ABSTRACT

We evaluated the impact of the November 1994 ban on smoking on school property in Ontario. Telephone interviews were conducted at the end of the 1995-96 school year with 213 high school administrators. Almost all high schools (96%) prohibit smoking on school property. Although some smoking still occurs on school property, the location of smoking by students has changed, giving rise to perceptions of both benefits and risks, as well as varying complaints from parents, students, neighbours, and nearby businesses. Most of the problems arising from the ban are viewed as minor. Local conditions, particularly the geographic environment of the school, appear to be important determinants of complaints and problems. While sizeable minorities of school administrators felt the ban had favourable effects, the majority perceived little effect on either smoking behaviour or attitudes towards smoking.

ABRÉGÉ

Nous avons évalué l'impact de l'interdiction de fumer sur les lieux scolaires, entrée en vigueur en novembre 1994 en Ontario. On a procédé à des entrevues par téléphone à la fin de l'année scolaire 1995-1996 auprès de 213 administrateurs d'écoles secondaires. Pratiquement toutes les écoles secondaires (96 %) interdisent de fumer sur les lieux de l'école. Bien que certaines personnes fument encore sur les lieux de l'école, l'endroit où elles fument a changé, ce qui a donné lieu à de nouvelles perceptions tant des avantages que des risques, ainsi qu'à différentes plaintes de la part des parents, des étudiants, des voisins et des commerces avoisinants. La plupart des problèmes découlant de l'interdiction de fumer sont considérés comme mineurs. Les conditions locales, particulièrement la situation géographique de l'école, apparaissent comme d'importants facteurs à l'origine des plaintes et des problèmes. Bien qu'une minorité non négligeable d'administrateurs scolaires ait le sentiment que l'interdiction a eu des effets bénéfiques, pour la majorité d'entre eux par contre, elle n'a eu que peu d'influence sur le tabagisme ou sur les attitudes à son sujet.

The Ontario Ban on Smoking on School Property: Perceived Impact on Smoking

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One goal of the Ontario Tobacco Strategy was that all schools would be smoke free by 1995.¹ To that end, the 1994 Tobacco Control Act (TCA) banned smoking on school property in Ontario.² While almost one third of the high schools had already implemented bans on smoking, all schools were affected by the TCA. In the first year, there were reports that some schools were experiencing difficulty and that a few wanted the government to change the law. This study was designed to provide a comprehensive assessment of the ban. In particular, the perceptions of school administrators on changes in the location of student smoking and consequent risks and benefits were assessed, as well as changes in attitudes toward smoking and in smoking rates. A companion paper describes issues in enforcement.³

METHODS

Telephone surveys were conducted with high school administrators. A questionnaire was developed, based on the litera-

ture and on semi-structured interviews with key informants from school boards (n = 16) and public health departments (n = 5) in Ontario, and with knowledgeable persons elsewhere in Canada and the United States.

A systematic sample was drawn of every third high school in Ontario. Of the 798 schools, 230 were selected and an interview was completed in June-July 1996 with a representative from 213 (93%) of these schools. Respondents were most often vice-principals (67%), followed by principals (26%) and other school personnel familiar with the survey topic (7%). The maximum sampling error, including corrections for the finite size of the population, is calculated to be $\pm 5.7\%$ at the 95% confidence interval.*

RESULTS

For each of the questions reviewed in the results section we completed analyses to determine if there was any variation according to the type of school (separate versus public), location of the school (downtown, suburban, small town or rural area), or the region (Metropolitan Toronto, South Central, West, East or Northern Ontario). We found that these factors were not statistically significant.

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This paper is based on a report submitted to the Ontario Ministry of Health (The Ban on Smoking on School Property: Successes and Challenges, December 1996). A copy of this report, which provides a detailed description of the research methodology, is available from the publication series of the Institute for Social Research at York University.

* The sampling error for a binary variable with a 50/50 distribution at the 95 percent confidence interval is 6.71, the calculation is $100\% \cdot (1.96 \cdot \sqrt{(.5 \cdot .5 / 213)})$. After adjusting for the finite population correction factor (fpc) the sampling error is 5.7. The fpc is calculated as $\sqrt{(1 - (\text{sample size} / \text{population}))}$ or as $\sqrt{(1 - (213 / 798))} = .85$ and $6.71 \cdot .85 = 5.7$. For a discussion on the calculation of sampling error and the use of the finite population correction factor, see Kish⁴ pp.45-47.

Compliance with the TCA

Compliance with the provision of the TCA that requires schools to officially prohibit smoking on school property is almost universal. Indeed, 31% of schools surveyed had banned smoking prior to the TCA. Information from school representatives suggests that only 4% of Ontario high schools had either never implemented the ban, or had subsequently reinstated smoking on school property, an estimate consistent with other findings.⁵ Although administrators from non-compliant schools were typically guarded in their comments, some maintained that smoking was reinstated in concert with local police, health officials, and school board officers.

Smoking on school property

Although almost all schools have banned smoking, only 5% of schools reported that students “never smoke on school property during the school day.” Forty-seven percent reported that “a few students smoke occasionally”, 33% reported that “a few students smoke often”, and the remainder reported either that “many students smoked occasionally” or that “many smoked often.” Almost all schools had warned students about smoking on school property, and 82% had suspended students in the last school year for doing so.

Location of smoking

A frequent theme in interviews with school administrators was that problems resulting from the ban often related to the change in location of smoking, from a designated area on school property determined by the school, to a public area off school property selected by students. Almost 80% of the schools that allowed smoking on school property prior to the TCA had a designated smoking area at the back of the school property, at the back or side of the school building, or in a courtyard or area partially surrounded by school buildings—areas typically characterized by low visibility to the main school population and segregation from adjacent land owners (Table I). Now students leave school property to smoke, congregating in two or three different places, most notably on the sidewalks or streets adjacent to the school, or on the edge of school property

(typically a small strip of land that runs between the sidewalk and the school), or between the sidewalk and the street (87%). Often the preferred patch of sidewalk or street is at the main entrance way into the school, an area frequented by parents, school buses, and public transit vehicles dropping off students. Thus, student smoking now occurs in highly visible areas. When student smokers move away from the school, they tend to cluster in commercial malls (49%), public parks or laneways (40%), or on the lawns and driveways of private residences (12%).

Perceived risks and benefits of changes in smoking location

While 38% of school administrators reported either that students did not leave school to smoke, or that those who did were not subject to consequent risks, many schools reported potential risks (Table II). About half reported that smokers were at risk of being hit by vehicles, although this also was true for some students prior to the ban. According to school administrators, however, the numbers of students and the time they spend on sidewalks or streets adjacent to the school had increased. The problem is particularly acute in schools where sidewalks and streets have become “in” places for students to “hang out”.

Some school representatives pointed out that the ban makes smoking an “inconvenience”, that the “social stigma” of smoking is more obvious now that smokers are off school property, and that students now think more about their smoking, because the ban makes smoking “a conscious and deliberate act.” However, a few argued that moving smoking from out-of-the-way areas to a highly visible area in front of the school has enabled students to “flaunt” smoking in a manner not possible previously.

Sources and types of complaints

School representatives were asked what complaints, if any, they had received about students smoking off school property. Twenty-eight percent reported that their schools had not received any complaints. Fifty-five percent of the schools reported complaints from neighbours, and a smaller percentage reported complaints from par-

TABLE I
Locations for Student Smoking in Relation to School Property Prior to and After the Tobacco Control Act as Reported by School Administrators

Location	% of Schools*
Prior to Act (n = 133)†	
At back/side of school building	35
At back/edge of school property	30
Courtyard/other area partially surrounded by school building	14
Close to school entrance/front of school	13
Sidewalk beside school	13
Elsewhere on school property‡	13
After Act (n = 205)	
Sidewalks adjacent to school	87
Malls and other commercial places	49
Public parks and laneways	40
Lawns and driveways of private residences	12
In cars or parking lots	8
Designated area on school property	4

* Schools often reported that students congregated to smoke in two or three different places; as a result the percent figures total more than 100.

† This question was not asked of schools that banned smoking prior to the TCA.

‡ Includes parking lots, between main school building and portables, between school and playing field and other locations.

TABLE II
Risks Associated with Students Leaving School Property to Smoke as Perceived by School Administrators (n = 213)

Risks	% of Schools*
No risks or no students leave school property to smoke	38
Smokers are subject to risk from vehicular traffic	49
Smokers are subject to personal safety risk including being targets for drug pushers	17
Smokers are more likely to skip or be late for classes, thus their academic achievement suffers	7
Property adjacent to where smokers congregate is vandalized	2
Non-smoking students and others are intimidated by smokers	3

* Because some schools reported more than one risk, the total percent does not equal 100.

ents (37%), students (23%), and nearby businesses (18%).

With respect to complaints made to schools by parents, the school representa-

TABLE III
Type and Source of Complaints Made to Schools About Smoking Off School Property

Type of Complaint	Source of Complaint (Percentage Distribution*)			
	Parents	Students	Neighbours	Businesses
Garbage and litter	21	18	56	18
Poor public image	40	43	18	23
Trespassing and blocking access to property	9	9	34	69
Intimidation and personal safety	16	25	25	18
Traffic safety	35	9	14	3
Damaging property	3	2	10	10
Students should not be allowed to smoke	18	2	3	—
Second-hand smoke	—	20	1	—
Hypocritical law	5	5	—	—
(Number of complaints described by schools)	(77)	(47)	(118)	(17)

* The people who called the school to complain often had more than one type of complaint. As a result, the columns total more than 100 percent.

Impact of the ban on attitudes and smoking behaviours

Although school administrators were more likely to report that the ban had positive effects than negative ones, their most common opinion was that it made no difference (Table IV). For example, 57% said the ban made no difference to the school's ability to discourage smoking, 28% thought it strengthened the school's position, while only 11% thought it weakened the school's position.

Almost a third of school representatives thought the ban made non-smoking students feel more comfortable on school property, while twice as many (20%) thought the ban made it more difficult for non-smokers to be pressured into smoking than the reverse (9%). Thus, it is not surprising that the majority of non-smoking students (53%) were seen as being very or somewhat supportive of the ban, while only 3% were seen as not supportive. One third also reported that the ban had positively affected how students think about smoking, while only 7% thought it had a negative effect. Four out of ten school representatives thought the ban had been very or somewhat effective in discouraging student smoking during the school day. They suggested it made the non-smoking message more serious and students more aware of the hazards of smoking.

Some school representatives thought the regulations had not gone far enough, and some expressed frustration. To quote one administrator:

We may have banned it on school property but we are still endorsing smoking because we are still allowing kids to smoke, sometimes right under our nose and there is nothing we can do about it. It is legal for kids to smoke on public property whether that property is one mile or one inch away from school property.

Perhaps the most important finding is that 16% of school representatives perceived a decrease in student smoking, while only 7% perceived an increase. That the net effect of the ban is a perceived reduction in smoking during the school day is consistent with other findings on the effect of restrictions on the amount stu-

tive noted that the most common issue of concern focused on the negative public image resulting from students smoking in front of the school (40%). Just over a third of the parents' complaints concerned traffic safety (Table III). Students were also concerned about school image—43% of their complaints dealt with this issue. One fifth of student complaints were about exposure to second-hand smoke when entering and leaving school property. Neighbours who complained were most concerned about garbage and litter generated by smokers on their property (56% of complaints). They also complained that groups of smokers trespassed on driveways and walkways (34% of complaints). By far the most common complaint from businesses was the gathering of smokers at entrance ways to their premises (69% of the complaints).

Seriousness of problems

Less than one third of schools (29%) thought that the ban had given rise to "major" problems. Most viewed issues arising from the ban as either "minor" (49%) or "not a problem" (22%). Schools that banned smoking prior to the TCA were much less likely than other schools to regard problems resulting from the ban as "major" (11% versus 39%, $p < 0.001$). More than half of the school administrators thought that local factors contributed to the extent and seriousness of ban-related problems, including who their neighbours were, whether or not there was a public park close-by, the space between the school property and streets, and the types of streets and roads around the school.

TABLE IV
Perceptions of the Impact of the Ban as Reported by School Representatives (Minimum Number of Observations = 206)

Survey Item	% of School Administrators
School's ability to discourage smoking	
Strengthened	28
Weakened	11
Made no difference	57
Non-smoking students more comfortable on school property	
Yes	31
No	2
Made no difference	57
Easier/more difficult to pressure non-smokers to smoke	
Easier	9
More difficult	20
Made no difference	60
Support for the ban among non-smoking students	
Very supportive	28
Somewhat supportive	25
Not supportive	3
Made no difference	37
Ban made difference in how students think about smoking	
Yes, positive difference	32
Yes, negative difference	7
Made no difference	49
Effect of ban in discouraging smoking during school day	
Very effective	11
Somewhat effective	30
Not effective	57
Ban's effect on amount students smoke during school day	
Increased	7
Decreased	16
Made no difference	59

* The percentages for each item do not sum to 100 because "don't know" responses are not shown. These ranged from 2% to 18%.

dents smoke.^{6,7} Research on workplace restrictions on smoking also show reduced tobacco consumption,⁸⁻²⁰ with little evidence of compensatory smoking outside work.^{13,15,18,20} This may result partly from increased quitting in response to restrictions among those contemplating quitting.¹⁴ This finding is particularly relevant to teenage smoking, since, in Canada, 81% of young smokers (ages 10-19) have seriously contemplated quitting, and 40% have tried to quit within the last six months.²¹ Taken together, these results provide grounds for arguing that a ban on smoking on school property should be included among strategies to reduce smoking among youth.

DISCUSSION

While sizable minorities of administrators felt that the school smoking ban had favourable effects, the majority felt that the ban had not affected either smoking behaviour or attitudes toward smoking. Few studies have directly examined the effects of school policies on student smoking. However, one multivariate analysis of factors associated with self-reported smoking among Australian secondary school students showed that smoking policy variables had minimal association with students' smoking behaviour.²² School administrators recognize the need for consistency between education on hazards of smoking and tobacco control policies in the school.

About one quarter of schools report no problems with the ban. However, the fact that much student smoking now takes place in highly visible areas at the entrance ways to schools and, unlike smoking on school property, it is not subject to sanctions, is a concern. In talking with representatives from schools that have problems, it was clear that they range from trivial to serious and from transient to chronic. For some schools, the worst consequences relate to image. For others, problems centre on the perception that students and those who live close to the schools are subject to serious risks, some resulting in ongoing police-school contacts. The different local conditions faced by schools and the variation in staff-student relationships appear to be important underlying factors,

suggesting that solutions must be sensitive to particular school conditions. Using multivariate methods, further analyses are being carried out to determine factors associated with the successful implementation of the school smoking ban.

Inconsistent societal attitudes toward young people's smoking are seen as an underlying problem. While it is illegal to sell cigarettes to minors, and schools are held responsible for the behaviour of their students, it is not illegal for students to possess cigarettes or to smoke, and little effort has been made to deal with problems associated with students smoking off school property.

Given that schools receive most of the complaints concerning the ban on smoking on school property, it is not surprising that they express frustration with the law. Previous research on reducing the prevalence of smoking by youth supports the need for comprehensive, community-wide interventions, including tax policies to decrease the economic accessibility of tobacco.²³⁻²⁵ Within such a context school bans may prove to be effective in their own right.

The challenge for the Ontario Ministry of Health and for schools is to balance the concerns of schools and surrounding neighbourhoods, that focus on immediate issues such as school image and traffic safety problems, against the long-term health effects of smoking. Awareness of the future benefits from tobacco control in schools needs to be more effectively communicated. The recognition that most adult smokers start smoking as teenagers underscores the importance of this challenge.^{21,26}

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L E T T E R S

Urban Air Pollution and Mortality

Dear Editor:

Re: Burnett RT, Cakmak S, Brook JR. The effect of the urban air pollution mix on daily mortality rates in 11 Canadian cities. *Can J Public Health* 1998;89(3):152-56.

In the above article, Burnett et al. reported that 8.2% of all non-accidental deaths from 1980-1991 were attributed in a time-series analysis to four gaseous air pollutants, nitrogen dioxide, sulphur dioxide, ozone and carbon monoxide. Such a high risk of premature mortality from contemporary levels of the four gases is surprising, as is the absence of risk from PM_{2.5} (respirable particulate matter less than 2.5 µm in average diameter). These surprising results, if confirmed, make this paper very important in a public health context by suggesting that a measurable, perhaps even dramatic improvement in population health can be obtained by reducing gaseous air pollution. However, these findings must be critically evaluated.

The high mortality indicated in Burnett et al.'s paper is inconsistent with other studies, and the authors do not acknowledge those differences. Time-series studies, in which area monitors serve as surrogate data for individual exposures and study populations, are assumed to be homogeneous (i.e., ecological study designs) and are useful in detecting associations, such as that in the present study, but such hypothetical associations require validation by other methods using other data sets. The authors' analysis ignores a massive amount of traditional epidemiology, human clinical and animal toxicology research that finds no mortality resulting from exposures to the four gases at the low levels¹ typical in Canada.

Burnett et al. do not provide sufficient details about their models to allow critical analysis. A host of investigator-specific decisions are incorporated into the statistical models and analyses, and many of these decisions influence the reported associa-

tions. These same authors have previously stated, "detecting an air pollution effect with time-series methodology requires the appropriate use of complex statistical techniques in order to tease out a relatively small signal from a forest of noise. The art of the analysis is to remove the proper amount of unwanted temporal variability in the time series, thus revealing the 'true' air pollution signal."² A means of confirming the validity of the "signal" in the present study is needed.

Among specific concerns, the selection of averaging time, days lagged and filters should be made *a priori* and should be based on some objective statistical criteria, such as what variable reduces autocorrelation to a minimum or causes the largest decrease in the log likelihood function, not based on maximizing relative risks. The use of biological criteria would be even more persuasive as a basis of modeling decisions and might suggest who (e.g., what sub-population) is at risk, which is a critical issue. The paper fails to provide statistical criteria used to select various model parameters, omits exposure-response functions, and fails to seriously treat biological plausibility. Rather, the authors note that different gases contribute to the overall risks differently in each city with no consistent pattern within regions. For example, Table IV shows the "increased risk" from nitrogen dioxide varies in different cities from 0 to 9.4% and that of sulphur dioxide from -0.3 to 2.9%. Is such variation indicative of a real, consistent effect, or is this an argument against causality?³

Unfortunately, Burnett et al. do not address these critical issues, yet they appear to have succeeded where other investigators have failed, using the time-series approach alone to identify a combination of the four air pollutants (most of which are correlated) as a major cause of increased mortality at low ambient levels.⁴⁻⁶

The strength of the opinions expressed in the article is disquieting for the additional reason that the four gases were
...see *Letters*, page 238