

## The Influence of School Smoking Policies on Student Tobacco Use

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### Abstract

**Objective**—To investigate the association between smoking behavior among secondary school students and school smoking policies.

**Design**—Cross-sectional provincially representative study.

**Setting**—Quebec secondary schools.

**Participants**—Complete data were available for 763 of 1058 students aged 13 years in 50 schools and for 768 of 1160 students aged 16 years in 57 schools. School principals provided data on school smoking policies.

**Main Exposure**—School smoking policies.

**Outcome Measure**—Student tobacco use.

**Results**—Of students aged 13 years, 3.8% of boys and 7.1% of girls smoked daily; 21.0% of boys and 25.2% of girls aged 16 years smoked daily. Of schools, 28.0% permitted staff to smoke indoors, 84.1% permitted staff to smoke outdoors on school grounds, and 83.2% permitted students to smoke outdoors on school grounds. Daily smoking was not associated with policies targeting student smoking or those targeting indoor smoking by staff. In multilevel analyses, girls

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aged 13 years were almost 5 times more likely to be daily smokers if they attended schools at which staff were permitted to smoke outdoors.

**Conclusions**—Younger girls may be more susceptible to social influences at school related to tobacco use. School policies banning smoking by teachers and other school personnel within and outside the school should be an important component of comprehensive adolescent smoking prevention programs.

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Despite more than 2 DEcades of research on the determinants of youth tobacco use, widespread implementation of public health prevention programs, explicit health warnings about the dangers of smoking, declines in the social acceptability of smoking, and increasingly restrictive regulation and policy, Canadian boys and girls continue to initiate cigarette smoking.<sup>1</sup> Because the prevalence of student smoking varies widely between schools after controlling for individual-level variables,<sup>2–5</sup> it is likely that features of the organizational or social environment at school influence tobacco-related behaviors among youth. School-related factors associated with higher smoking prevalence among students include lower school “connectedness” (ie, feeling of belonging and relatedness with significant others at school),<sup>6,7</sup> poor discipline and low teacher involvement,<sup>8</sup> and lack of smoking bans and enforcement.<sup>5,9</sup> The 2002 Ontario Youth Smoking Survey<sup>10</sup> found that students who reported full bans at school smoked fewer cigarettes per day than students who reported partial or no bans. Moore et al<sup>11</sup> reported that the prevalence of daily smoking among students aged 15 to 16 years in schools with written policies banning smoking everywhere on school grounds was 3 times lower than in schools without such policies. Finally, Poulsen et al<sup>12</sup> found that adolescents who reported seeing teachers smoking outdoors were almost twice as likely to be daily smokers.

In December 1999, the Quebec provincial government adopted a law prohibiting smoking inside schools, with sanctions (primarily fines) to be imposed beginning in June 2000. While most schools had already banned smoking indoors, policies banning smoking elsewhere on school grounds were left to the discretion of each school. Shortly before the new legislation was adopted, we conducted a survey of school policies and student smoking behaviors in a large representative sample of Quebec youth. Incorporating a social ecological perspective, which posits that environmental factors in addition to those at the individual level influence youth smoking,<sup>2,13–15</sup> we examined the association between school smoking policies targeting indoor or outdoor smoking and student smoking behavior.

## METHODS

This investigation is a secondary analysis of data from the Quebec Child and Adolescent Health and Social Survey. The design and methods of this survey have been reported previously.<sup>16</sup> Briefly, schools were selected from the Quebec Ministry of Education lists of public and private schools to obtain 3 provincially representative, independent, random samples of students (1 each for 9-, 13-, and 16-year-old students) clustered within schools. The target sample size of 1500 per age group was chosen to obtain coefficients of variation of less than 15% for sex-specific proportions of 10%, taking the cluster design effect and an expected 80% response proportion into account. The school samples were selected independently for each age group; in each school, 25 students were randomly selected, with

approximate equal representation of boys and girls. In all, 189 schools were selected, including 109 secondary schools. This analysis includes all 13- and 16-year-old adolescents attending secondary school.

Data were collected during school visits between January 18, and May 6, 1999. Self-report questionnaires were completed at school by 79.2% (1186 of 1498) and 81.1% (1212 of 1495) of 13- and 16-year-old students randomly selected for the study, respectively. Data were also collected in questionnaires completed by parents and by school principals. For the current analysis, 182 students aged 13 years were excluded (128 attended primary school, 41 attended schools that were missing data on smoking policies, and 13 were missing data on smoking behavior); similarly, 136 students aged 16 years were excluded (52 had dropped out of school, 73 attended schools that were missing data on smoking policies, and 11 were missing data on smoking behavior). Data on the smoking status of parents or guardians and siblings were available for 76.0% of 1004 students aged 13 years and 70.9% of 1076 students aged 16 years. Complete data were available for 763 students aged 13 years attending 50 schools and for 762 students aged 16 years attending 57 schools. The smoking status of students retained for analysis did not differ from that of those excluded because of incomplete data; however, students retained for analysis were less likely to have siblings and peers who smoked, to live in urban areas, to attend private schools, and to attend schools that permitted smoking by students and school personnel. The study was approved by the Ethics Review Board of Sainte-Justine Hospital and the Institut de la Statistique du Québec, Montréal, Québec, Canada. Informed consent was obtained from participants and their legal guardians.

## MEASURES

### Student-Level Variables

Students were categorized as “daily smokers” if they reported smoking every day for the past 30 days. “Less than daily smokers” included students who reported smoking in the past 30 days but not every day, and “nonsmokers” included students who did not smoke in the past 30 days. Daily smoking (yes or no) was the dependent variable in this analysis; all others were categorized as “nondaily smokers.” “Sibling smoking status” was categorized as 0 vs 1 or more siblings who smoked. Students were categorized as living in a household in which 0 vs 1 or more parents or guardians smoked based on data collected in questionnaires completed by the parent or guardian.

### School-Level Variables

Schools were categorized as permitting teachers and other school personnel to smoke indoors if school principals responded yes to any of the following: “Smoking by staff is allowed inside the school in completely enclosed spaces (such as a smoking room)” or “Smoking by staff is allowed inside the school in completely open spaces (such as corridors and the cafeteria section)” or “Smoking by staff is allowed inside the school in both closed and open spaces.” Schools were categorized as permitting staff to smoke outdoors if school principals responded yes to the following: “Smoking by staff is allowed on the school grounds.” Finally, schools were categorized as permitting students to smoke outdoors if

school principals responded yes to the following: “Smoking by regular students is allowed on school grounds.” Policies permitting students to smoke indoors were not investigated because this situation only applied to 2 schools. These school-level measures comprise the main independent variables in this analysis.

Schools were categorized as urban if the school was located in an area inhabited by at least 1000 people and the population density was at least 400 people per square kilometer; otherwise, they were categorized as rural.<sup>17</sup> Schools were categorized as belonging to either the public or the private system according to the classification used by the Quebec Ministry of Education.<sup>18</sup>

Average school-level annual income was defined as the average total annual income of all families of married or common-law couples residing in the census district in which the school was located, based on data from the 1996 census.<sup>19</sup> Schools were categorized as located in areas where the average total annual income was either equal to or less than, or greater than \$50 000 per year (the median value).

## ANALYSIS

Univariate associations between smoking status and student- and school-level characteristics were computed. We used multilevel modeling to investigate the independent effect of school policies on student smoking behavior.<sup>20</sup> It was necessary to analyze age groups separately because 13- and 16-year-old students were selected from 2 entirely different samples of schools. Age-specific models initially combined boys and girls and included interaction terms between sex and all other variables. Because sex modified the association of parental smoking ( $P=.04$ ) and outdoor smoking policy ( $P=.08$ ) with daily smoking and because of prior evidence that environmental influences on smoking are modified by sex,<sup>21,22</sup> we chose to perform all subsequent analyses on age- and sex-specific subsets of the data. Coefficients estimated from the null model (ie, including no student- or school-level predictors) were used to compute the expected proportion of daily smokers for a “typical” school, defined as  $1/(1+\exp^{-b_{oi}})$ , where  $i$  varies for each age-sex category.<sup>23</sup> Separate sets of hierarchical models were developed by sequentially adding the following groups of variables to the null models: (1) the main independent variables (ie, outdoor student smoking policy and indoor and outdoor staff smoking policy, examined separately); (2) potential student-level confounders, including parent and sibling smoking; and (3) potential school-level confounders, including average school-level annual income, rural or urban location, and public or private status. We used restricted penalized quasi likelihood to estimate fixed and random effects. This method of estimation also permits testing for possible overdispersion or underdispersion of the data at the student level. Analyses were performed using SAS statistical software, version 8.12 (SAS Institute Inc, Cary, North Carolina), and HLM 6 (Scientific Software International, Inc, Lincolnwood, Illinois).

## RESULTS

School and student characteristics are described in Table 1 for 13- and 16-year old students separately. Overall, smoking indoors by staff was permitted in 28.0% of schools and outdoors in 84.1% of schools.

The prevalence of daily smoking among parents was high: 46.4% and 51.3% of students had at least 1 parent who reported smoking among 13- and 16-year old subjects, respectively.

The proportion of students who smoked daily varied markedly by school, ranging from 0% to 31.8% among 13-year-old students and from 6.5% to 50.0% among 16-year-old students. Daily smoking was more prevalent among students whose parents or siblings smoked and who reported that most or all of their friends smoked (Table 2). Among 16-year-old students, daily smoking was more prevalent in public than in private schools, although the reverse was observed for 13-year-old students. Policies permitting students to smoke outdoors were not associated with daily smoking among either 13- or 16-year-old students. Policies permitting staff to smoke indoors were significantly associated with daily smoking among 16-year-old students, while policies permitting staff to smoke outdoors were significantly associated with daily smoking among 13-year-old students.

## MULTILEVEL ANALYSIS

Based on the null models for 13- and 16-year-old boys and girls separately, the expected proportion of daily smokers was 1.8% and 4.2% among 13-year-old boys and girls and 20.7% and 25.0% among 16-year-old boys and girls, respectively.

Among 13-year-old students, student-level variance for daily smoking was less than expected under the Bernoulli distribution, likely because of the many schools in which there were no daily smokers among 13-year-old students. Although evidence of underdispersion indicates possible misspecification of the random effects,<sup>23</sup> we were interested in fixed effects, and neither the coefficients nor the standard errors of the fixed effects were affected by the underdispersion at level 1.

The null models showed a significant random effect for mean daily smoking among 13-year-old students ( $\chi^2_{49}=185.7$ ,  $P<.001$ ) and among 16-year-old students ( $\chi^2_{56}=77.1$ ,  $P=.03$ ), indicating that much of the variation between schools in mean daily smoking prevalences was related to school-level factors. Sex- and age-specific null models also showed significant between-school variation for 13-year-old students ( $P<.001$  for boys and for girls) and borderline significance among 16-year-old students ( $P=.07$  for both boys and girls).

Smoking policy variables were entered into sex- and age-specific models. Univariate associations between school staff smoking policy and daily smoking among students were observed only for 13-year-old girls and 16-year-old boys. Specifically, 13-year-old girls were more likely to smoke daily if they attended schools that permitted staff to smoke outdoors, compared with girls who attended schools that did not permit staff to smoke outdoors; similarly, 16-year-old boys were more likely to smoke daily if they attended

schools that permitted staff to smoke indoors, compared with those who attended schools at which staff were not permitted to smoke indoors. Inclusion of outdoor and indoor smoking policy variables reduced school-level variation in mean daily smoking by 8% each in the 13-year-old girl and the 16-year-old boy models. Policies targeting students were not associated with daily smoking in any age-sex category.

Potential student-level confounders were then added to age- and sex-specific models. As expected, parental and sibling smoking were significantly associated with daily smoking, in all age-sex groups. Between-school variance in mean daily smoking increased in all sex-age groups. The strength and magnitude of the association between student daily smoking and school policies were not affected by the addition of parental and sibling smoking in the 13-year-old girl model but were significantly reduced in the 16-year-old boy model.

Finally, other school-level correlates were added to the models. Because mean daily smoking was moderately associated with public or private status and with urban or rural location and because private schools and schools located in rural areas were also less likely to permit smoking by students or staff, both of these school-level descriptors were included in all multilevel models.

Final models are presented in Table 3. After taking student-level confounders, and school status (public or private) and location (rural or urban), into account, the magnitude of the association between indoor smoking policy and daily smoking in the 16-year-old boys' model was reduced and became nonsignificant. In the model for 13-year-old girls, however, school policy targeting outdoor smoking by staff remained strongly associated with daily smoking. Relative to girls who attended schools that did not permit staff to smoke outdoors, girls attending schools at which staff were permitted to smoke outdoors were almost 5 times more likely to be daily smokers.

## COMMENT

To our knowledge, this is the first North American study to investigate the association between student tobacco use and school policies that specifically target school personnel in a large representative sample of adolescents. The transition from primary to secondary school has been identified as a period of increased risk for adopting unhealthy lifestyle behaviors.<sup>24</sup> The findings herein are consistent with this observation because we found that staff school smoking policies were highly associated with the prevalence of daily smoking at the age of 13 years but not at the age of 16 years. The transition year into secondary school, which typically occurs at the age of 12 to 13 years, represents a period of vulnerability during which younger adolescents (vs older students) may be more susceptible to environmental cues related to tobacco use.

We found that outdoor smoking policies (targeting staff) were strongly associated with daily smoking in 13-year-old girls but not in same-aged boys. In contrast, daily smoking was associated with parental and sibling smoking to a much greater extent in 13-year-old boys than in 13-year-old girls. These findings may reflect important sex differences regarding “norm internalization,” with girls tending to be more receptive than boys to specific social



influences at school.<sup>7</sup> Indeed, the idea that girls are more susceptible to external influences is not new; for example, it has been observed that being exposed to a higher prevalence of smoking at school is a significant risk factor for the transition to current smoking only among girls.<sup>25</sup> It may also be that at the age of 13 years, developmental differences between boys and girls are especially pronounced and, in particular, that boys are affected to a greater extent than girls by familial influences. In addition, school-level influences on student smoking behaviors likely interact with family smoking norms, which in turn affect boys and girls differently.

Our findings also suggest that the prevalence of daily smoking in younger girls was associated with outdoor, but not indoor, smoking policies. Our findings are consistent with those reported by Poulsen et al,<sup>12</sup> who found that the prevalence of smoking among adolescents was associated with a higher exposure to teachers smoking outdoors but not indoors. It is possible that policies prohibiting outdoor smoking send a stronger “message” than those that only address indoor smoking. The latter may be perceived as “passive” adherence to legislation, while the former reflects a proactive position based on principle and on the acceptability of and tolerance toward smoking. Similarly, policies targeting staff, but not those targeting students, were associated with daily smoking, suggesting that policies that target students’ social environment, rather than those aimed directly at their behavior, may be more effective in reducing overall student smoking.

To address possible student-level confounding, we undertook sex- and age-specific analyses and we controlled for parent and sibling smoking. Although measured at the student level, it is likely that including parent and sibling smoking in the models also controlled to some extent for community tolerance for smoking, itself an indicator of many unmeasured influences on smoking. As recommended by Aveyard et al,<sup>5</sup> we did not include smoking by peers as a student-level confounder because students’ peers are likely to attend the same school and to be influenced by the same school policies. However, even among 13-year-old girls who reported that most or all of their peers smoked, those attending schools at which staff were permitted to smoke outdoors were 6.8 times (95% confidence interval, 1.5–30.9 times) more likely to be daily smokers (data not shown). After including parental and sibling smoking, between-school variance in mean daily smoking increased in all sex-age groups, suggesting that differences between schools in the prevalence of parental and sibling smoking partially masked the actual between-school variation in student daily smoking. Analyses that fail to incorporate these important influences are likely underestimating the potential impact of the school environment on student smoking behavior.

Because location (urban or rural) and status (public or private) were associated with the presence of smoking policies, we examined school policy effects on student smoking as a function of the school’s urban or rural location and public or private status. The association between indoor smoking policy and daily smoking among 16-year-old boys was reduced once school status and location were taken into account, but findings for 13-year-old girls were unaffected. Our findings suggest that the contextual effect of broader social influences reflecting cultural and socioeconomic conditions should be examined because these may confound the relationship between school-level influences and student-level behaviors for particular subgroups.

Although the natural course of cigarette use among youth includes several important milestones, we investigated daily smoking as our primary outcome because regular smoking is a strong predictor of tobacco dependence<sup>26</sup> and because more frequent smokers have more accurate recall than less frequent smokers.<sup>27</sup> However, we also examined the correlates of “less than daily smoking in the past 30 days” (ie, students who reported smoking in the past 30 days but not every day). The associations observed were similar but weaker and did not meet the threshold for significance in any sex-age group. Others<sup>11,12</sup> have observed stronger school contextual effects for daily or heavy smoking than for occasional smoking. This may be due in part to misclassification because less than daily smoking includes infrequent smokers and recent ex-smokers. Alternately, it is possible that, while they may have little effect on smoking “uptake” or occasional smoking among students, policies that permit smoking by staff may reinforce smoking among students. This, in turn, may make it more likely that students will progress to daily smoking and less likely that they will attempt and succeed at smoking cessation. Given the cross-sectional design, we were not able to examine if policies targeting staff were related to smoking uptake among students. Longitudinal studies are needed to examine the impact of smoking policies on smoking uptake among students.

We did not examine if school smoking policies were enforced, nor did we assess student perceptions of these policies or of the frequency of smoking by school personnel. However, the possibility of information bias was reduced by collecting data on smoking policies in questionnaires completed by principals. Student perceptions are subject to information bias because those who smoke have more opportunities to see staff smoking when they go outdoors to smoke and, thus, may be more aware of staff smoking.

The cross-sectional design precludes statements on causality because it is possible that parents (or students) chose a specific school for their child based on how restrictive the smoking policy was. It is more likely, however, that choice of school is motivated by geographic proximity to the home and other factors, such as academic standing or availability of sports programs.

In conclusion, it is likely that most, if not all, schools in Quebec adhere to legislation banning indoor smoking; however, a potential consequence of banning indoor smoking in schools is an increase in outdoor smoking by teachers and other school personnel. This study provides evidence that interschool variation in daily smoking among adolescents is explained in part by policies that permit outdoor smoking among school staff. The potential impact of such policies seems to be great in younger adolescent girls and may have been underestimated in past studies. Clearly, school-level influences do not affect all students equally—in particular, the impact of smoking policies on student tobacco use varies substantially according to students’ age and sex and broader social influences related to cultural and socioeconomic factors. Research and prevention programs need to take these interactions within and between levels into account to better understand tobacco use behaviors in youth. Meanwhile, our findings suggest that schools should ban tobacco use among students, teachers, and other school personnel everywhere on school grounds, to reduce the prevalence of smoking in adolescents.



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**Table 1**School and Student Characteristics: Quebec Child and Adolescent Health and Social Survey, 1999<sup>a</sup>

Characteristic	13-Year-Old Students	16-Year-Old Students
Student related		
Sex		
Boys	368 (48.2)	357 (46.9)
Girls	395 (51.8)	405 (53.1)
Parent(s) smoke daily		
Yes	354 (46.4)	391 (51.3)
No	409 (53.6)	371 (48.7)
Sibling(s) smoke daily		
Yes	157 (20.6)	196 (25.7)
No	606 (79.4)	566 (74.3)
Living with both parents <sup>b</sup>		
Yes	593 (78.0)	576 (76.1)
No	167 (22.0)	181 (23.9)
Smoking status		
Boys		
Daily	14 (3.8)	75 (21.0)
Less than daily	29 (7.9)	43 (12.0)
Nonsmokers	325 (88.3)	239 (67.0)
Girls		
Daily	28 (7.1)	102 (25.2)
Less than daily	65 (16.5)	60 (14.8)
None	302 (76.5)	243 (60.0)
School related <sup>c</sup>		
Location		
Urban	34	38
Rural	16	19
Status		
Private	11	10
Public	39	47
Average area annual income		
<\$50 000	24	28
\$50 000	26	29
Students can smoke outdoors		
Yes	39	51
No	11	6
Staff can smoke indoors		
Yes	12	18
No	38	39
Staff can smoke outdoors		

Characteristic	13-Year-Old Students	16-Year-Old Students
Yes	39	51
No	11	6

<sup>a</sup>Data are given as number (percentage) of each group unless otherwise indicated. Percentages are based on totals for each category and may not total 100 because of rounding. n = 763 for 13-year-old students and n = 762 for 16-year-old students unless otherwise indicated.

<sup>b</sup>Excluding missing data.

<sup>c</sup>Data are given as number of schools. n = 50 for 13-year-old students and n = 57 for 16-year-old students.

**Table 2**  
Univariate Associations With Smoking Status: Quebec Child and Adolescent Health and Social Survey, 1999<sup>a</sup>

Characteristic	13-Year-Old Students				16-Year-Old Students			
	No. of Students	Smoke Daily, %	Smoke Less Than Daily, %	Do Not Smoke, %	No. of Students	Smoke Daily, %	Smoke Less Than Daily, %	Do Not Smoke, %
Student level								
All	763	5.5	12.3	82.2	762	23.2	13.5	63.3
Boys	368	3.8 <sup>b</sup>	7.9 <sup>c</sup>	88.3 <sup>c</sup>	357	21.1	12.0	67.0 <sup>b</sup>
Girls	395	7.1	16.5	76.5	405	25.2	14.8	60.0
Parent(s) smoke daily								
Yes	354	9.6 <sup>c</sup>	13.3	77.1 <sup>c</sup>	391	29.4 <sup>c</sup>	14.8	55.8 <sup>c</sup>
No	409	2.0	11.5	86.6	371	16.7	12.1	71.2
Sibling(s) smoke daily								
Yes	157	12.7 <sup>c</sup>	22.9 <sup>c</sup>	64.3	196	40.3 <sup>c</sup>	15.3	44.4 <sup>c</sup>
No	606	3.6	9.6	86.8	566	17.3	12.9	69.8
Most or all friends smoke								
Yes	159	26.4 <sup>c</sup>	29.6 <sup>c</sup>	44.0 <sup>c</sup>	277	53.8 <sup>c</sup>	15.5	30.7 <sup>c</sup>
No	601	0	7.8	92.2	481	5.4	12.5	82.1
School level								
Location								
Urban	484	5.8 <sup>d</sup>	11.6	82.6	495	24.4	13.3	62.2
Rural	279	5.0	13.6	81.4	267	21.0	13.9	65.2
Status								
Private	152	7.2	9.9	82.9	131	17.6 <sup>d</sup>	20.6 <sup>b</sup>	61.8
Public	611	5.1	12.9	82.0	631	24.4	12.0	63.6
Average area annual income								
<\$50 000	381	5.8	12.9	81.4	379	23.0	14.0	63.1
\$50 000	382	5.2	11.8	83.0	383	23.5	13.1	63.4
Students can smoke outdoors								
Yes	588	6.1	12.2	81.6	666	23.6	13.8	62.6

Characteristic	13-Year-Old Students				16-Year-Old Students			
	No. of Students	Smoke Daily, %	Smoke Less Than Daily, %	Do Not Smoke, %	No. of Students	Smoke Daily, %	Smoke Less Than Daily, %	Do Not Smoke, %
No	175	3.4	12.6	84.0	96	20.8	11.5	67.7
Staff can smoke indoors								
Yes	164	4.3	12.2	83.5	249	28.1 <sup>b</sup>	14.9	57.0 <sup>d</sup>
No	599	5.8	12.4	81.8	513	20.9	12.9	66.3
Staff can smoke outdoors								
Yes	586	6.5 <sup>b</sup>	11.3	82.3	683	23.3	14.1	62.7
No	177	2.3	15.8	81.9	79	22.8	8.9	68.4

<sup>a</sup>Smoke daily indicates daily smoking in the past 30 days; smoke less than daily, smoked in the past 30 days but not every day; and do not smoke, did not smoke in the past 30 days. Row percentages may not total 100 because of rounding.

<sup>b</sup> $P < .05$ .

<sup>c</sup> $P < .001$ .

<sup>d</sup> $P < .10$ .



**Table 3**

School Smoking Policies and Daily Smoking Among Students in Final Multilevel Models for 13- and 16-Year-Old Adolescents: Quebec Child and Adolescent Health and Social Survey, 1999<sup>a</sup>

Fixed Effect <sup>b</sup>	13-Year-Old Students		16-Year-Old Students	
	Girls (n = 395)	Boys (n = 368)	Girls (n = 405)	Boys (n = 357)
School-level policy				
Staff can smoke outdoors				
No	1 [Reference]	NA	NA	NA
Yes	4.8 (1.1–21.1)	NA	NA	NA
Staff can smoke indoors				
No	NA	NA	NA	1 [Reference]
Yes	NA	NA	NA	1.6 (0.8–3.1)
Covariates				
School status				
Public	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Private	1.9 (0.6–5.9)	2.1 (0.2–19.0)	1.1 (0.6–2.2)	0.7 (0.3–1.7)
School location				
Rural	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Urban	1.2 (0.4–3.4)	3.4 (0.4–29.0)	1.0 (0.6–1.6)	1.5 (0.8–3.0)
Student-level covariates				
Parent(s) smoke daily				
No	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Yes	2.8 (1.3–5.8)	17.6 (6.6–46.8)	1.9 (1.3–3.0)	2.1 (1.2–3.7)
Sibling(s) smoke daily				
No	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Yes	2.4 (1.2–4.7)	7.6 (4.2–14.0)	2.8 (1.7–4.6)	2.4 (1.4–4.2)

Abbreviation: NA, data not applicable.

<sup>a</sup>Data are given as odds ratio (95% confidence interval) for daily smoking.

<sup>b</sup>Random effect data:  $\mu$  (SE) and *df* values were 0.95 (0.91) and 46 for 13-year-old girls, 2.3 (5.3) and 46 for 13-year-old boys, 0.59 (0.35) and 54 for 16-year-old girls, and 0.59 (0.35) and 53 for 16-year-old boys, respectively.