Tobacco Retailer Density Surrounding Schools and Cigarette Access Behaviors Among Underage Smoking Students

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ABSTRACT

Background: *Current tobacco access restrictions are ineffective because youth can find noncompliant retailers or social sources from which to get cigarettes.* ***Purpose:*** *The purpose of this study is to examine characteristics related to the cigarettes access behaviors of underage smoking youth.* ***Methods:*** *Data were collected from 20,297 students (Grades 9–12) attending 29 secondary schools in Ontario, Canada in 2001. Multilevel logistic regression analyses were used to examine how tobacco retailers surrounding schools, school smoking rates, and student characteristics were related to smokers buying their own cigarettes, getting someone else to buy their cigarettes, or getting their cigarettes from friends.* ***Results:*** *Among underage smokers, 34.3% usually buy their own cigarettes, and 42.1% report that they are never asked for their age when trying to buy cigarettes. The more tobacco retailers there were surrounding a school, the more likely smokers were to buy their own cigarettes and the less likely they were to get someone else to buy their cigarettes. Students' smoking habits were also related to their cigarette access behaviors.* ***Conclusions:*** *Tobacco retailer density surrounding schools is related to student cigarette access behaviors. Selective enforcement of youth access laws in retail outlets in close proximity to schools might help to prevent underage youth from smoking.*

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INTRODUCTION

Point-of-sale access restrictions were designed to prevent underage youth from purchasing tobacco due to evidence that youth smoking behavior is related to access to tobacco (1,2). Although point-of-sale restrictions have proliferated, research has found that underage youth still have access to tobacco (3–6) and do not perceive difficulty in obtaining tobacco (6). One way youth obtain cigarettes is illegally through tobacco retailers (3,6–8). Retailers are expected to comply with point-of-sale age restrictions, but it is common for clerks to either miscalculate the age of youth when they provide identification (9) or to proceed to sell them tobacco products regardless of their age (8,10). For point-of-sale restrictions to be effective, retailer compliance must approach 100% because youth will travel, even across communities, to buy tobacco from noncompliant retailers (6). Considering that tobacco retailer density in a community is associated with smoking behavior (11), it would be insightful to understand how tobacco retailer density in the community surrounding a school is also associated with the cigarette access behaviors of underage smoking youth within the school.

The theory of triadic influence (12) posits that characteristics in the broader social environment (e.g., school) are associated with youth smoking. For instance, research has identified that smoking behavior in elementary school and secondary school populations is associated with the prevalence of smoking within the school (13–14). Considering that another important way youth obtain cigarettes is through social sources, including friends (15–16) and strangers (e.g., older peers) (15–19), it is important to determine whether the smoking prevalence at a school is also associated with the cigarette access behaviors of underage smoking youth within the school.

To reduce youth access to tobacco, a better understanding of different tobacco access behaviors is required. Therefore, the purpose of this study is to examine how the number of tobacco retailers surrounding a school, the prevalence of smoking within a school, and student characteristics are associated with the likelihood that underage smoking youth: (a) usually buy their own cigarettes, (b) usually get someone else to buy their cigarettes, or (c) usually get their cigarettes from friends.

METHODS

This cross-sectional study used self-reported data collected during the 2000–2001 academic term from 20,297 Grade 9 to 12 students ages 18 and younger from 29 secondary schools in Ontario, Canada. This study was one part of a larger study designed to examine how characteristics of school environments and the community surrounding schools are associated with student

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smoking behavior (14,20,21). Data were collected using the Tobacco Module of the School Health Action, Planning and Evaluation System. Student data were collected during class time, and participants were not provided compensation. Active information with passive consent was used to reduce demands on schools and to increase student participation rates. The researcher informed the parents of the students via mail and asked them to call the Public Health contact person for their child's school (toll-free number accessible 24 hr a day) if they refused participation. Overall, 95.9% (n = 19,464) of eligible students completed the survey; missing respondents resulted from absenteeism on the day of the survey (1.2%), student refusal (1.9%), and parental refusal (1.0%). The school environmental scan occurred on the same day as the student data collection at each school. The University of Waterloo Office of Research Ethics and appropriate School Board and Public Health Ethics committees approved all procedures, including passive consent. Additional details about the School Health Action, Planning and Evaluation System Tobacco Module and the host study are available (13,20,21).

Outcome Variables

Student smokers were asked to report how they usually obtain their cigarettes. Consistent with the literature (3), three different outcome variables were created: *buys their own cigarettes* (usually buys his or her own cigarettes = 1; does not usually buy his or her own cigarettes = 0), *someone else buys their cigarettes* (usually gets someone else to buy his or her cigarettes = 1; does not usually get someone else to buy his or her cigarettes = 0), and *friends supply their cigarettes* (usually gets his or her cigarettes from a friend = 1; does not usually get his or her cigarettes from a friend = 0).

Student Characteristics

Students were asked if they had a father or a mother who smoked cigarettes (*yes/no*), if they had an older brother or sister who smoked cigarettes (*yes/no*), if they ever smoked with their family members (*yes/no*), and how many of their five closest friends smoked cigarettes (0–5). Smoking status was determined by asking students about their smoking habits in the 30 days prior to completing the survey. Consistent with the literature (13), students were classified as occasional smokers if they reported that they smoked more than once in the 30 days prior to the survey but did not smoke everyday or almost everyday, or regular smokers if they reported that they smoked everyday or almost everyday in the 30 days prior to the survey. Students were asked to report how many cigarettes they usually smoke in a typical day of smoking. Responses were grouped into two categories (five or fewer cigarettes per day vs. six or more cigarettes per day). Students were also asked to report how often they smoke during the school day (*often/sometimes/never*), how often they smoke on weekends (*often/sometimes/never*), and how often they are asked their age when trying to buy their own cigarettes (*always/sometimes/never*).

School Environment Characteristics

The school smoking rate for each of the 29 schools was determined by calculating the prevalence of occasional and regular smokers within each school. The number of tobacco retailers surrounding a school was objectively measured by data collection staff who mapped out the area located within a six-block radius of each participating school and counted the total number of tobacco retailer outlets within that area. The different types of tobacco retail outlets considered included facilities such as bowling alleys, convenience stores, gas stations, grocery stores, and restaurants/taverns. When a potential tobacco retailer was identified, research staff entered the facility to verify that tobacco products were sold at that location.

Descriptive analyses of the individual characteristics were examined according the cigarette access behavior of students identified as being smokers (occasional or regular). Three different multilevel logistic regression models were conducted to determine the relations between the different individual and school environment characteristics and student cigarette access behaviors. Model 1 differentiated smoking students who usually buy their own cigarettes from students who do not usually buy their own cigarettes. Model 2 differentiated smoking students who usually get someone else to buy their cigarettes from students who do not usually get someone else to buy their cigarettes. Model 3 differentiated smoking students who usually get their cigarettes from friends from students who do not usually get their cigarettes from friends. The statistical package SAS 8.02 was used for the analyses in Step 1 (22), and the multilevel analyses for Step 2 were conducted with MLwiN Version 1.1 (23).

RESULTS

Among the 29 participating schools, the average school smoking rate was 29.4% (range = 16.4%–39.9%), and there was an average of 6.3 tobacco retailers per school (range = 1–13 retailers). Retailer density was related to the prevalence of smoking at a school ($r = .414$, $p < .05$), and schools with a higher prevalence of smoking among the student population also tended to have a larger number of tobacco retailers in the surrounding neighborhood. Significant between-school random variation in the odds that a smoker usually buys his or her own cigarettes ($\sigma^2_{\mu 0} = .06(.02)$, $p < .01$), usually gets someone else to buy his or her cigarettes ($\sigma^2_{\mu 0} = .07(.02)$, $p < .01$), and usually gets his or her cigarettes from friends ($\sigma^2_{\mu 0} = .03(.01)$, $p < .05$) were found.

Descriptive statistics are presented in Table 1. Significantly more boys than girls reported that they usually buy their own cigarettes, whereas more girls than boys reported that they usually get someone else to buy their cigarettes or usually get their cigarettes from friends, $\chi^2(2) = 168.1$, $p < .001$. On average, students who buy their own cigarettes were older (16.5 ± 1.3 years of age) than students who get someone else to buy their cigarettes (15.7 ± 1.2 years of age) or students who get their cigarettes from friends (15.7 ± 1.3 years of age). Overall, 2,370 (12.2%) students were classified as occasional smokers and 3,288 (17.0%) students were classified as regular smokers. The

TABLE 1

Descriptive Statistics for the Sample of Smoking Students (Grade 9–12) Who Usually Buy Their Own Cigarettes, Usually Get Someone Else to Buy Their Cigarettes, or Usually Get Their Cigarettes From Friends

	Buys Their Own Cigarettes[a]		*Someone Else Buys Their Cigarettes*[b]		*Friends Supply Their Cigarettes*[c]		
	%	*n*	%	*n*	%	*n*	*Chi-Square*
Gender							
Male	46.9	1,179	20.8	523	32.3	813	$\chi^2(2) = 168.1, p < .001$
Female	29.4	765	29.3	763	41.3	1,076	
Age							
14	15.0	98	33.0	216	52.0	341	$\chi^2(8) = 532.3, p < .001$
15	24.0	279	31.4	364	44.6	518	
16	35.2	433	27.2	335	37.6	462	
17	51.0	617	21.3	257	27.7	335	
18	61.1	506	12.4	103	26.5	219	
No. of close friends who smoke							
None	21.7	97	17.2	77	61.1	273	$\chi^2(10) = 641.6, p < .001$
1	23.5	143	16.7	102	59.8	365	
2	27.1	235	21.9	190	51.0	442	
3	36.4	337	25.1	233	38.5	357	
4	43.7	363	31.1	258	25.2	209	
5	53.7	773	29.5	425	16.8	242	
Has a parent who smokes							
Yes	39.6	977	29.1	718	31.3	773	$\chi^2(2) = 72.9, p < .001$
No	36.6	973	21.4	569	42.0	1,117	
Has an older sibling who smokes							
Yes	43.4	140	32.8	106	23.8	77	$\chi^2(2) = 26.5, p < .001$
No	37.7	1,812	24.6	1,184	37.7	1,814	
Smokes with family							
Yes	53.3	1,145	31.6	679	15.1	324	$\chi^2(2) = 745.5, p < .001$
No	26.8	703	20.3	534	52.9	1,390	
Smoking status							
Occasional	20.6	315	19.9	305	59.5	909	$\chi^2(2) = 1,316.5, p < .001$
Regular	59.8	1,392	33.6	783	6.6	154	
Average number of cigarettes per smoking occasion day							
≤ 5	21.6	398	20.6	380	57.8	1,067	$\chi^2(2) = 1,285.1, p < .001$
> 6	59.1	1,404	33.2	788	7.7	182	
Frequency of smoking during the school day							
Often	58.7	1,209	33.6	692	7.7	158	$\chi^2(4) = 1,477.3, p < .001$
Sometimes	31.1	431	25.0	347	43.9	610	
Never	16.8	236	13.2	185	70.0	982	
Frequency of smoking on the weekends							
Often	56.7	1,427	32.6	820	10.7	269	$\chi^2(4) = 1,542.2, p < .001$
Sometimes	20.4	346	17.6	299	62.0	1,051	
Never	13.1	68	12.9	67	74.0	385	
Frequency of being asked age when trying to buy cigarettes							
Always	43.6	184	44.1	186	12.3	52	$\chi^2(4) = 119.7, p < .001$
Sometimes	61.7	844	24.2	332	14.1	193	
Never	63.0	821	18.4	240	18.6	243	

[a] $n = 1,944$. [b] $n = 1,286$. [c] $n = 1,899$.

TABLE 2
Multilevel Logistic Regression Analyses Examining Factors Related to a Student in Grades 9 to 12 Cigarette Access Behavior

	Adjusted Odds Ratio (95% Confidence Interval)		
Parameters	*Model 1*[a]	*Model 2*[b]	*Model 3*[c]
Individual characteristics			
Gender			
Female	1.00	1.00	1.00
Male	1.93 (1.64,2.29)***	0.55 (0.46,0.65)***	0.99 (0.81,1.22)
Age (each year of age 14+)	1.84 (1.71,1.98)***	0.61 (0.57,0.66)***	0.91 (0.84,0.99)*
Close friend smoking (each smoking friend)	1.03 (0.97,1.10)	0.96 (0.90,1.02)	1.03 (0.95,1.10)
Parent(s) smoke			
No	1.00	1.00	1.00
Yes	0.81 (0.68,0.96)*	1.13 (0.95,1.35)	0.86 (0.70,1.06)
Older sibling(s) smokes			
No	1.00	1.00	1.00
Yes	0.76 (0.55,1.04)	1.02 (0.74,1.40)	0.98 (0.62,1.53)
Smokes with family			
No	1.00	1.00	1.00
Yes	1.07 (0.89,1.29)	1.13 (0.93,1.36)	0.61 (0.48,0.76)***
Smoking status			
Occasional	1.00	1.00	1.00
Regular	2.81 (1.15,6.84)*	4.90 (1.97,12.2)**	2.17 (0.85,5.51)
Average number of cigarettes per smoking occasion day			
≤ 5	1.00	1.00	1.00
> 6	1.44 (1.15,1.81)**	2.03 (1.61,2.56)***	0.61 (0.51,0.74)***
Frequency of smoking during the school day			
Never	1.00	1.00	1.00
Sometimes	1.02 (0.76,1.36)	1.74 (1.29,2.35)**	0.80 (0.63,1.03)
Often	1.25 (0.89,1.77)	1.65 (1.16,2.34)**	0.49 (0.34,0.71)***
Frequency of smoking on the weekends			
Never	1.00	1.00	1.00
Sometimes	1.97 (1.15,3.35)**	1.42 (0.87,2.34)	0.87 (0.60,1.27)
Often	2.94 (1.70,5.09)***	2.28 (1.36,3.81)**	0.43 (0.28,0.65)***
Frequency of being asked age when trying to buy cigarettes			
Never	1.00	1.00	1.00
Sometimes	5.89 (4.72,7.35)***	0.38 (0.30,0.48)***	0.87 (0.62,1.23)
Always	6.17 (5.08,7.49)***	0.30 (0.24,0.37)***	0.90 (0.69,1.16)
School environment characteristics			
Student smoking rate (each 1% increase)	0.98 (0.96,1.01)	1.01 (0.99,1.02)	1.01 (0.98,1.03)
Number of tobacco retailers (each retailer)	1.04 (1.01,1.08)*	0.96 (0.94,0.98)**	1.02 (0.98,1.05)

Note. Odds ratios adjusted for all other variables in the table.
[a]1 = Usually buys their own cigarettes (n = 1,944), 0 = Does not usually buy their own cigarettes (n = 3,714). [b]1 = Usually gets someone else to buy cigarettes (n = 1,286), 0 = Does not usually get someone else to buy cigarettes (n = 4,372). [c]1 = Usually gets cigarettes from friends (n = 1,889), 0 = Does not usually get cigarettes from friends (n = 3,769).
*p < .05. **p < .01. ***p < .001.

majority of occasional smokers reported that they usually get their cigarettes from friends (59.5%), whereas the majority of regular smokers reported that they usually buy their own cigarettes (59.8%).

All students included in this study were under the legal age to purchase tobacco in Ontario (19 years of age), and yet 42.1% of student smokers reported that they were never asked for their age when trying to buy cigarettes. Only 13.6% of smokers reported that they were always asked their age when trying to buy cigarettes. Over one third of underage youth smokers (34.3%) reported that they usually buy their own cigarettes.

As shown in Table 2, it appears that smokers who usually buy their own cigarettes are different than smokers who usually get their cigarettes from other sources. Male smokers were more likely to usually buy their own cigarettes (odds ratio [OR] = 1.93, p < .001) and less likely to usually get someone else to buy their cigarettes (OR = 0.55, p < .001) than female smokers. Older underage smokers were also more likely to usually buy

their own cigarettes (OR = 1.84, $p < .001$) and less likely to access cigarettes through friends (OR = 0.91, $p < .05$) or someone else (OR = 0.61, $p < .001$) than younger underage smokers. A smoker with a parent who smokes was less likely to usually buy their own cigarettes (OR = 0.81, $p < .05$) than a smoker without a smoking parent, whereas a smoker who smokes with his or her family was less likely to usually buy their cigarettes from friends (OR = 0.61, $p < .001$) than a smoker who does not smoke with his or her family. Regular smokers were more likely to usually buy their own cigarettes (OR = 2.81, $p < .05$) or get someone else to buy their cigarettes (OR = 4.90, $p < .01$) than occasional smokers. Smokers who have six or more cigarettes a day were also more likely to usually buy their own cigarettes (OR = 1.44, $p < .01$) or get someone else to buy their cigarettes (OR = 2.03, $p < .001$) than smokers who have less than six cigarettes a day. Smokers who often smoke during the school day were more likely to usually get someone else to buy their cigarettes (OR = 1.65, $p < .01$) and less likely to get their cigarettes from friends (OR = 0.49, $p < .001$) than smokers who never smoke during the school day. Smokers who were always asked their age when trying to purchase cigarette were more likely to buy their own cigarettes (OR = 6.17, $p < .001$) and less likely to get someone else to buy their cigarettes (OR = 0.30, $p < .001$) than smokers never asked their age during their purchase attempts.

The number of tobacco retailers surrounding a school was also related to student cigarette access behavior. As illustrated in Figure 1, smokers attending a school surrounded by many tobacco retailers were more likely to usually buy their own cigarettes and less likely to get someone else to buy their cigarettes. The number of tobacco retailers was not related to whether a student was a smoker (OR = 1.01, 5% confidence interval = 0.99–1.03, $p = .64$).

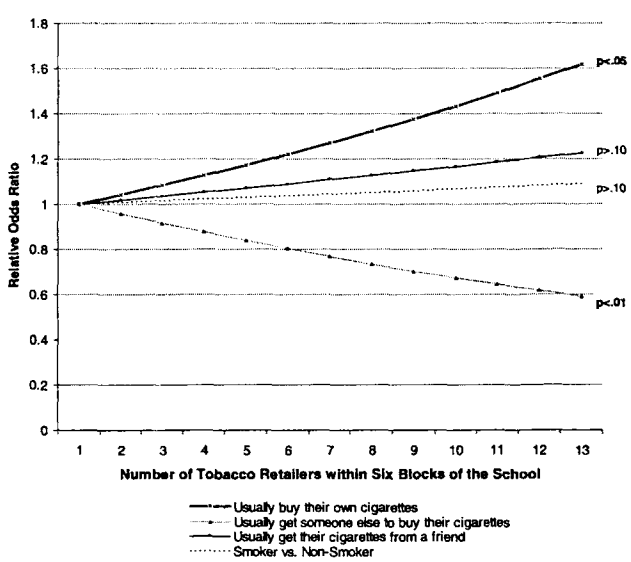

FIGURE 1 Model-based estimated odds ratios for a student usually buying his or her own cigarettes, usually getting someone else to buy his or her cigarettes, usually getting his or her cigarettes from a friend, and being a smoker versus a nonsmoker as a function of the number of tobacco retailers located within six blocks of the student's school.

DISCUSSION

The 1994 Ontario Tobacco Control Act legislated that youth younger than 19 years of age were not legally allowed to purchase cigarettes in Ontario (24). Despite this law, underage youth in this study reported that they commonly accessed cigarettes illegally. This study also identified that the more tobacco retailers there were within the community surrounding a school, the more likely underage smokers were to report that they usually buy their own cigarettes and the less likely they were to get someone else to buy their cigarettes. The marked ease in which youth report accessing cigarettes from retailers and social sources suggest that point of sale restrictions are ineffective in their current form (3–10).

The finding that retailer density within a six-block radius of a school was associated with an increased likelihood of minors buying their own cigarettes and decreased likelihood of minors getting someone else to buy their cigarettes is a valuable new finding. Retailer compliance must approach 100% to be effective among youth populations (6), and although compliance data were not available in this study, our preliminary finding suggests that the number of retailers there are in a community may be associated with compliance rates. Research is required to test this assumption.

Social influences are generally considered to be importance factors associated with youth smoking behavior (12–14); however, our data suggest that they may not be as important when it comes to how underage youth access cigarettes. For instance, youth smokers commonly report getting cigarettes from friends (15,16) and family members (8), but neither the number of friends nor the number of siblings who smoked were associated with the access behaviors examined here. Although the smoking rate in a school is associated with smoking onset and progression (13,14), it did have an effect on cigarette access behavior. Moreover, the importance of social influences appears to diminish even more when one considers the timing or social context of the smoking behavior. For example, it was unlikely for students who often smoke during the school day or on weekends to usually get their cigarettes from friends as they typically buy their own cigarettes. Future research should move beyond examining only social influences to examine when and where underage students smoke.

The methods youth commonly use to obtain cigarettes can vary depending on their cigarette consumption patterns (3). We identified that smoking more cigarettes increased the likelihood of students buying their own cigarettes and having someone else buy for them, as did being a regular smoker. Conversely, light regular smokers were more likely to get their cigarettes from friends. If longitudinal data were available it would be possible to determine how cigarette access behaviors change as youth transition through the various stages of smoking onset and progression. Such insight would be valuable to tailoring and targeting enforcement efforts.

Being older, being male, and the frequency of being asked their age during purchase attempts were all associated with an increased likelihood of students buying their own cigarettes and a decreased likelihood of getting their cigarettes from someone else. These findings are consistent with previous research (25–27) and further demonstrate the limitations associated with our current point-of-sale restrictions. For example, although it appears counterintuitive that the more underage youth are asked their age the more likely they are to buy their own cigarettes, youth who try to buy their own cigarettes more often would be asked for identification more as a simple function of the frequency of their purchase attempts. Retailer compliance would have to reach 100% to prevent these youth from accessing cigarettes through commercial sources because research suggests that youth will continue to try purchasing tobacco until they identify a noncompliant retailer (6). Because there are no enforcement strategies that have achieved complete, sustained compliance among retailers to date (28), it seems clear that a new approach to retailer point-of-sale restriction enforcement is required. For instance, given the limited resources for enforcing point-of-sale restrictions in most jurisdictions, a potential new prevention strategy could target enforcement efforts (and increase penalties for infractions) to tobacco retailers within close proximity to schools. The impact of this type of targeted approach to enforcement would require evaluation.

Limitations

First, because students were only asked to identify how they usually obtain cigarettes, it does not necessarily mean that the student uses that source exclusively. The actual numbers of youth who have purchased their own cigarettes or who have used a social source to purchase their cigarettes are likely larger than the data presented in this article. Second, data were not available to determine whether youth were successful at buying cigarettes when they were asked for their age, whether youth were required to show photo identification to verify their age when asked, or who youth buy their cigarettes from if they don't buy their own or don't get them from friends (e.g., stranger or family member). Third, we do not have data on the number of tobacco retailers in the area beyond the six-block radius of each school, so we are unable to determine the effect of retailer density in the broader community on cigarette access behaviors. Finally, the cross-sectional design of this study precludes examination of temporal relations among variables. For instance, it would be useful to understand how cigarette access behavior changes if the number of tobacco retailers surrounding a school increases or decreases. Longitudinal data are required to address such questions.

CONCLUSION

In their current form, point-of-sale restrictions are insufficient to prevent underage youth from acquiring cigarettes. Our data identify that the number of tobacco retailers surrounding a school is related to how youth in those schools commonly access their cigarettes. An innovative prevention strategy could focus on strengthening enforcement efforts (and increased penalties for infractions) among tobacco retailers within close proximity to schools. Additional research is required to further understand the circumstances surrounding youth cigarette access behaviors.

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