

# School-based tobacco control efforts and the smoking behaviour of high school students in Prince Edward Island, Canada: examining differences

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**Aim:** This study examined the factors related to whether or not school-based tobacco control efforts were associated with student smoking behaviour among two groups of students: Group 1 (15–17 years of age; grade 10 in 2000 and grade 11 in 2001) and Group 2 (16–19 years of age; grade 11 in 2000 and grade 12 in 2001). **Background:** Between 1999 and 2001, Prince Edward Island (PEI) introduced a province-wide initiative to implement both school-based policies banning smoking on school grounds and school-based smoking prevention programming, phased in over a three-year period, in all schools.

**Methods:** Data were collected from all 10 English-speaking secondary schools in PEI (Canada) over three years (1999–2001) using the Tobacco Module of the School Health Action, Planning and Evaluation System. **Findings:** Results showed an increase in both occasional and regular smoking behaviour with Group 1 showing an 18% increase in occasional smoking compared to 3.9% for Group 2. The characteristic associated with an increased likelihood of regular and occasional smoking for 2000 and 2001 was students overestimating the percentage of youth their age who smoke. However, students' knowledge and awareness of smoking policies and enforcement, students' perceptions of schools having clear rules, and that students who break the rules get into trouble increased from 2000 to 2001. The findings from this study provide important information about how groups of students within schools experience tobacco control efforts differently. Addressing student misperceptions and policy implementation within schools may provide direction for tobacco control.

**Key words:** comparison group; evaluation; policy; schools; tobacco control

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## Introduction

Despite the overwhelming evidence on the harmful effects of smoking (Health Canada, 2008), youth

smoking rates in Canada remain high (Health Canada, 2007a). Cigarette smoking is often initiated and escalates during the school-years (Clark, 1996). For instance, according to the 2004–2005 Youth Smoking Survey, rates of ever-smoking increased from 5.8% in grade 5 to 34.3% in grade 9 for both males and females (Health Canada, 2007b). Such early initiation of tobacco use is also associated with increased length of time spent smoking and

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increased risk of many tobacco-related diseases (Clark, 1996; Chen, 2003). As such, youth tobacco control programming should remain a priority for primary health care systems.

Social influences within the school environment are particularly important correlates associated with the smoking behaviour of Canadian youth (Cameron *et al.*, 1999; Leatherdale *et al.*, 2005), not only because the vast majority of youth spend a substantial amount of their waking day at school, but also because many important influences for smoking exist within the school context. For example, Social Cognitive Theory posits that the environment, both social (eg, smoking friends) and physical (eg, smoking programmes and policies), influences behaviour through observational learning and vicarious experience (Bandura, 1986). Social Cognitive Theory, a well-known motivational model, assumes that anticipation of a negative health outcome, and the desire to avoid this outcome, or reduce its impact, creates motivation for self-protection and that action can reduce the likelihood or severity of harm. Moreover, Social Cognitive Theory assumes that people learn by observing the behaviours of others and the outcomes of those behaviours, that learning can occur without change in the behaviour and, that cognition (ie, awareness and expectations of future reinforcements or punishments) plays a role in learning and encompasses attention, memory and motivation. Thus, Bandura suggests that by observing another person's actions and the ensuing positive or negative reinforcements that the person receives, the observer forms rules of behaviour that serve as a guide for their own action in future situations. For example, youth are more likely to begin smoking if they have friends or family members who smoke (Leatherdale *et al.*, 2005; de Vries *et al.*, 2006; Mercken *et al.*, 2007). Conversely, students appear less apt to smoke if they attend schools with low smoking rates among senior students (Leatherdale *et al.*, 2005; Murnaghan *et al.*, 2007), or have programmes that support tobacco reduction (Murnaghan *et al.*, 2007; 2008), if smoking is made to appear undesirable and difficult (Wium and Wold, 2006; Currie *et al.*, 2008) and if there are consistent restrictions on smoking in the home (Proescholdbell *et al.*, 2000; Szabo *et al.*, 2006).

Between 1999 and 2001, Prince Edward Island (PEI) introduced a province-wide initiative to

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implement both school-based policies banning smoking on school grounds and school-based smoking prevention programming, phased in over a three-year period, in all schools. Research conducted earlier from this study showed significant differences in influences of policy and programmes on the smoking behaviour of grade 10 and grade 12 students (Murnaghan *et al.*, 2007; 2008). Moreover, analysis of a single group of students, who we assume were followed over the three waves of data collection (grade 10–12), showed that programmes and policies associated with banning smoking and enforcing smoking restrictions at school alone may not work unless they also adequately address the influence of smoking peers and family members. Given the findings from those papers, we were interested in understanding if smoking behaviour for two groups of students were different, as they experience the implementation of the policy in high schools in PEI: Group 1 (15–17 years of age) experienced the implementation of the policy during grade 10 in 2000 and grade 11 in 2001), and Group 2 (16–19 years of age) experienced the implementation of the policy during grade 11 in 2000 and grade 12 in 2001.

The purpose of this paper was to examine the factors related to whether or not school-based tobacco control efforts were associated with the smoking behaviour of high school students and to determine if two groups of students (Group 1 and Group 2) experienced the implementation of a new tobacco control policy differently between 2000 and 2001.

## Methods

### Sampling procedure

This study collected annual smoking behaviour data from all 10 English-speaking secondary schools<sup>1</sup> in the province of PEI (Canada) over three years (1999–2001), using the Tobacco Module of the School Health Action, Planning and Evaluation System (SHAPES); additional details about SHAPES and the Tobacco Module measures and psychometric properties are available

<sup>1</sup>The French school district was not included because confidentiality could not be guaranteed when reporting the data due to the small sample size of students.

in print (Cameron *et al.*, 2007) and online (<http://www.shapes.uwaterloo.ca>). Overall, there were 13 100 students who participated in three waves of data collection: Wave 1 ( $n = 4104$  in 1999), Wave 2 ( $n = 4417$  in 2000) and Wave 3 ( $n = 4579$  in 2001). For this paper, we report on the groups of students who had the potential to be attending one of the 10 schools over all three waves of data collection (ie, students who were in grade 9 or 10 in 1999). In effect, we can assume that there were two groups of students who would have been followed over two waves of data collection (ie, Group 1,  $n = 3022$ ); Group 2,  $n = 2943$ ).

In Wave 1 (1999), none of the schools (a) had policies banning smoking on school property or (b) were participating in provincially directed school-based smoking prevention programmes. In Wave 2 (2000), (a) four of the schools had introduced a policy banning smoking on school property and (b) the remaining six schools had implemented provincially directed school-based smoking prevention programmes (Students Working in Tobacco Can Help (SWITCH) and Kick the Nic (refer to Murnaghan *et al.* (2007) for additional details on these programmes)). In Wave 3 (2001), all 10 schools had (a) introduced a policy banning smoking on school property and (b) implemented the provincially directed school-based smoking prevention programmes (SWITCH and Kick the Nic).

## Measures

Consistent with earlier research (Biglan and Lichtenstein, 1984; Flay *et al.*, 1994; Murnaghan *et al.*, 2007; 2008), the outcome variables for smoking behaviour were defined as: (a) regular smoker (smokes every week), (b) occasional smoker (smokes, but less than weekly) and (c) non smoker (never smoked or tried once but quit). Board 1 represents those six schools that introduced new smoking prevention programmes in 2000 and the new smoking policy in 2001, whereas Board 2 represents the four schools who introduced the new tobacco policy in 2000 and the new smoking prevention programmes in 2001.

Student-level predictors included misperceptions (overestimate  $>30\%$  or underestimate  $<30\%$ ) about smoking behaviour of other youth their age; whether or not they see students smoking near school (yes = 1, no = 0); whether or not they see teachers/staff smoking near school

property (yes = 1, no = 0); knowledge that clear policy rules are in place in their school (yes = 1, no = 0); perceptions that students get in trouble if they break the smoking rules (yes = 1, no = 0); that students smoke in their school where they are not allowed (yes = 1, no = 0); gender (female = 1, male = 0) and Board (Board 1 = 1, Board 2 = 0)).

## Questionnaire implementation

Consistent with existing research, surveys were implemented by the teachers, during class time, using exam-type protocol. A more detailed description of the data collection and research protocol procedures are described elsewhere (Murnaghan *et al.*, 2007; 2008). The University of PEI Research Ethics Board and appropriate School Board Ethics' committees approved all procedures, including passive consent. In accordance with ethical requirements, anonymous data collection was required on all surveys so individual student smoking behaviour could not be tracked over time.

## Analysis

Analyses were conducted separately to examine within-group differences: one set of analyses focused on Group 1 by year and the other analyses focused on Group 2 by year. Although not ideal, this group approach provided the best means to examine changes in the prevalence of smoking behaviour over time, and to examine characteristics associated with smoking behaviour using multiple waves of cross-sectional student level-data. Next, we ran logistic regression models with all variables included. Within our logistic regression models, school was used as a class statement in order to control the effect of clustering of smoking behaviour within schools. Consistent with our earlier studies (Murnaghan *et al.*, 2007; 2008), the strongest predictor of youth smoking behaviour was the number of friends who are smoking. Therefore, for this analysis we wanted to determine if there were other predictors of smoking behaviour that could be addressed more clearly through school-level programming. In this paper, we report on these specific analyses. In order to understand the factors that are associated with smoking behaviour, 12 logistic regression models were run. Each logistic regression model compared students'

perceptions of characteristics in the school that influence smoking behaviours, as well as Board and gender influence on smoking behaviour. Model 1 was used to differentiate occasional versus non-smokers, Model 2 differentiated regular smokers versus non-smokers, and Model 3 differentiated regular smokers versus occasional smokers. Each model was run for 2000 and 2001. SPSS 15.0 was used for all analyses.

## Results

Descriptive characteristics of the student smoking behaviours between 2000 and 2001 are presented in Table 1 (Group 1) and Table 2 (Group 2). Group 1 students ranged in age from 15 to 17 while Group 2 ranges from 16 to 19. The majority of students were located predominantly in rural schools (70%), with approximately equal distribution (~50%) of females and males in Group 1 and slightly more females (51.9%) compared to males (48.1%) in Group 2.

### Group 1 results

To examine the effect of variables on the odds that a student would be a smoker as opposed to a non-smoker or occasional smoker, multi-variate logistic regression models were fit to the data for Group 1. Factors influencing the smoking behaviour of Group 1 students are presented in Table 3. In 2000, students from Board 1 were less likely to be regular smokers (OR = 0.68; 95% CI = 0.50–0.92) compared to students from Board 2. Students reporting often seeing students smoking near the school were associated with decreased likelihood of regular versus non-smoking (OR = 0.42; 95% CI = 0.19–0.94) and a substantial decreased likelihood of regular versus occasional smoking (OR = 0.11; 95% CI = 0.01–0.89) compared to students who did not see students smoking near school property. Students attending schools in which students smoke where they are not allowed were associated with a significant increase in regular smoking (OR = 1.42; 95% CI = 1.06–1.91) compared to schools in which students do not smoke where they are not allowed.

In 2001, students reporting that there are clear rules about smoking in their school were less likely to be occasional smokers (OR = 0.42; 95% CI = 0.21–0.86) or regular smokers (OR = 0.46; 95% CI = 0.22–0.95) compared to students who

did not report clear rules being present in their school.

In Model 1, females were more likely than males to be occasional smokers (OR = 1.64; 95% CI = 1.17–2.28 and OR = 1.59; 95% CI = 1.17–2.17) for both waves of data collection.

### Group 2 results

To examine the effect of variables on the odds that a student would be a smoker, as opposed to a non-smoker or occasional smoker, multi-variate logistic regression models were fit to the data for Group 2. Factors influencing the smoking behaviour of Group 2 students are presented in Table 4. During both waves of data collection, Group 2 students were at a substantial, increased risk of regular versus non-smoking (OR = 1.88; 95% CI 1.40–2.52 and OR = 2.38; 95% CI = 1.76–3.22) and regular versus occasional smoking (OR = 1.62; 95% CI = 1.12–2.35 and OR = 1.80; 95% CI = 1.24–2.60) when students overestimated the percentage of youth their age who smoke. Moreover, between 2000 and 2001, there was a notable increased impact of the misperception about the percentage of youth smoking on the smoking behaviour of students in grade 11 and grade 12. In 2001, students who overestimated the percentage of youth their age who smoke (>30%), were at greater risk of occasional smoking (OR = 1.42; 95% CI = 1.05–1.94) compared to students who did not overestimate youth smoking rates.

### Group 1 and Group 2 differences in smoking behaviour

Overall, school boards were not independently predictive of youth smoking behaviour for either Group 1 or Group 2 students; although, there was a trend across both groups where the impact of Board in relation to occasional versus non-smokers and regular versus non-smokers increased between 2000 and 2001. One exception to this finding was in 2000, Group 1 students from Board 1 (did not have policy in place) were less likely than students from Board 2 (had policy in place) students to be regular versus non-smokers (OR = 0.68; 95% CI = 0.50–0.92). There are a number of possible reasons for this result, including: (1) the decision by this Board 1 to increase smoking prevention programming activities and help inform schools and parents about the upcoming policy that would be implemented in

**Table 1** Student perceptions of school characteristics and smoking behaviour by year among Group 1 (grade 10, 2000 and grade 11, 2001) high school students in Prince Edward Island

Demographics		Wave 2 (2000)	Wave 3 (2001)	Chi-square
		(n = 1538)	(n = 1484)	
		% (n) <sup>a</sup>	% (n) <sup>a</sup>	
Gender	Female	50.0 (765)	49.2 (728)	$\chi^2 = 0.21, df = 1, P = 0.64$
	Male	50.0 (764)	50.8 (752)	
Smoking status	Regular smoker	21.9 (298)	23.0 (302)	$\chi^2 = 4.81, df = 2, P = 0.09$
	Occasional smoker	14.9 (203)	17.6 (231)	
	Non-smoker	63.2 (860)	59.4 (781)	
Perception of youth smoking prevalence	≥30%	68.3 (1034)	61.7 (904)	$\chi^2 = 14.40, df = 1, P < 0.001$
	<30%	31.7 (480)	38.3 (562)	
Often sees students smoking near their school	Yes	97.7 (1481)	94.4 (1395)	$\chi^2 = 20.95, df = 1, P < 0.001$
	No	2.3 (35)	5.6 (82)	
See teachers/staff smoking near school	Yes	18.2 (277)	15.8 (232)	$\chi^2 = 3.27, df = 1, P = 0.07$
	No	81.8 (1242)	84.2 (1241)	
School has clear rules about smoking	Yes	86.5 (1307)	95.3 (1397)	$\chi^2 = 69.09, df = 1, P < 0.001$
	No	13.5 (204)	4.7 (69)	
Students get into trouble for breaking smoking rules	Yes	80.0 (1205)	87.0 (1267)	$\chi^2 = 25.85, df = 1, P < 0.001$
	No	20.0 (301)	13.0 (190)	
Students at school smoke where they are not allowed	Yes	52.5 (786)	57.9 (846)	$\chi^2 = 8.71, df = 1, P < 0.01$
	No	47.5 (712)	42.1 (616)	

<sup>a</sup> Numbers may not add to total because of missing values.

**Table 2** Students perceptions of school characteristics and smoking behaviour by year among Group 2 (grade 11, 2000 and grade 12, 2001) high school students in Prince Edward Island

Demographics		Wave 2 (2000)	Wave 3 (2001)	Chi-square
		(n = 1514)	(n = 1429)	
		% (n) <sup>a</sup>	% (n) <sup>a</sup>	
Gender	Female	51.9 (785)	52.8 (752)	$\chi^2 = 0.23$ , df = 1, $P = 0.63$
	Male	48.1 (729)	47.2 (672)	
Smoking status	Regular smoker	26.3 (354)	27.8 (351)	$\chi^2 = 1.35$ , df = 2, $P = 0.51$
	Occasional smoker	20.7 (278)	21.5 (272)	
	Non-smoker	53.0 (712)	50.7 (641)	
Perception of youth smoking prevalence	≥30%	65.6 (982)	60.8 (857)	$\chi^2 = 7.25$ , df = 1, $P < 0.01$
	<30%	34.4 (515)	39.2 (553)	
Often sees students smoking near their school	Yes	98.5 (1474)	94.8 (1336)	$\chi^2 = 31.02$ , df = 1, $P < 0.001$
	No	1.5 (23)	5.2 (74)	
See teachers/staff smoking near school	Yes	19.8 (296)	17.7 (249)	$\chi^2 = 2.18$ , df = 1, $P = 0.14$
	No	80.2 (1197)	82.3 (1159)	
School has clear rules about smoking	Yes	90.9 (1356)	94.1 (1322)	$\chi^2 = 10.66$ , df = 1, $P < 0.001$
	No	9.1 (136)	5.9 (83)	
Students get into trouble for breaking smoking rules	Yes	74.7 (1105)	80.9 (1136)	$\chi^2 = 16.24$ , df = 1, $P < 0.001$
	No	25.3 (375)	19.1 (268)	
Students at school smoke where they are not allowed	Yes	58.3 (866)	62.1 (869)	$\chi^2 = 4.24$ , df = 1, $P < 0.05$
	No	41.7 (619)	37.9 (531)	

<sup>a</sup> Numbers may not add to total because of missing values.

**Table 3** Logistic regression analyses examining factors associated with smoking behaviour among Group 1 (grade 10, 2000 and grade 11, 2001) students in Prince Edward Island, Canada

		Wave 2 (2000) OR (95% CI) <sup>§</sup>	Wave 3 (2001) OR (95% CI) <sup>§</sup>	Δ in OR
<b>Model 1</b>				
<b>Occasional smoker (1) versus non-smoker (0)</b>				
School board	1	1.00	1.00	↑
	0	0.95 (0.66, 1.37)	1.13 (0.81, 1.59)	
Often sees students smoking near their school	No	1.00	1.00	↓
	Yes	3.25 (0.42, 25.0)	1.89 (0.82, 4.38)	
Teacher/staff smoking near school	No	1.00	1.00	↑
	Yes	1.60 (1.05, 2.42)*	1.81 (1.18, 2.78)**	
School has clear rules about smoking	No	1.00	1.00	↓
	Yes	1.39 (0.82, 2.34)	0.42 (0.21, 0.86)*	
Students get into trouble for breaking smoking rules	No	1.00	1.00	↑
	Yes	0.71 (0.47, 1.08)	1.36 (0.85, 2.17)	
Students at school smoke where they are not allowed	No	1.00	1.00	↓
	Yes	1.35 (0.97, 1.87)	1.19 (0.86, 1.66)	
Misperception about the number of youth who smoke	<30%	1.00	1.00	↓
	≥30%	1.75 (1.22, 2.52)**	1.27 (0.93, 1.74)	
Gender	Female	1.00	1.00	↔
	Male	1.64 (1.17, 2.28)**	1.59 (1.17, 2.17)**	
<b>Model 2</b>				
<b>Regular smoker (1) versus non-smoker (0)</b>				
School board	1	1.00	1.00	↑
	0	0.68 (0.50, 0.92)*	1.21 (0.88, 1.65)	
Often sees students smoking near their school	No	1.00	1.00	↑
	Yes	0.42 (0.19, 0.94)*	0.83 (0.46, 1.50)	
Teacher/staff smoking near school	No	1.00	1.00	↑
	Yes	1.47 (1.02, 2.13)*	2.38 (1.62, 3.48)***	
School has clear rules about smoking	No	1.00	1.00	↓
	Yes	1.37 (0.83, 2.28)	0.46 (0.22, 0.95)*	
Students get into trouble for breaking smoking rules	No	1.00	1.00	↑
	Yes	1.24 (0.81, 1.89)	2.67 (1.58, 4.52)***	
Students at school smoke where they are not allowed	No	1.00	1.00	↓
	Yes	1.42 (1.06, 1.91)*	1.21 (0.89, 1.63)	
Misperception about the number of youth who smoke	<30%	1.00	1.00	↓
	≥30%	2.50 (1.79, 3.51)***	2.24 (1.65, 3.04)***	
Gender	Female	1.00	1.00	↔
	Male	1.15 (0.86, 1.55)	1.18 (0.89, 1.58)	
<b>Model 3</b>				
<b>Regular smoker (1) versus occasional smoker (0)</b>				
School board	1	1.00	1.00	↑
	0	0.75 (0.50, 1.14)	1.13 (0.76, 1.68)	
Often sees students smoking near their school	No	1.00	1.00	↑
	Yes	0.11 (0.01, 0.89)*	0.43 (0.17, 1.09)	
Teacher/staff smoking near school	No	1.00	1.00	↑
	Yes	0.82 (0.51, 1.31)	1.44 (0.91, 2.30)	
School has clear rules about smoking	No	1.00	1.00	↔
	Yes	1.02 (0.52, 2.00)	1.10 (0.48, 2.54)	
Students get into trouble for breaking smoking rules	No	1.00	1.00	↑
	Yes	1.76 (1.03, 2.99)*	1.99 (1.05, 3.76)*	
Students at school smoke where they are not allowed	No	1.00	1.00	↔
	Yes	1.04 (0.71, 1.54)	1.02 (0.70, 1.50)	
Misperception about the number of youth who smoke	<30%	1.00	1.00	↑
	≥30%	1.48 (0.94, 2.34)	1.73 (1.18, 2.55)**	
Gender	Female	1.00	1.00	↔
	Male	0.67 (0.45, 0.99)	0.74 (0.51, 1.06)	

Note: § Odds ratios adjusted for all other variables in the model.

\* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$ .

↓Odds ratio decreased, ↔Odds ratio remained the same (OR ± 0.1), ↑Odds ratio increased.

**Table 4** Logistic regression analyses examining factors associated with smoking behaviour among Group 2 (grade 11, 2000 and grade 12, 2001) students in Prince Edward Island, Canada

		Wave 2 (2000) OR (95% CI) <sup>§</sup>	Wave 3 (2001) OR (95% CI) <sup>§</sup>	Δ in OR
<b>Model 1</b>		<b>Occasional smoker (1) versus non-smoker (0)</b>		
School board	1	1.00	1.00	↑
	0	0.79 (0.57, 1.09)	1.36 (0.98, 1.90)	
Often sees students smoking near their school	No	1.00	1.00	↑
	Yes	0.89 (0.23, 3.47)	1.19 (0.60, 2.37)	
Teacher/staff smoking near school	No	1.00	1.00	↑
	Yes	1.35 (0.92, 1.98)	1.60 (1.04, 2.46)*	
School has clear rules about smoking	No	1.00	1.00	↓
	Yes	1.42 (0.80, 2.52)	1.08 (0.52, 2.23)	
Students get into trouble for breaking smoking rules	No	1.00	1.00	↑
	Yes	0.88 (0.61, 1.27)	1.11 (0.74, 1.66)	
Students at school smoke where they are not allowed	No	1.00	1.00	↑
	Yes	1.04 (0.77, 1.41)	1.16 (0.84, 1.61)	
Misperception about the number of youth who smoke	<30%	1.00	1.00	↑
	≥30%	1.15 (0.85, 1.55)	1.42 (1.05, 1.94)*	
Gender	Female	1.00	1.00	↓
	Male	1.56 (1.16, 2.10)**	1.30 (0.96, 1.76)	
<b>Model 2</b>		<b>Regular smoker (1) versus non-smoker (0)</b>		
School board	1	1.00	1.00	↑
	0	0.93 (0.69, 1.26)	1.13 (0.83, 1.52)	
Often sees students smoking near their school	No	1.00	1.00	↑
	Yes	0.34 (0.13, 0.90)	1.13 (0.59, 2.13)	
Teacher/staff smoking near school	No	1.00	1.00	↑
	Yes	1.97 (1.41, 2.76)***	2.20 (1.51, 3.22)***	
School has clear rules about smoking	No	1.00	1.00	↓
	Yes	0.99 (0.59, 1.68)	0.75 (0.38, 1.46)	
Students get into trouble for breaking smoking rules	No	1.00	1.00	↑
	Yes	1.68 (1.16, 2.43)**	2.07 (1.34, 3.19)**	
Students at school smoke where they are not allowed	No	1.00	1.00	↑
	Yes	1.10 (0.83, 1.45)	1.27 (0.94, 1.72)	
Misperception about the number of youth who smoke	<30%	1.00	1.00	↑
	≥30%	1.88 (1.40, 2.52)***	2.38 (1.76, 3.22)***	
Gender	Female	1.00	1.00	↓
	Male	1.04 (0.79, 1.36)	0.89 (0.67, 1.18)	
<b>Model 3</b>		<b>Regular smoker (1) versus occasional smoker (0)</b>		
School board	1	1.00	1.00	↓
	0	1.21 (0.84, 1.75)	0.85 (0.59, 1.24)	
Often sees students smoking near their school	No	1.00	1.00	↑
	Yes	0.33 (0.09, 1.24)	0.98 (0.43, 2.19)	
Teacher/staff smoking near school	No	1.00	1.00	↓
	Yes	1.48 (0.98, 2.23)	1.32 (0.85, 2.06)	
School has clear rules about smoking	No	1.00	1.00	↔
	Yes	0.76 (0.39, 1.49)	0.66 (0.29, 1.50)	
Students get into trouble for breaking smoking rules	No	1.00	1.00	↔
	Yes	1.89 (1.21, 2.93)**	1.92 (1.15, 3.19)*	
Students at school smoke where they are not allowed	No	1.00	1.00	↔
	Yes	1.12 (0.80, 1.58)	1.17 (0.81, 1.71)	
Misperception about the number of youth who smoke	<30%	1.00	1.00	↑
	≥30%	1.62 (1.12, 2.35)*	1.80 (1.24, 2.60)**	
Gender	Female	1.00	1.00	↔
	Male	0.63 (0.45, 0.89)**	0.62 (0.44, 0.88)**	

Note: § Odds ratios adjusted for all other variables in the model.

\* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$ .

↓ Odds ratio decreased, ↔ Odds ratio remained the same ( $OR \pm 0.1$ ), ↑ Odds ratio increased.

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their schools, fall of 2000, as well as, (2) the development of student-led tobacco reduction teams for schools from that Board.

Students who reported seeing teachers/staff smoking near the school were at an increased risk of both regular and occasional smoking compared to non-smoking. For Model 3, the risk was not significant. However, the impact of seeing teachers/staff smoking appeared to increase between 2000 and 2001 for all three models.

In Models 2 and 3, students getting into trouble for breaking the smoking rules were associated with increased risk of being regular smokers, and the impact of this increased between 2000 and 2001. In addition, reports of students smoking where they were not allowed was not an important factor on smoking behaviour. However, the percentage of students reporting that students smoke where they are not allowed increased between 2000 and 2001.

Interestingly, in this study, females from both Group 1 (OR = 1.64; 95% CI = 1.17–2.28; OR = 1.59; 95% CI = 1.17–2.17) and Group 2 (OR = 1.56; 95% CI = 1.16–2.10; OR = 1.30; CI = 0.96–1.76) were consistently more likely to be occasional smokers than males.

In general, the characteristic associated with an increased likelihood of regular and occasional smoking for 2000 and 2001 was students overestimating the percentage of youth their age who smoke. This finding was consistent for both Groups 1 and 2 and across all smoking behaviours (Models 1, 2 and 3). However, students overestimating the percentage of youth their age that smoke did not change significantly from 2000 to 2001.

### Changes in smoking behaviour between 2000 and 2001

Between 2000 and 2001, Group 1 students showed positive change (10.2%) in awareness about the existence of a tobacco policy, but also in beliefs about the smoking policy and enforcement (Table 1). However, findings from this younger group showed a 5.0% change in regular smoking behaviour (21.9%–23%) and an 18% change in occasional smoking behaviour (14.9%–17.6%). There was a significant decrease (3.4%) in reports of students seeing other students smoking near the school property ( $\chi^2 = 20.95$ ,  $df = 1$ ,  $P < 0.001$ ) and students overestimating the percentage of students their age who smoke (9.7%,  $\chi^2 = 14.40$ ,

$df = 1$ ,  $P < 0.001$ ). School policies and enforcement of those policies also showed strong positive changes during the final two waves of data collection. A greater percentage of students reported increased knowledge about clear smoking rules being in place in their school (10.2%,  $\chi^2 = 69.09$ ,  $df = 1$ ,  $P < 0.001$ ) and that students in their school who break the rules get in trouble (8.8%,  $\chi^2 = 25.85$ ,  $df = 1$ ,  $P < 0.001$ ). Further, fewer students reported students smoking where they were not allowed (10.3%,  $\chi^2 = 8.71$ ,  $df = 1$ ,  $P < 0.01$ ).

For Group 2 students (Table 2), there was also a positive change in students knowing that there were clear smoking policy rules in place (3.5%). Between 2000 and 2001, smoking behaviour for this group increased by 4.6% for regular smoking (26.3%–27.8%) and 3.9% for occasional smoking (20.7%–21.5). Reports of students smoking near their school property decreased by 3.8% ( $\chi^2 = 31.02$ ,  $df = 1$ ,  $P < 0.001$ ) and students overestimating the percentage of students their age who smoke decreased by 7.3%, ( $\chi^2 = 7.25$ ,  $df = 1$ ,  $P < 0.01$ ). A greater percentage of students reported knowledge about clear smoking rules being in place in their school (3.5%,  $\chi^2 = 10.66$ ,  $df = 1$ ,  $P < 0.001$ ), that in their school students who break the rules get in trouble (8.3%,  $\chi^2 = 16.24$ ,  $df = 1$ ,  $P < 0.001$ ) and that students smoke where they are not allowed (6.5%,  $\chi^2 = 4.24$ ,  $df = 1$ ,  $P < 0.05$ ).

From our analyses, we were able to examine student perceptions of school characteristics and smoking behaviour adjusting for age for students in grade 11 in 2000 (Table 2) compared to students in grade 11 in 2001 (Table 1). Between 2000 and 2001, both regular (26.3%–23%) and occasional smoking (2.7%–17.6%) behaviour of grade 11 students decreased. Grade 11 students' perceptions of changes in overestimation of youth their age smoking, and seeing students, teachers and/or staff smoking near the school and students smoking where they were not allowed also decreased. Moreover, grade 11 students showed a positive increase in their perceptions of smoking policy implementation including knowledge of clear rules, and that if students break the rules they get in trouble.

### Discussion

The increasing use of tobacco among high-school students is a serious public health concern. Yet,

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little research has addressed differences in rates of smoking among targeted groups within these populations, such as grades within schools. This current study differentiated smoking behaviour and influences among two groups of students, one year apart, during implementation of a new smoking policy. Specifically, the data presented in this study suggest that the proportion of both occasional and regular tobacco use increased between 2000 and 2001. Moreover, junior level students (Group 1) showed a much stronger increase percentage in occasional smoking behaviour (18%) compared to Group 2 students (3.9%). This finding is supportive of recent literature (Leatherdale *et al.*, 2005; Lovato *et al.*, 2007; Murnaghan *et al.*, 2007) that suggests that more youth are adopting occasional smoking behaviour, and may add further understanding to the influence of senior students on the smoking behaviour of junior level students (Reitsma and Manske, 2004; Leatherdale *et al.*, 2005; Murnaghan *et al.*, 2007). These findings contribute to additional support for initiating smoking prevention programmes for younger age groups (with booster sessions for transition periods such as start of middle (grade 7–9) or secondary (grade 10–12) school years). Additionally, female students from Group 1 were more likely to be occasional smokers. Smoking among this junior female group may be associated with a sense of place (ie, smoke hole), struggling to say no especially after the first cigarette, and feeling pressured by friendship groups (Lucas and Lloyd, 1999). Further studies that explore gender differences in smoking behaviour are needed across targeted age groups.

A new finding from this study was that both perceptions of the smoking rates of other students and seeing smoking near the school decreased from 2000 to 2001 among both groups of students. This finding may suggest that the introduction of the new tobacco policy and programming may have an impact on students' knowledge about the percentage of youth their age who smoke. It may be that by 2001 schools were more vigilant in monitoring the implementation of the policy and may have influenced fewer students to smoke near the school property.

Prior to the 2001 data collection, all schools received the results of their school's 2000 data collection. This feedback report (precursor to

current SHAPES Feedback Reports) provided school-level results compared to national results followed by a section on recommendations for action. We cannot suggest that this knowledge exchange process was directly linked to the reduction in misperception of youth smoking. However, we might suggest that using local data about the overestimation of smoking and its impact on smoking behaviour of youth could be a simple cost-effective tool for tobacco control reduction in schools.

Earlier research suggests that seeing smoking near the school could undermine new policies (Kumar, O'Malley and Johnston, 2005; Murnaghan *et al.*, 2009). However, in this study, seeing students smoke near school was associated with a decrease in smoking behaviour from 2000 to 2001. This finding may be explained by the fact that the new policies banning smoking on school property created the introduction of 'smoke holes,' places close or near school property where youth congregate to smoke cigarettes during the school day. Consistent with the Social Cognitive Theory, these 'smoke holes' may provide both the social (eg, smoking friends, teachers) and physical (eg, smoking site) environment where students can be influenced through observational learning and vicarious experience (Bandura, 1986). Although we cannot suggest reasons why results from this study differ, we suggest that the introduction of the policies and programmes to reduce tobacco control may have provided positive reinforcement to the no smoking activities. However, we suggest that a better understanding of the meaning that these smoke holes play in youth smoking behaviour in schools may contribute new knowledge for future interventions.

Students' perceptions of the school having clear rules about smoking, and students getting into trouble for breaking the rules increased from 2000 to 2001 among both groups of students. This finding contributes to earlier research suggesting that strongly enforced policies are necessary for successful tobacco control (Proescholdbell *et al.*, 2000; Szabo *et al.*, 2006). It may be that when students do not perceive the rules to be clear, and when few, if any, repercussions occur for breaking the rules, that students will tend to follow the behaviour of other students. Whether students perceive the smoking behaviour in a positive or negative way and how well the policies are

communicated and enforced may serve as a guide for youth smoking behaviour.

Disappointingly, our study showed an increased prevalence of both regular and occasional smoking from 2000 to 2001 among both groups of students. We suggest that smoking rates increased because students are getting older and the uptake of cigarettes is increasing. In a recent study, Lovato *et al.* (2007) noted that more youth are adopting occasional smoking behaviour, and studies by Reitsma and Manske (2004), Leatherdale *et al.* (2005) and Murnaghan *et al.* (2007) showed that smoking rates increase as youth age during the adolescent years. However, we had hoped that smoking rates would decrease when policies were being implemented and a presence of tobacco control measures existed in schools and communities. Further, the increases in occasional and regular smoking were greater for Group 1, the junior level students, compared to the senior level students. In our previous studies of grade 10 and then grade 12 students (Murnaghan *et al.*, 2007; 2008) we noted that as students move through high-school, the smoking rates (both occasional and regular) increase. What we need to consider is the need for intervention at an early age with continued booster inoculations at strategic intervals such as transition periods, when youth move from one school to another or from a specific grade level or age group to another. This finding may contribute further support for studies that have shown the influence of senior students on the smoking behaviour of junior level students (Reitsma and Manske, 2004; Leatherdale *et al.*, 2005; Murnaghan *et al.*, 2007) and targeted programmes to address tobacco control for specific age groups or grades within schools.

However, when we adjusted for age, our data also showed that both regular and occasional smoking rates for grade 11 students decreased. This is consistent with our earlier papers that showed the smoking rates of grade 10 students (Murnaghan *et al.*, 2007) decreased over the three years of the study (regular smoking from 20%–15.8% and occasional smoking from 19.2%–14.3%). Similarly, in our analysis of grade 12 students, there was also a decrease in regular (30.1%–24.6%) and occasional smoking (20.6%–19.1%) over the three years of the study. Further research to look at changes in smoking behaviour across schools and grades would be important for future

analyses. These findings support earlier studies that suggest targeting tobacco control efforts at different age groups is needed, particularly in high schools where tobacco use is known to increase with the age and grade of student (Leatherdale *et al.*, 2005; Murnaghan *et al.*, 2007; 2008).

Additionally, perceptions of students at school smoking where they are not allowed increased from 2000 to 2001 among both groups of students. These perceptions may have increased because students are now smoking in areas near school property that are very visible to the students. In this study, students' knowledge and beliefs about smoking behaviour and policies and programmes to support reduction in tobacco control were enhanced. Further, school-level factors alone did not influence student smoking behaviour of either group of students. This finding is consistent with the strong reviews that showed many factors, not just one single approach, influenced adolescent smoking (Reid *et al.*, 1995; Stead *et al.*, 1996; Tyas and Pederson, 1998), and that the most effective tobacco control campaigns use a comprehensive set of policy measures, target different populations and meet different needs (Jha and Chaloupka, 2000; Leatherdale *et al.*, 2005; Murnaghan *et al.*, 2007). Consistent with a recent review by Sandford (2007), which suggests that there is little evidence that school based smoking education programmes have a lasting impact on youth smoking, we suggest that a population approach using government and community interventions are required to address youth smoking prevention.

### Limitations of the study

This study is subject to limitations. First, self reported surveys were used where the validity of the responses may be questioned. The small population of high-schools (10) within the province was not sufficient power to conduct higher-level analysis at the school level. Classroom level analysis could not be completed because of variability in the class-level data collection procedures. Further, we acknowledge that we cannot account for the small portion of students who failed a grade and may have answered the question during the repeat year, students who may have answered the questionnaire one year but not the next, students who left the school for other reasons and students who were new to the grade that year.

## Conclusion

The results of this study provide important information about how Group 1 (grade 10 in 2000 and grade 11 in 2001) and Group 2 (grade 11 in 2000 and grade 12 in 2001) students experienced tobacco control efforts differently. Students' knowledge and awareness of smoking policies and policy enforcement, students' perceptions of schools having clear rules and students' perceptions that students who break the rules get into trouble, increased. However, between 2000 and 2001, occasional and regular smoking rates for both Group 1 and Group 2 increased. Only when we adjusted the data by age did we see a decrease in regular and occasional smoking rates for grade 11 students between 2000 and 2001. The characteristic associated with an increased likelihood of regular and occasional smoking was students overestimating the percentage of youth their age who smoke. This information may contribute new insight for future cost-effective interventions for reducing tobacco use among high-school students.

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