

Smoking in Ontario Schools

Does Policy Make a Difference?

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ABSTRACT

Objective: Studies in other countries have shown that school tobacco control policy has potential to prevent smoking uptake in adolescents. Since no Canadian research has studied this association, we assessed the statistical link between school tobacco policy and smoking status in Ontario elementary and secondary schools.

Methods: We conducted secondary analysis of data collected using the School Smoking Profile, a cross-sectional, self-report questionnaire. School policy variables were formed from five survey items concerning students' perceptions of school tobacco control policy. Smoking status was determined through self-report measures which had been validated by carbon monoxide testing. Logistic regression models used school policy variables to explain smoking status in elementary and secondary schools, controlling for school location, school size, and student's grade level.

Results: The smoking policy variables, rules and enforcement, explained smoking status after controlling for other variables. In elementary schools, perceptions of stronger enforcement reduced the odds of being a smoker (OR=0.39, CI₉₅=0.34-0.44). In secondary schools, enforcement lost its protective effect (OR=1.05, CI₉₅=1.00-1.10). In addition, student perceptions that rules were strong were indicative of increased smoking in secondary schools (OR=1.32, CI₉₅=1.27-1.37).

Discussion: Strong enforcement of school tobacco control policy appears to be effective in elementary schools but is not as helpful in secondary schools. Secondary school policy-makers should consider modifying their sanctions to avoid alienating smokers.

La traduction du résumé se trouve à la fin de l'article.

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Currently 45,000 Canadians die of smoking-related causes each year, and despite all efforts at reduction, more than one fifth of all Canadians smoke.¹ Many people start smoking in their adolescent years. In fact, recent statistics show that of all adult smokers, 85% began before the age of 18.¹ Although Canadian federal laws make it illegal for people under the age of 18 to buy cigarettes, 22 % of Canadians aged 15 to 19 smoke.² Therefore, it is important that all avenues of smoking prevention directed at youth be considered.

Comprehensive prevention programs that aim to change smoking behaviour at a population level usually include a mix of public education and policy with the goal of changing the social environment in which smoking occurs.³ Schools are an important target for youth smoking prevention because schools can be environments that socially reinforce behaviours.⁴

We systematically searched for literature published from 1966-2002 that statistically assessed the association of school tobacco control policies with smoking status. Four of five studies identified reported moderate associations of school tobacco policy with smoking status.⁵⁻⁸ The association in one study was not significant.⁹ Wakefield et al.⁸ reported the strongest relation for lower prevalence when school smoking bans were strongly enforced ($r = 0.86$ [CI₉₅ 0.77-0.9]) $p < 0.001$). These studies spanned geography (three continents), time (1989-2002) and definitions for smoking status and tobacco policy. All studies were cross-sectional, and ranged in size from 55 to 347 schools. All but one studied secondary schools. The search did not identify any Canadian studies.

The current study assessed the statistical link between school tobacco policy and the smoking rates in Ontario elementary and secondary schools. Ontario's 1994 Tobacco Control Act (TCA) banned smoking in school buildings and on school property in all publicly funded schools.¹⁰ However, since schools monitor compliance, wide variation exists.¹¹ The current study associates student perceptions of smoking rules and enforcement with smoking status.

METHODS

Design and sample

Researchers approached 14 school boards in proximity to the research centre and

accepted the first 8 boards who agreed to participate. A total of 57 elementary and 29 secondary schools participated in the School Smoking Profile (SSP). All classes in school grades 6 to OAC* participated. Questionnaire administration had two conditions: in the field grade condition, teachers administered the surveys; in the research grade, trained researchers administered the survey and conducted carbon monoxide testing.

The university Research Ethics Board approved all procedures, including passive consent. The researchers informed the parents of the students via mail, and asked the parents to return the signed letter only if they refused permission. Passive consent produces higher parental permission rates, thereby increasing the probability that significant treatment effects are detected.¹²

Instrument

Students completed the *School Smoking Profile* as part of an SSHRC-funded study examining the validity and reliability of the instrument which supports targeting and evaluation of youth tobacco control initiatives at community levels by providing school-level feedback to schools. The *School Smoking Profile* contains 43 items covering areas such as smoking behaviour, cigarette access, school characteristics concerning policy, and family characteristics. The validity and reliability of the instrument has been recorded in an earlier report, including the ability of self-report to correctly classify 96% of non-smokers assessed by exhaled carbon monoxide levels.¹³

Variables

The dependent variable, cigarette smoking status, was defined using Health Canada's six-level score: lifetime abstainer, former experimenter, former smoker, beginner, non-daily smoker, and daily smoker.¹⁴ For the purposes of this analysis, the first three levels were collapsed into a current non-smoker group and the last three levels collapsed into a current smoker group (Table I). The independent variable of primary interest in this research was strength of school tobacco policy. Five items deter-

TABLE I
Smoking Status Variable

Survey Item	Status
Non-smoker Group	
Has never smoked a cigarette, not even a few puffs	Lifetime abstainer
Has not smoked 100 cigarettes in lifetime, and has not smoked a cigarette, not even a few puffs, in the last 30 days	Past experimenter
Has smoked 100 or more cigarettes in lifetime, but has not smoked a cigarette, not even a few puffs, in the last 30 days	Former smoker
Current Smoker Group	
Has not smoked 100 or more cigarettes in lifetime, but has smoked a cigarette in the last 30 days	Beginner
Has smoked 100 or more cigarettes in lifetime, and has smoked in the last 30 days, but not every day	Non-daily smoker
Has smoked 100 or more cigarettes in lifetime, and has smoked every day in the last 30 days	Daily smoker

TABLE II
Summary of Items and Factor Loadings for Varimax Orthogonal Two-Factor Solution for the Student Smoking Survey (N = 29,888)

Item	Factor Loading		Communality
	1 Rules	2 Enforcement	
You can be fined for smoking on school property. (True, I'm not sure, False)	0.32	-0.05	0.29
I often see students smoking near this school. (True, Usually true, I'm not sure, Usually false, False)	-0.04	0.55	0.75
This school has a clear set of rules about smoking for students to follow. (True, Usually true, Usually false, False)	0.50	-0.04	0.67
If students are caught breaking the smoking rules at this school, they get into trouble. (True, Usually true, I'm not sure, Usually false, False)	0.51	0.13	0.69
How many students at this school smoke where they are not allowed to? (A lot, Some, A few, None)	0.05	0.57	0.76

Note: **Bold** indicates highest factor loadings.

mined the perceived school policy variables (Table II).

Analyses controlled for possible confounding variables, school size and school location. We classified elementary and secondary schools separately into tertiles based on number of students. School postal codes served to divide urban from rural schools. An area serviced by a rural route mail delivery has a "0" in the second position of a postal code denoting a "rural" postal code.¹⁵

Data analysis

All analyses used SAS Version 8.¹⁶ After examining descriptive statistics for the sample, we conducted principal components analysis to determine factors underlying the five policy items. Next, we conducted χ^2 and correlation analyses to assess univariate trends among smokers and non-smokers by levels of the independent variables. Variables exhibiting significant univariate relationships with smoking status

were entered into separate logistic regressions for elementary and secondary schools. The regression model explored the ability of policy variables (rules and enforcement), grade, school size, and school location to explain variance in smoking status.

RESULTS

Characteristics of participants

The survey response rate included 89.1% of students in 86 participating schools. Current smokers comprised 23.1% of the sample (n = 6,795). The 57 elementary schools (grades 6-8 only) provided 6,430 students, representing 21.5% of the total sample. The 29 secondary schools provided 23,458 students in grades nine to OAC, representing 78.5% of the total sample. The 7 elementary and 3 secondary schools classified as rural provided 6.6% of the sample. Table III contains details on all demographic descriptors.

* At the time of the study, Ontario schools included an "Ontario Academic Credit" year after grade 12 for students who expected to attend university.

TABLE III
Demographic Characteristics of Participants (N = 29,888)

Characteristic	n	%
Grade Level		
6	2,170	7.27
7	2,260	7.57
8	2,183	7.31
9	6,331	21.21
10	5,873	19.68
11	5,092	17.06
OAC	1,690	5.66
Gender		
Male	14,894	50.05
Female	14,865	49.95
Smoking Status		
Current non-smoker	22,673	76.94
Lifetime abstainer	14,638	49.67
Past experimenter	7,466	25.34
Former smoker	569	1.93
Current smoker	6,795	23.06
Beginner	2,308	7.83
Non-daily smoker	1,617	5.49
Daily smoker	2,870	9.74
School Location		
Urban	27,919	93.41
Rural	1,969	6.59
Elementary School Size		
<90	1,258	19.57
90-149	1,842	28.65
>149	3,329	51.78
High School Size		
<800	3,675	15.67
800-1199	6,303	26.87
>1199	13,480	57.46

Characteristics of school policies

Students responded to five questionnaire items pertaining to school policy. Principal components analysis of these items resulted in two factors with eigenvalues greater than 1 (Table II). Three items loaded simply and greater than 0.30 on a factor centred on rules. Factor scores for this factor ranged from 1.3 to 6.0. However, only 3.6% of the sample rated their school rules as weak (<3.0). A third of the sample (n = 9,665) gave the highest score possible, 6.0. Tests of the between-school variance of the scores for rules found significant differences (p<0.0001) but no significant differences in school score within schools (p=0.68). This suggests that students within a school rated their school’s policy similarly, but rules at different schools were perceived as varying in strength.

The remaining two policy items centred around the presence of smokers on campus and loaded simply (>0.50) on a factor named ‘enforcement’. Factor scores ranged from 1.1 to 4.5. Almost half (46.7%, n = 13,387) of the students rated their school as having poor enforcement (<1.7) while just 7.8% rated their school as having strong enforcement (>3.9). Once again, the between-school variance on the

TABLE IV
Mean Values or Frequencies for Predictor Variables as a Function of Smoking Status for Secondary Schools and Elementary Schools

Variable	Elementary Schools		χ^2
	Current Non-smoker	Current Smoker	
Grade Level			<0.0001
Grade 6	97.36	2.64	
Grade 7	96.45	3.55	
Grade 8	92.08	7.92	
Gender			0.0358
Male	94.74	5.26	
Female	95.86	4.14	
School Location			0.8346
Rural	95.42	4.58	
Urban	95.26	4.74	
School size			<0.0001
<90	94.83	5.17	
90-149	93.67	6.33	
>149	96.35	3.65	
Strength of Rules			<0.0001
1 weak	94.40	5.60	
2	84.90	15.10	
3	92.01	7.99	
4	93.97	6.03	
5	92.16	7.84	
6 strong	94.80	5.20	
Enforcement			<0.0001
1 weak	79.13	20.87	
2	90.34	9.66	
3	96.33	3.67	
4 strong	98.69	1.31	
Variable	Secondary Schools		χ^2
	Current Non-smoker	Current Smoker	
Grade Level			<0.0001
Grade 9	81.60	18.40	
Grade 10	73.49	26.51	
Grade 11	68.16	31.84	
Grade 12	61.92	38.08	
OAC	66.81	33.19	
Gender			0.1785
Male	72.32	27.68	
Female	71.52	28.48	
School location			0.0427
Rural	74.68	25.32	
Urban	71.78	28.22	
School size			0.0011
<800	71.53	28.47	
800-1199	70.27	29.73	
>1199	72.79	27.21	
Strength of Rules			<0.0001
1 weak	73.79	26.21	
2	73.08	26.92	
3	73.64	26.36	
4	77.62	22.38	
5	75.87	24.13	
6 strong	64.25	35.75	
Enforcement			<0.0001
1 weak	69.53	30.47	
2	64.73	35.27	
3	66.84	33.16	
4 strong	58.23	41.77	

TABLE V
Summary of Logistic Regression Analysis Predicting Smoking Status

Predictor	β	SE	Odds Ratio
Elementary School Students			
Enforcement	-0.95	0.06	0.39
Grade level	0.44	0.08	1.55
School size	-0.25	0.08	0.78
Secondary School Students			
Enforcement	0.05	0.02	1.05
Rules	-0.12	0.02	1.32
Grade level	0.23	0.01	1.25
School size	0.19	0.08	0.91

enforcement factor was significant (p<0.0001) but the within-school variance was not (p=0.67).

Trends in smoking status

The percentage of current smokers increases with each grade level from grade 6 to

12, and shows a slight decrease in OAC ($p < 0.0001$). There is no significant difference in smoking status between males and females ($p = 0.18$), and no difference among urban and rural schools. Larger elementary and high schools have significantly fewer current smokers than smaller schools ($p < 0.001$). The relation of smoking status to the policy factors, rules and enforcement, differed in elementary and secondary schools. Elementary schools with weak enforcement ratings had more current smokers than schools with a high score on enforcement. This trend reversed in secondary schools. The strength of the second policy variable, rules, was not related to smoking status in elementary schools; however, in secondary schools, students who gave their school the highest score on strength of rules were more likely to be smokers than students who rated their school lower. Table IV displays the full results of the chi square statistics.

Predictors of smoking

To assess the association between school policy and smoking status, logistic regressions were conducted separately for elementary and high schools. Each regression model tested the association of four variables (enforcement, rules, grade level, and school size) with smoking status. Table V displays the results of the logistic regressions.

In elementary schools, three of four variables held significant relations with smoking status after controlling for other variables in the model. A high score on the policy variable enforcement indicates that students have reduced odds of being a current smoker (OR = 0.39, CI₉₅ 0.34 - 0.44). In other words, elementary school students are less likely to be current smokers if they rarely see people smoking near the school or where they are not allowed. The second policy variable, rules, did not contribute significantly to the model. As elementary school students pass to a new grade, they are 1.55 (CI₉₅ 1.32-1.81) times more likely to be a current smoker, while students attending a large elementary school (≥ 150 students) are less likely to be a current smoker (OR = 0.78, CI₉₅ 0.67-0.91).

In secondary schools, all four variables met the significance level to be included in the model. The enforcement variable predicted a very slight increase in the odds of

being a current smoker (OR = 1.05, CI₉₅ 1.00-1.10). Students who rated their school smoking rules as strong were 1.32 (CI₉₅ 1.27-1.37) times more likely to be a current smoker. The relation of grade and school size to smoking status paralleled that in elementary schools. Each increasing grade increased the odds by 1.25 times (CI₉₅ 1.22-1.28) of being a current smoker while students in large schools ($\geq 1,200$ students) had lower odds of being a current smoker (OR = 0.91, CI₉₅ 0.874-0.947).

DISCUSSION

Policy variables had differing relations to smoking status in elementary and high schools. Enforcement was strongly protective against current smoking in elementary schools but associated with a slight increase in the odds of being a current smoker in secondary schools. In secondary schools only, students' perceptions of stronger rules are associated with increased odds of smoking. However, in our Ontario-based study, where rules are set by province-wide legislation, students in both elementary and secondary schools consistently rated rules as strong. This restricted variance may have limited our ability to detect a relationship with smoking status. Since our regression analyses categorized former smokers as current non-smokers, we investigated whether differences across school level could be the result of a greater proportion of former smokers in secondary school populations. However, former smokers (students who previously smoked more than 100 cigarettes but have not smoked in the past 30 days) constitute only 3.3% of the secondary school sample and 0.4% of the elementary school sample. Their impact on perceptions of policy is likely to be minimal.

The cross-sectional nature of the data meant we were unable to determine direction of causality. It seems likely that since the percentage of current smokers increases considerably with the highest possible rules score, current smokers (who experience the direct consequences of the rules) feel that the rules are too strict. In the case of enforcement of policy, the wider variation in scores may reflect local implementation of enforcement. In elementary schools, where a concurrent observational study

reported that only one school had students smoking on school grounds or the periphery, enforcement efforts are associated with fewer current smokers. However, the same study observed smokers and evidence of smoking in the same locations at 90% of secondary schools. In this case, increased enforcement may be a reaction to administrators' seeing more students smoking, rather than vice versa. However, we cannot determine the direction of causation. The above findings on rules and enforcement control for context variables. Significant among these, in both school types, increasing grade level and decreasing school size increased the odds of being a current smoker.

The use of students' opinions and perceptions of school policy is a strong point in this study, as compared to previous studies that used one administrator or teacher's report to define the school tobacco policy.^{5,6,9} The consistency of student responses within schools suggests the reliability of student perceptions of smoking policy. The results strongly suggest separating elementary and secondary schools in the statistical analysis of school policy variables in future research because of the marked differences in results between the two school types.

Location was not found to be a significant variable in predicting smoking status in this study, but future researchers may investigate this further considering students' home location rather than the location of the school building.

One potential limitation of our study involves the decision to include students with previous smoking experience but who did not smoke in the past 30 days (i.e., former smokers) in our current non-smoker category. While opinions on the strength of rules did not appear to vary between never smokers and former smokers, never smokers had more favourable opinions about enforcement. In this latter case, former smokers were more similar to current smokers than to never smokers. A second potential limitation relates to the generalizability of results due to our non-representative sample. While not completely resolving that concern, the smoking rates in our study (23%) closely paralleled those obtained by the 2001 Ontario Student Drug Use Survey (23.6%), although there was some within-grade variation between studies.¹⁷

The results of this study have implications for policy in schools. Strong provincial laws prohibiting smoking on school property are clear to all students, but secondary schools need to carefully consider the sanctions used against smokers so as not to alienate them from the school. However, enforcing the tobacco policy by keeping smokers off school property appears to be an effective preventive measure at the elementary school level. A longitudinal study would help determine direction of causality with these policies.

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RÉSUMÉ

Objectif : Des études menées dans d'autres pays ont montré que les politiques de lutte contre le tabagisme à l'école peuvent parfois empêcher les adolescents de commencer à fumer. Comme aucune étude canadienne n'a encore porté sur cette association, nous avons évalué le lien statistique entre les politiques scolaires de lutte contre le tabagisme et l'usage du tabac dans les écoles primaires et secondaires de l'Ontario.

Méthode : Nous avons procédé à l'analyse secondaire de données recueillies à l'aide du *School Smoking Profile*, un questionnaire transversal d'auto-évaluation du tabagisme dans les écoles. Les variables des politiques scolaires ont été déterminées à partir des cinq éléments du questionnaire portant sur la perception, par les élèves, des politiques de lutte contre le tabagisme à l'école. L'usage du tabac a été déterminé au moyen de mesures d'autodéclaration validées par un test de dépistage du monoxyde de carbone. Des modèles de régression logistique fondés sur les variables des politiques scolaires ont servi à expliquer l'usage du tabac dans les écoles primaires et secondaires, en tenant compte de l'emplacement de l'école, de sa taille et du niveau de l'élève.

Résultats : Les variables, les règles et l'application de la politique de lutte contre le tabagisme ont servi à expliquer l'usage du tabac, après élimination des autres variables. Au primaire, la perception d'une application vigoureuse de la politique antitabac réduisait les probabilités de devenir fumeur (RC = 0,39, IC de 99 % = 0,34-0,44). Au secondaire, non seulement l'application de la politique perdait-elle son effet protecteur (RC = 1,05, IC de 99 % = 1,00-1,10), mais la perception par les élèves de l'existence de règles strictes était liée à un tabagisme accru (RC = 1,32, IC de 99 % = 1,27-1,37).

Discussion : L'application vigoureuse d'une politique de lutte contre le tabagisme à l'école semble être efficace au primaire, mais elle n'est pas aussi utile au secondaire. Les décideurs des écoles secondaires devraient songer à modifier leurs sanctions pour éviter de se mettre les fumeurs à dos.

COMING EVENTS / À VENIR

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First Nations Nutrition and Health Conference

17-18 June 2004

Capilano Territory, Squamish First Nation

This aboriginal-initiated volunteer project is being undertaken to promote traditional culture-based means to remedy the poor physical and mental health status of the people of the First Nations.

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Friends of Aboriginal Health

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