

Effects of a School Tobacco Policy on Student Smoking and Snus Use

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Objective: A school tobacco policy (STP) commonly is used to reduce smoking among adolescents, but the effectiveness of such programs is unclear. We evaluated the impact of an STP on tobacco use in 4 schools. **Methods:** The study included 4 intervention and 4 control schools, located in the inner city of Stockholm, Sweden. Schools self-selected for assignment to either an intervention program or a comparison group. In total, the study was comprised of 2671 students in grades 9 and 11, ages 15 to 18, and 1998 students (75%) responded to the questionnaire. We used a repeated cross-sectional design with assessment of tobacco use prevalence before implementation of the STP in 2016 and after 2 years under the program, in 2018. **Results:** Two years after the STP, the intervention school in grade 9 showed a lower prevalence (13.5% vs 1.6%) in the proportion of students who reported smoking ($\chi^2 = 4.54$; $p < .05$) whereas the proportion reporting snus use was practically unchanged. We found no statistically significant impact of the STP for grade 11. **Conclusions:** The results are promising with regard to smoking, when the STP is implemented in early adolescence.

Key words: health communication; public health; school health; smoking; snus use; tobacco use and control

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Tobacco use represents a major preventable cause of morbidity and death. Globally, 5 million tobacco-related deaths occur annually, a number predicted to rise to 8 million by 2030.¹ Sweden has the lowest rate of smoking in the European Union² with about 10% of the population smoking on a daily basis. Still, about 12,000 people die each year, and almost 100,000 need hospital care each year due to tobacco-related disease, making smoking a considerable public health problem. In addition, an important aspect of Swedish tobacco culture is snus (moist tobacco placed under the lip), legally sold and used by about 14% of adults.³

Because most tobacco use starts in early adolescence,⁴ youths represent a promising target for

anti-smoking programs, with schools presumed to be an ideal arena for tobacco-use prevention. Programs in schools may provide information about smoking and the harm arising from it, foster social competence and advice on refusing offered tobacco, and present multi-faceted programs directed to parents, teachers, and the community.⁵ However, school programs in general have demonstrated weak effects, commonly explained by competing social influences promoting smoking outside, as well as within, school premises.⁶ It has been reported that seeing teachers smoking outdoors on school grounds is significantly and positively associated with student smoking,⁷ and peer and parental smoking has been suggested to counteract school-based prevention programs.^{8,9}

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Nevertheless, implementing a school tobacco policy (STP) has been proposed as a promising strategy to reduce adoption of smoking among adolescents.¹⁰ An STP may comprise a variety of components including regulating whether, and the circumstances under which, students are allowed to smoke, establishing consequences for smoking, and controlling adult smoking in school.¹¹ The main objectives of an STP are the prevention or delay of student tobacco use as well as to reduce staff and student exposure to secondhand smoke. Whether such approaches are effective is unclear. Aveyard et al¹² found weak associations of some aspects of STPs with smoking. Comprehensive and strictly enforced policies are associated with lower levels of active smoking in the school, but may only transfer it to the surrounding area.¹¹ Schools without STPs have been shown to have a higher prevalence of student smoking;¹³ however, no details of the policies were provided.¹⁴

A review of 31 international studies⁵ concluded that effects of a school policy alone were questionable. However, many of the included studies were cross-sectional, without including contextual factors such as laws and restrictions, precluding a causal inference between the STP and tobacco use. Another review¹⁴ included cluster randomized studies but found only one cited study¹⁵ to be adequate.

That study¹⁵ was conducted in 2008 in China and included participants aged between 13 and 15 years old. Of 1807 participants between 13 and 15 years old, 941 students attended intervention schools and 866 attended control schools. The students were then surveyed a year later about their smoking habits. No effect of intervention policies on adolescent smoking were found. Thus, a comprehensive search of the literature did not provide evidence of an effect. The authors concluded that this is mainly explained by the absence of rigorous studies. A Norwegian review concluded likewise, that school-based interventions are unlikely to influence adolescent smoking habits.¹⁶ Interventions shown to be beneficial include media campaigns and those that focus on children 5-11 years of age.¹⁶ In a review of randomized studies,¹⁷ school-based programs were not shown to reduce adolescent smoking but to potentially be effective in delaying the start of smoking up to 2 years.

There is little information on how STPs might influence the use of smokeless tobacco, such as Swedish snus, but a Norwegian study found that school policies banning its use during school hours is likely to result in less use.¹⁸ School tobacco policies are increasingly common, but data quantifying the effects are scarce and contradictory.

The aim of the present study was to determine the impact of an STP on tobacco use among students in the highest year in Swedish primary school (age 15-16) and in the second year of upper secondary school (17-18), hereafter referred to as grade 9 and grade 11.

METHODS

The present study was part of a larger prevention project, "Tobacco Free Inner City," conducted by the City of Stockholm, with support from the Public Health Agency of Sweden.¹⁹

Participants

The study included 4 primary schools and 4 upper secondary schools in the inner city of Stockholm, Sweden. We had no data about the socioeconomic variables of individual students. Students in the Stockholm metropolitan area have the possibility of "free school choice," students in a particular school may be recruited from the entire county. To our knowledge, demographic and socioeconomic conditions were largely similar in intervention and comparison schools.¹⁹ The STP intervention group consisted of one school with grade 9 and 3 schools with grade 11; the comparison group included 3 schools with grade 9 and one grade 11 school. For the year 2016, the number of registered pupils was 1273; for the year 2018, the number of pupils was 1398 (total N = 2671). As Table 1 shows, there was a response rate of 79% for 2016 and 71% for 2018 (total N = 1998). The schools were not randomized to the 2 conditions, but were allowed to choose whether they wanted to be part of the intervention or comparison.

Instruments

The data of nicotine use among students were extracted from the Stockholm School Survey. The survey is carried out in alternate years in all city pri-

Table 1
Proportion of Respondents/Total Number of
Students in Intervention and Comparison Schools

Year	Group	Grade	Proportion
2016	Comparison group	9	287/332 = 0.86
		11	297/366 = 0.81
	Intervention group	9	58/75 = 0.77
		11	369/500 = 0.74
	Total 2016		
2018	Comparison group	9	284/381 = 0.75
		11	249/415 = 0.60
	Intervention group	9	60/75 = 0.80
		11	394/527 = 0.75
	Total 2018		

mary and upper secondary schools. Participation of other schools is voluntary. All students in grades 9 and 11 completed the questionnaire during school hours. The questions cover areas such as health, alcohol and drugs, lifestyle, and well-being at school. The questions: “Do you smoke?” and “Do you use snus?” could be answered with Yes (Daily or Sometimes, but not every day) or No (Never, Have tasted, or Have quit).

Table 1 also presents a summary of response rates. Because some students did not respond to all tobacco questions, the effective N in the analyses was somewhat smaller than the study sample.

Intervention

The city of Stockholm developed an STP, a multi-component program consisting of “clarity, support, knowledge, and participation.” Because the STP is part of a larger prevention project, it is anchored in a strategic policy and program context.

The program was implemented in spring 2016 in the intervention schools *after* the 2016 school survey was completed. Thus, in the first survey, there was no difference between intervention and comparison schools with respect to exposure to the STP. The STP program targeted both smoking and snus and includes 4 components associated with

low incidence of smoking:⁵ – universal tobacco laws or restrictions, strict rules against tobacco use, and availability of education for both staff and students about the consequences of tobacco use. The constituent components of this intervention are: (1) mapping (focus groups with students, outline of present situation with respect to tobacco policy and use as reported by staff and observations of the school grounds); (2) staff education; (3) activities and lectures for students; (4) methodological support for program implementation and follow-up; (5) training of student/adolescent ambassadors; (6) tobacco cessation groups for students; (7) dissemination of information and links to relevant material on the Internet; and (8) preparation of individual school information material and No Smoking signs.

The Tobacco Free Inner-City intervention is comprised of 5 principal steps: (1) setting school goals; (2) investigation of the current smoking situation in the school and identification of available support systems; (3) formulation of a school tobacco policy; (4) implementation of the policy; and (5) evaluation to identify factors that worked and areas for improvement. The schools were offered support with 5 workplace meetings to address the steps and to aid in organizing focus groups with students and the school grounds observations.

Table 2
Proportion and Percentage of Respondents in Grade 9 and Grade 11 in Comparison and Intervention Schools Responding “Yes” to the Question “Do You Smoke?”

Year	Group	Grade	Smokers Proportion (%)
2016	Comparison schools	9	29/267 (10.9)
		11	85/297 (28.6)
	Intervention schools	9	8/58 (13.8)
		11	123/369 (33.3)
2018	Comparison schools	9	29/284 (10.2)
		11	53/249 (21.3)
	Intervention schools	9	1/60 (1.7)
		11	99/394 (25.1)

Study Design and Data Analysis

The study employed a repeated cross-sectional design²⁰ with measurements before, and 2 years after, the implementation of the STP. Because 2 separate cohorts of students were surveyed on the 2 occasions, it was only possible to compare intervention to control groups for each year separately. Thus, it was not possible to statistically evaluate the changes between years.. We used non-parametric chi-square tests to assess statistically significant differences in tobacco use.

RESULTS

Overall, 1998 pupils of 2671 responded – 1117/1494 (75%) in the comparison group and 881/1177 (75%) in the intervention group (Table 1). Table 2 shows the prevalence of smoking before and after 2 years of STP. Table 3 shows the corresponding data for snus.

Grade 9 Smoking

Before the implementation of the STP, there was a slightly higher non-significant prevalence of smokers in grade 9 in the intervention school (Table 2), relative to comparison schools; after 2 years of the STP, the prevalence of smoking was reduced in the intervention school, while remaining unchanged in comparison schools (Table 2). There was a statistically significant difference between the comparison school and the intervention schools in

smoking rate in 2018 ($\chi^2 = 4.54$; $df = 1$; $p < .05$). In the intervention group, a greater number of students than expected reported being non-smokers and fewer than expected reported smoking.

Grade 9 Snus Use

We found a non-significant difference in snus use prevalence between the comparison (1.9%) group and the intervention (5.2%) group before the STP implementation (Table 3). In 2018, after 2 years of the STP, the prevalence of snus use was significantly higher in the intervention group compared to the comparison group ($\chi^2 = 6.09$, $df = 1$; $p < .05$). In 2016 the intervention school showed a prevalence of 5.2% and in 2018 it was 6.7%.

Grade 11 Smoking

Before implementing the STP, the proportion of smokers was similar in the intervention schools and the comparison schools (Table 2). After exposure to the STP, the prevalence of smoking was slightly reduced in both groups. Results did not reach statistical significance.

Grade 11 Snus Use

Table 3 shows that the snus use was higher in the intervention group compared to the comparison group before the intervention ($\chi^2 = 5.02$, $df = 1$, $p < .05$); after the intervention, there was a non-significant tendency ($\chi^2 = 3.62$, $df = 1$, $p > .05$).

Table 3
Proportion and Percentage of Respondents in Grade 9 and Grade 11 in Comparison and Intervention Schools Responding “Yes” to the Question “Do You Use Snus?”

Year	Group	Grade	Use snus Proportion (%)
2016	Comparison schools	9	5/265 (1.9)
		11	18/294 (6.1)
	Intervention schools	9	3/58 (5.2)
		11	42/379 (11.1)
2018	Comparison schools	9	4/286 (1.4)
		11	16/246 (6.5)
	Intervention schools	9	4/60 (6.7)
		11	43/391 (11.0)

DISCUSSION

The aim of this study was to evaluate a policy intervention, (“a Tobacco free” inner city) by comparing an intervention group and a control group. Before the implementation of the STP, the intervention school had a slightly but non-significantly higher prevalence of smokers in grade 9 than recorded in the comparison schools. After 2 years of the STP, the prevalence of smoking was significantly lower in the grade 9 intervention school compared to the comparison schools. The result of this study is in contrast to earlier studies reporting no or ambiguous impacts of STPs on smoking behavior.^{5,16}

Before the intervention there was no statistically significant difference in snus use between the intervention group and the control group in grade 9. After 2 years of STP, the proportion of snus users in grade 9 and grade 11 was practically unchanged in both intervention and control schools. We found a significantly higher prevalence of snus use in the intervention group in grade 11 compared to the comparison group before the intervention, but this difference disappeared after the intervention. The prevalence of snus use in grades 9 and 11 remained similar in intervention and comparison schools during the study period. Thus, it seems that the STP did not influence snus use substantially, despite its inclusion in the intervention program. The mechanisms behind this are obscure, but possibly, it was easier for students to conceal snus use from teachers and staff (no smoke, less odor) in an attempt

to subvert the tobacco ban. In addition, although school campaigns about health effects included snus as well as smoking, information of the former may have been less alarming. In contrast to the findings from Norway,¹⁶ the STP in our Swedish study was not associated with a reduction in snus use. Moreover, some students could have switched due to the general opinion that snus is a less harmful alternative to cigarettes.²¹ However, there is evidence that snus use increases the risk for type II diabetes, heart attack/stroke, and various forms of cancer, as well as leading to nicotine dependence.²²

A previous study¹⁹ showed that the prevention project was implemented correctly, ie, the elements of the program were likely to be transmitted to students by the staff, raising the question as to why this multi-component program probably had an impact on the smoking habits of students in the grade 9 but not on those in grade 11. It may be that intervention conducted with a primary preventive purpose influences the decision of whether to start smoking but has limited effect on those who already smoke.

How can this study contribute to tobacco control objectives? To some extent, the results are in line with previous research and tobacco control policies. The 4 components identified³ as being associated with decreased tobacco use, ie, smoking bans, strict rules, supervision, and education, were all part of the intervention in the STP of Tobacco Free Inner City.

Limitations and Strengths

Our study included some methodological limitations. First, the included schools were self-selected to the 2 conditions, and thus, not randomized. The voluntary decision to enroll in the STP may have been associated with greater pre-existing interest in tobacco prevention among staff. Furthermore, the design is based on repeated cross-sectional data rather than longitudinal follow-up.⁵ On the other hand, the study had a high participation rate (~75%) and included 1998 respondents. Moreover, the survey targeted both smoking and snus use, an important aspect for Sweden where snus is relatively common and accepted. There was no difference between intervention and comparison schools in regards to exposure to a school STP before the study started; consequently, any effect of the STP was limited to the study period. The results are promising in favor of STP with regard to smoking, particularly in early adolescence.

IMPLICATIONS FOR HEALTH BEHAVIOR OR POLICY

Tobacco Policymakers

In Sweden, the key actors with respect to tobacco policy development are the World Health Organization (WHO) and the European Union (EU). In 1964, WHO confirmed that cigarette smoking causes lung cancer, but it was not until scientific evidence of an association between secondhand smoke and lung cancer was presented that the interest in regulatory approaches to tobacco control increased at the international level.²³ The WHO Framework Convention on Tobacco Control (FCTC) set guidelines for restricting access to, and reducing demand for, tobacco. The FCTC was adopted in 2003 and is the WHO's most important tobacco control tool. Sweden signed the treaty in July 2005, requiring compliance with its tenets in setting national tobacco law. Our study may contribute to a decrease in smoking by evaluating prevention policies, being a component of the WHO FCTC. Sweden has been a member of the EU since 1995 and is obliged to follow the EU Tobacco Products Directive designed to protect the public health by providing health warnings and smoke-free environments. Recently, Swedish law with respect to smoke-free areas, was expanded to include

sport arenas, outside public buildings, outdoor terraces, and playgrounds. The WHO predicts that extensive smoking bans will reduce smoking, especially among teenagers,²⁴ because social exposure is reduced, potentially leading to a change in societal norms. As previously noted, snus is a commonplace commodity, but nicotine dependence may be lifelong and is associated with increased health risks. Therefore, future research about school policies ought to address achievable ways to reduce the risk of developing dependence of smokeless tobacco.

Implications for Policymakers

Since 1997, Sweden has had an age limit of 18 years to purchase all types of tobacco. Although the smoking prevalence among adolescents has decreased over time, about 10% of students in grade 9 and about 20% in grade 11 report smoking either occasionally or daily,²⁵ suggesting lack of compliance with the law. Sweden has not implemented a display ban since it was ruled that marketing should be allowed when not intrusive or actively encouraging tobacco use.²⁶ This means that children entering an establishment that sells tobacco products are likely to see displays and brands. We suggest that:

- monitoring of compliance with laws against sale of tobacco to minors should be more frequent;
- penalties for retailers who sell tobacco to minors should be substantial, including withdrawal of the license;
- retailers should be informed of valid law and health issues;
- policymakers should prohibit any marketing of tobacco; and
- policymakers should implement a ban on display of tobacco products.

Implications for Practitioners

Because an STP seems more likely to reduce tobacco smoking among pupils ≤ 15 years of age compared with those 2 years older, our results suggest that STPs should be implemented early in the education process. Official statistics on tobacco use among adolescents have shown a decrease over time especially in smoking, suggesting that the establishment of smoke-free areas as stipulated by WHO

has had an impact. Sweden's smoking ban includes not only indoor premises, but also schoolyards, because seeing adults such as teachers and parents smoking is shown to influence student-smoking behavior. Practitioners should:

- develop new, and combine already existing, STP programs;
- make these programs multimodal, using different ways to communicate about all aspects of tobacco use;
- initiate the program in early adolescence or before; and
- target the program to students, teachers, and parents to provide appropriate tools.

Lastly, research such as that which we present, is important to monitor and evaluate prevention programs.

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Human Subject Approval Statement

Tobacco use data for this study were extracted from a larger school survey, the Stockholm School Survey (SSS). The SSS is completed anonymously by students, with no information on personal identification. Therefore, the data are exempt from ethical approval, according to a decision by the Regional Ethical Review Board of Stockholm (2010/241-31/5).

Conflict of Interest Disclosure Statement

The authors declare no conflict of interests.

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