Youth exposure to smoking in the home and in cars: how often does it happen and what do youth think about it?

S T Leatherdale,1 P Smith,2 R Ahmed3

ABSTRACT

Aim: Little is known about what youth think about restricting smoking in their homes or in cars. The present study characterises the frequency of youth being exposed to smoking in their homes and cars, and the beliefs that youth have about restricting people from smoking around youth in those locations.

Methods: Data from the 2004 Youth Smoking Survey (YSS) were used to examine youth exposure to smoking and beliefs about smoking in the home and car among 29 243 Canadian youth in grades 5–9. Logistic regression models were conducted to examine if being exposed to smoking at home or in the car were associated with the beliefs youth have about either smoking around children at home or smoking around children in cars.

Results: In 2004, 23.1% of youth in grades 5–9 were exposed to smoking in their home on a daily or almost daily basis, 26.3% were exposed to smoking while travelling in a car at least once in the previous week. The majority of youth reported that they do not think smoking should be allowed around children at home (90.6%) or in cars (90.2%). Males were more likely than females to report that smoking should not be allowed around children at home (OR 1.38) or in cars (OR 1.39). Youth living in a house where someone smokes inside daily were more likely to report that smoking should not be allowed around children at home (OR 1.20) or in cars (OR 1.21). Youth living in a house where the rules do not prevent people from smoking inside were also more likely to report that smoking should not be allowed around children at home (OR 2.07) or in cars (OR 1.76). Youth who have ridden in a car with someone who was smoking cigarettes in the past 7 days were more likely to report that smoking should not be allowed around children in cars (OR 1.73).

Conclusions: It is common for Canadian youth to be exposed to SHS in their homes or while in cars on a frequent basis even though the vast majority of youth do not think smoking should be allowed around children in those locations. This new evidence suggests that programs and policies designed to prevent individuals from smoking around youth in these locations should be a public health priority.

Second-hand smoke (SHS), also known as environmental tobacco smoke (ETS), is the combination of the smoke from burning tobacco and from exhaled smoke. The public health impact of SHS is substantial as there is no safe level of SHS exposure.1–3 Considering that children are more heavily exposed to SHS than adults,5 and are frequently unable to prevent their own exposure,4 youth populations are at greater risk for future SHS related morbidity and mortality. The International Agency for Research on Cancer (IARC) has classified SHS as a Group 1 carcinogen;6 however, the effect of SHS exposure is not limited to cancer among non-smoking adults.7 The adverse health effects of involuntary SHS exposure among non-smoking youth include lower respiratory tract infections (eg, bronchitis and pneumonia), upper respiratory tract irritation, asthma, fluid in the middle ear, sudden infant death syndrome (SIDS), low birth-weight, and decreased lung function.8–10 Aside from disease outcomes, it has also been reported that youth exposed to SHS report more days of restricted activity, more days of bed confinement, and more days of school absence than those not exposed,9 as well as an increased likelihood that they will also start smoking.2,10 Reducing youth exposure to SHS should be a public health priority.

Youth exposure to SHS is very common. According to the 2000–2007 Global Youth Tobacco Survey (GYTS), 48.9% of students internationally are exposed to SHS at home, while 55.8% are exposed to SHS in public places.10 In fact, the World Health Organization (WHO) estimates that almost half of the world’s children, breathe air polluted by tobacco smoke, particularly at home.1

In Canada, 12% of Canadian youth aged 0 to 11 and 19% of youth aged 12 to 17 are regularly exposed to SHS in the home according to the 2004 Canadian Tobacco Use Monitoring Survey (CTUMS).11 This represents close to 500 000 children under the age of 12 who were regularly exposed to SHS with the numbers reaching over 1 million when you include children 12 to 17.11 Considering that these estimates do not include youth exposure to SHS while travelling in vehicles (cars), which is both a common source of SHS exposure and a particularly dangerous source of exposure (SHS in a car is 25 times more toxic than in a house due to the enclosed space12), the extent of SHS exposure and subsequent risk among youth populations in Canada is likely underestimated. (The term “car” is used throughout this manuscript rather than the term “vehicle” to be consistent with terminology used in the Youth Smoking Survey questionnaire and the published literature.)

At the present time, the two domains that offer the best intervention potential are homes and cars. Not only are these locations principal sources of children’s SHS exposure,12 13 14 but also adults are supportive of developing policies that restrict smoking in these places. For instance, in Canada, the 2003 CTUMS reported that 63% of

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respondents thought there should be a law which prohibits parents from smoking in a home if children are living there and 73% thought there should be a law prohibiting parents from smoking inside a car if children are present. Nevertheless, the existing research tends to only examine the beliefs adults have toward such restrictions; little is known about what youth think about restricting smoking in their homes or in cars. As such, the current study seeks to: (a) characterise the frequency of youth being exposed to smoking in their homes and cars, (b) characterise the prevalence of different beliefs youth have about smoking around children in their homes and cars, and (c) examine if current exposure to smoking in the home or in cars is associated with those beliefs.

METHODS
This study used nationally representative data collected from 29 245 youth in grades 5–9 as part of the 2004 Canadian Youth Smoking Survey (YSS). The target population for the YSS consisted of all Canadian youth in grades 5–9 attending public and private schools in 10 Canadian provinces; youth residing in the Yukon, Nunavut and the Northwest Territories were excluded, as were youth living in institutions or on First Nation Reserves, and youth attending special schools or schools on military bases. The sample design consisted of a two-stage stratified clustered design with schools as primary sampling units and classes as secondary sampling units. All of the students in the selected classes were surveyed. The sample design featured three levels of stratification: province, grade level, and census metropolitan area. The sample of schools was selected systematically with probability proportional to school size. The selection of the secondary sampling units (classes) was conducted by field staff who randomly selected one class in the desired grade. Detailed information on the sample design, methods, and survey rates for the 2004 YSS is available from Statistics Canada.

Smoking was measured by asking: “Have you ever smoked a whole cigarette?” (yes/no). Beliefs about smoking were measured by asking “Should smoking be allowed around children at home?” (yes/no/1 don’t know), and “Should smoking be allowed around children in cars?” (yes/no/1 don’t know). Respondents were asked “What are the rules about smoking in your home? (no one is allowed to smoke in my home), only special guests are allowed to smoke in my home/people are allowed to smoke only in certain areas in my home/people are allowed to smoke anywhere in my home), “Excluding yourself, how many people smoke inside your home every day or almost every day? (none/1 person/2 people/3 or more people), and “During the past 7 days, on how many days did you ride in a car with someone who was smoking cigarettes?” (0 days/1 or 2 days/3 or 4 days/5 or 6 days/all 7 days). Respondents also reported their sex (male/female), grade (5–9), and if they had a parent who smokes (no parent(s)/1 parent or/2 parent(s) at least 1 parent smokes).

In step 1, descriptive analyses of being exposed to smoking and beliefs about smoking in the home and car were examined according to sex and smoking status. In step 2, two logistic regression models were conducted to examine if being exposed to smoking at home or in the car were associated with the beliefs youth have about either smoking around children at home or smoking around children in cars. In step 3, we examined gender interactions for factors associated with the beliefs youth have about either smoking around children at home or smoking around children in cars. Survey weights were used to adjust for non-response between provinces and groups, thereby minimizing any bias in the analyses caused by differential response rates across regions or groups. The statistical package SAS 8.02 (SAS software, Cary, North Carolina) was used for all analyses.

RESULTS
Descriptive statistics are presented by gender in table 1, by smoking status in fig 1 and by province in fig 2. Results of the logistic regression models examining beliefs about smoking around children at home or in cars are presented in table 2.

Exposure to smoking in the home
In 2004, 85.8% (1 793 100) of Canadian youth were exposed to smoking in their home on a daily or almost daily basis; rates of exposure were similar between males and females. Moreover, 35.4% (691 200) of youth reported that they live in a house where smoking is not completely restricted, meaning there is the potential for them to be exposed to smoking in the home at some time. Youth who were themselves smokers reported the highest prevalence of being exposed to smoking in the home (50.5%) and living in a house where smoking is not completely restricted (59.7%).

Beliefs about smoking at home
In 2004, 90.6% (1 800 700) of Canadian youth reported that they did not think smoking should be allowed around children at home; this belief was more common among females than males ($\chi^2 = 56.89, df = 2, p<0.001$). Although the prevalence was highest among non-smoking youth (92.1%), most smoking youth (73.8%) also reported that smoking should not be allowed around children in the home.

Beliefs about smoking in cars
In 2004, 90.2% (1 793 100) of Canadian youth reported that they do not think smoking should be allowed around children in cars; this belief was more common among females than males ($\chi^2 = 54.51, df = 2, p<0.001$). Although the prevalence was highest among non-smoking youth (91.8%), most smoking youth (72.9%) also reported that smoking should not be allowed around children in the home.

Factors associated with beliefs about smoking in the home
Males were more likely than females to report that smoking should not be allowed around children at home (OR 1.38, 95% CI 1.28–1.51). Youth were much more likely to have reported
that smoking should not be allowed around children at home if they have never smoked a whole cigarette (OR 2.83, 95% CI 2.53–3.18). Youth living in a house where someone smokes inside daily were more likely to report that smoking should not be allowed around children at home (OR 1.20, 95% CI 1.05–1.38) compared to those in a house where no one smokes inside. Youth living in a house where the rules do not prevent people from smoking inside were more than twice as likely to report that smoking should not be allowed around children at home (OR 2.07, 95% CI 1.87–2.30) compared to youth in homes where the rules do not allow smoking inside. Youth who have ridden in a car with someone who was smoking cigarettes in the past 7 days were more likely to report that smoking should not be allowed around children at home (OR 1.54, 95% CI 1.38–1.71). Examination of gender interactions revealed that males who do not smoke are more likely than females who do not smoke to believe smoking should not be allowed around children at home (fig 3). The negative impact of having a parent who smokes on the likelihood of believing that smoking should not be allowed around children at home was larger among males than females (fig 4).

Factors associated with beliefs about smoking in cars
Males were more likely than females to report that smoking should not be allowed around children in cars (OR 1.39, 95% CI 1.27–1.51). Youth were almost three times more likely to have reported that smoking should not be allowed around children in cars if they have never smoked a whole cigarette (OR 2.96, 95% CI 2.65–3.32). Youth who have ridden in a car with someone who was smoking cigarettes in the past 7 days were more likely to report that smoking should not be allowed around children in cars (OR 1.73, 95% CI 1.56–1.93) than youth who have not been exposed to smoking in a car over the last 7 days. Youth living in a house where someone smokes inside daily were more likely to report that smoking should not be allowed around children in cars (OR 1.21, 95% CI 1.06–1.38) compared to those in a house where no one smokes inside. Youth living in a house where the rules do not prevent people from smoking inside were more likely to report that smoking should not be allowed around children in cars (OR 1.59, 95% CI 1.59–1.95). Examination of gender interactions revealed that males are more likely than females to believe smoking should not be allowed around children in cars among never smokers (fig 3), and that the negative impact of having a smoking parent on beliefs about smoking around children in cars was larger among males than females (fig 4).

DISCUSSION
Canadian youth are frequently exposed to SHS in their homes or while in cars even though the vast majority of youth do not think smoking should be allowed around children in those locations. Even most youths who are themselves smokers
reported that smoking should be restricted around children in homes and cars. This new evidence, coupled with the existing evidence that the majority of adults hold similar beliefs, suggests that it may be timely to move forward with programs and/or policies designed to reduce or eliminate SHS exposure among youth in these locations.

Some jurisdictions are already moving ahead with programs and policies. For example, the federal government in Canada has implemented a program called “Make your home and car smoke-free: A guide to protecting your family from second-hand smoke”, which is designed to help families make their homes and cars smoke-free; the impact of this program is not yet known. More recently, the state of California passed a law making it an offence to smoke in a vehicle when a youth under the age of 18 years is present (http://dist28.casen.govoffice.com/); the effectiveness of this policy is also not yet known. Given that youth often cannot remove themselves from SHS exposure while in those contexts, additional programs and policies to protect youth from SHS in homes and in cars need to be developed and evaluated.

Previous research has identified that the beliefs youth have about SHS exposure is associated with their risk of being susceptible to future smoking. This is important as the current findings highlight important links between current SHS exposure and the beliefs youth have about SHS. Youth who live in a household where smoking is allowed inside or youth who commonly ride in a car where some smokes inside was positively associated with believing that smoking should not be allowed around children in homes or in cars. Interestingly, parental smoking status was not independently predictive of youth beliefs about SHS exposure, however, when sex was considered (figs 3 and 4) it appears that parental smoking has an impact among male youth. We also identified that being a smoker had a larger impact on the beliefs of male youth than female youth; a unique new finding in the literature. Additional research that explores the mechanisms underlying these gender differences would provide valuable insight for developing new smoking prevention resources appropriate for both males and females.

### Table 1 Descriptive statistics for the sample of youth in grades 5–9 by sex in Canada, 2004

<table>
<thead>
<tr>
<th></th>
<th>Male, % (n = 1 034 200)</th>
<th>Female, % (n = 976 800)</th>
<th>Total, % (n = 2 011 000)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grade:</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5</td>
<td>19.2</td>
<td>19.3</td>
<td>19.3</td>
</tr>
<tr>
<td>6</td>
<td>19.6</td>
<td>19.7</td>
<td>19.6</td>
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<td>7</td>
<td>20.7</td>
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<td>20.6</td>
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<tr>
<td>8</td>
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<td>20.3</td>
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<tr>
<td>9</td>
<td>20.2</td>
<td>20.3</td>
<td>20.2</td>
</tr>
<tr>
<td><strong>Have you ever smoked a whole cigarette?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>7.7</td>
<td>9.6</td>
<td>8.6</td>
</tr>
<tr>
<td>No</td>
<td>92.3</td>
<td>90.4</td>
<td>91.4</td>
</tr>
<tr>
<td><strong>Parental smoking:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At least 1 parent smokes</td>
<td>30.4</td>
<td>33.7</td>
<td>32.0</td>
</tr>
<tr>
<td>No parent(s) smoke</td>
<td>69.6</td>
<td>66.3</td>
<td>68.0</td>
</tr>
<tr>
<td><strong>Should smoking be allowed around children at home?</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Yes</td>
<td>3.1</td>
<td>2.2</td>
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<tr>
<td>No</td>
<td>89.7</td>
<td>89.5</td>
<td>89.6</td>
</tr>
<tr>
<td>I don't know</td>
<td>7.2</td>
<td>6.3</td>
<td>6.7</td>
</tr>
<tr>
<td><strong>What are the rules about smoking in your home?</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>No one is allowed</td>
<td>66.0</td>
<td>63.1</td>
<td>64.6</td>
</tr>
<tr>
<td>Only special guests</td>
<td>8.7</td>
<td>9.2</td>
<td>8.9</td>
</tr>
<tr>
<td>Allowed in certain areas</td>
<td>13.9</td>
<td>15.5</td>
<td>14.7</td>
</tr>
<tr>
<td>Allowed anywhere</td>
<td>11.4</td>
<td>12.2</td>
<td>11.8</td>
</tr>
<tr>
<td><strong>Excluding yourself, how many people smoke inside your home every day or almost every day?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>77.9</td>
<td>75.8</td>
<td>76.9</td>
</tr>
<tr>
<td>1 person</td>
<td>11.4</td>
<td>12.2</td>
<td>11.8</td>
</tr>
<tr>
<td>2 people</td>
<td>8.4</td>
<td>8.7</td>
<td>8.5</td>
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<td>3 or more people</td>
<td>2.3</td>
<td>3.3</td>
<td>2.8</td>
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<tr>
<td><strong>Should smoking be allowed around children in cars?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>3.2</td>
<td>2.3</td>
<td>2.8</td>
</tr>
<tr>
<td>No</td>
<td>89.3</td>
<td>91.2</td>
<td>90.2</td>
</tr>
<tr>
<td>I don't know</td>
<td>7.5</td>
<td>6.5</td>
<td>7.0</td>
</tr>
<tr>
<td><strong>During the past 7 days, on how many days did you ride in a car with someone who was smoking cigarettes?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 days</td>
<td>76.0</td>
<td>71.1</td>
<td>73.7</td>
</tr>
<tr>
<td>1 to 2 days</td>
<td>12.7</td>
<td>15.5</td>
<td>14.0</td>
</tr>
<tr>
<td>3 to 6 days</td>
<td>6.8</td>
<td>8.8</td>
<td>7.8</td>
</tr>
<tr>
<td>All 7 days</td>
<td>4.5</td>
<td>4.6</td>
<td>4.5</td>
</tr>
</tbody>
</table>

*Population estimate.
†Does not count those who smoke outside.
The evidence from Canada, as well as from the US and Australia suggests that the prevalence of homes becoming smoke-free is increasing; there are currently no data pertaining to the prevalence of smoke-free cars. Despite such improvements, the fact that so many youth continue to be exposed to SHS indicates that more needs to be done in terms of SHS prevention programming. However, at present, little is known about which programs are effective. Moreover, programs need to ensure that they inform the public that it is not enough to just stop smoking when children are present, but rather it is critical to eliminate smoking from homes and cars at all times in order to protect youth. This is critical since harmful components of SHS are deposited and absorbed into fabric, furniture, and other objects after tobacco smoke is emitted, and then re-emitted from those surfaces into the air over the course of the next hours and several months. Even if a person never smokes in the car or house when youth are present, youth can be exposed to the dangers of SHS when in those environments at a later date due to the ongoing emissions from the surfaces within them; a potential limitation associated with policies designed to only ban smoking in cars when children are present. The impact that this information may have on the behaviour of adult smokers and future policies needs to be explored.

Another potential avenue for prevention programming would be for healthcare professionals to become actively engaged in identifying youth exposed to SHS and to work with parents to stem such exposure. This could involve having practitioners help smoking parent(s) try to quit or taking advantage of a teachable moment while educating parents of the dangers of SHS when treating their child for any illnesses associated with SHS exposure. Considering that the current primary emphasis of school-based tobacco control is focused on smoking onset prevention and cessation, future school-based tobacco control efforts could also be shifted to focus more on reducing SHS exposure. There is a need to understand how to better take advantage of the existing infrastructure provided by the health care community or schools in future SHS prevention initiatives.

This study has several limitations common to survey research. Although the response rate was high and the data were weighted to help account for non-response, the findings...
are nevertheless subject to sample bias. In addition, the findings likely reflect some under-reporting for SHS exposure among youth in living in multi-unit dwellings due to shared air circulation. Although direct measurement of SHS exposure was not performed, biological assessment to verify these self-reported data could have confirmed responses. The cross-sectional nature of the design does not allow for causal inferences regarding the association between beliefs and previous SHS exposure; longitudinal data are required. Finally, the YSS did not ask about who the individuals are that smoke around the youth in the home or in the car (e.g., was the smoker a friend or family member). As such, it is difficult to determine which group or groups (e.g., parents, visitors or friends) would be the most appropriate to target with future programs and policies.

CONCLUSIONS
These results highlight that Canadian youth are frequently exposed to SHS in their homes and in cars. Considering that the majority vast majority of youth do not think smoking should be allowed around children in those locations, coupled with the existing evidence that the majority of adults also think smoking should be restricted around youth in homes and in cars, it may be a timely opportunity to move forward with programs and policies designed to prevent individuals from smoking around youth in these locations. As such, there is an immediate need to move forward with programs and policies to protect youth from SHS in homes and in cars.

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Competing interests: None.

REFERENCES

**The Lighter Side**

“An Affair (or a Smoke?) to Remember”: RJ Reynolds associates smoking with movies in this glossy cover of a discount coupon booklet for Camel cigarettes, sent to people on their mailing list in the United States in 2004.
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