interest

JOL is a member of the HPCDP Editorial Board. JOL and TG are Guest Editors on this special theme issue of HPCDP, but recused themselves from the review process.

## Authors' contributions and statement

AP reviewed the literature and drafted the manuscript. JOL contributed to interpretation of the data and wrote sections of the article. TG conducted the analyses and wrote sections of the article. CC critically reviewed the article. KLF obtained funding and critically reviewed the article. All authors commented on and approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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