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DOI
10.1093/ntr/ntz212

Publication date
2020

Document Version
Final published version

Published in
Nicotine & Tobacco Research

Nicotine & Tobacco Research, 2020, 1964–1972
doi:10.1093/ntr/ntz212
Original Investigation
Received July 10, 2019; Editorial Decision November 4, 2019; Accepted November 11, 2019

Original Investigation

The Association Between Smoke-Free School Policies and Adolescents' Perceived Antismoking Norms: Moderation by School Connectedness

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Abstract

Introduction: Many European schools implement smoke-free school policies (SFSPs). SFSPs may decrease adolescent smoking by causing adolescents to perceive stronger antismoking norms, yet there exists no quantitative evidence that indicates for which norms and for whom such effects may occur. This study therefore assessed to what extent adolescents' perceived antismoking norms among best friends, teachers, and society at large were associated with SFSPs, and whether these associations were moderated by adolescents' level of school connectedness.

Aims and Methods: Survey data were collected in 2016/2017 on 10,653 adolescents aged 14–16 years old and 315 staff members in 55 schools from seven European cities. Associations of adolescent-perceived SFSPs and staff-reported SFSPs with best friend, teacher, and societal antismoking norms were estimated in multilevel logistic regression models, adjusted for demographics and school-level smoking prevalence. We tested for interaction between school connectedness and SFSPs.

Results: Adolescent-perceived SFSPs were positively associated with antismoking norms by teachers (odds ratio [OR]: 1.46, 95% confidence interval [CI]: 1.15–1.85), were negatively associated with antismoking norms by best friends (OR: 0.81, 95% CI: 0.67–0.99), but were not significantly associated with antismoking norms by society at large (OR: 0.87, 95% CI: 0.74–1.02). All interaction tests between adolescent-perceived SFSPs and school connectedness were nonsignificant. Staff-reported SFSPs were not associated with any norm and showed no significant interaction with school connectedness.

Conclusions: We found that SFSPs are associated with adolescents' perception of more antismoking norms by teachers, but less antismoking norms by best friends, irrespective of adolescents' level of school connectedness.

Implications: Smoke-free school policies, just as many other tobacco control policies, are assumed to foster adolescents' perception of antismoking norms. Still, current evidence does not demonstrate which antismoking norms may be influenced by SFSPs and whether this influence is equal for adolescents with different levels of school connectedness. This study suggests that SFSPs foster adolescents' perception of antismoking norms by teachers, but may concurrently lead to the perception of less antismoking norms by best friends, irrespective of adolescents' school connectedness. SFSPs may therefore need to be complemented with interventions that target antismoking norms in adolescent peer groups.

Introduction

An increasing number of schools in European countries implement smoke-free school policies (SFSPs). SFSPs describe for whom, where, and when smoking is prohibited, and what the consequences are for those who violate the smoking rules. However, there is still no conclusive evidence about the impact of SFSPs on adolescent smoking behavior: previous studies showed positive, no, or even negative associations.[1] Researchers therefore increasingly focus on developing a more refined understanding of the mechanisms through which SFSPs may influence adolescent smoking behavior, under which conditions these mechanisms may occur, and for whom beneficial or harmful mechanisms may occur.[2–4]

A recent literature review identified individual-level mechanisms through which SFSPs may decrease adolescent smoking behavior.[5] One of these was that SFSPs may cause adolescents to perceive stronger antismoking norms. The occurrence of this mechanism would be most likely when schools implement strong SFSPs.[1,5] Strong SFSPs prohibit smoking everywhere on the school area, for everyone, during all school hours, and are strictly enforced. Strong SFSPs thereby communicate a clear norm that school disapproves smoking in all places that fall within their jurisdiction. Weak SFSPs, in contrast, allow adolescents to smoke in certain areas, apply different rules to younger and older adolescents, or do not consistently connect consequences to rule violations, thereby communicating a more ambiguous smoking norm.

Contemporary literature, however, remains unclear about which types of antismoking norms may be influenced by strong SFSPs and whether this influence differs between groups of adolescents. This is an important gap to address because it develops a more refined understanding about how and for whom SFSPs may be beneficial or harmful.

A distinction could be made between adolescents' perception of antismoking norms of best friends, teachers, and society at large. Best friend and teacher norms are known to influence adolescent smoking behaviors[6,7] and such influence of societal norms seems likely as of its strong relation to denormalization and stigmatization,[8–10] but studies never systematically assessed the associations of these norms with SFSPs. There do exist some qualitative studies that suggest that SFSPs may associate with adolescents' perception of specific types of antismoking norms. First, a qualitative study about adolescents' smoking during school hours described how smokers try to mitigate feelings of shame toward their peers for having to stand at a designated smoking area.[11] Second, qualitative studies linked adolescents' perception of weak SFSPs with the view that teachers do not care about, accept, facilitate, or even encourage adolescent smoking.[12–14] Last, qualitative studies described (young) adults (ex-)smokers experiencing more societal disapproval and devaluation since the implementation of smoke-free public policies.[9,15] However, these qualitative studies provide no insights about whether SFSPs may more strongly influence some antismoking norms than others and included smaller samples selected for specific reasons (eg, only smokers).

One may also expect SFSPs to associate differently with adolescents' perception of antismoking norms for adolescents who show different levels of connectedness to the school. The level of school connectedness may differ considerably between individuals within the same school[16,17] and feeling connected to the school (vs. unconnected) has been associated with lower odds of smoking susceptibility and lower risk of smoking initiation.[18–20] Feeling connected to the school was argued to protect adolescents against smoking because of a social bond of attachment and commitment that exists between adolescents and the school, which facilitates adolescents' aligning of their norms, values, and behaviors with those held and practiced by the school.[21] Contrariwise, unconnected adolescents tend to attach and commit to antischool norms, values and behaviors, and thinking and doing the opposite of what school health interventions aim to achieve may be perceived as a marker of status.[22] This may imply that SFSPs may have no or even adverse effects on the perception of antismoking norms among unconnected adolescents.

We used data from 55 schools in seven European cities, allowing for sufficient variation in strength of SFSPs. First, we assessed to what extent the strength of SFSPs is associated with adolescents' perception of antismoking norms by best friends, teachers, and society at large. Second, we assessed the moderation of the association between SFSPs and smoking norms by adolescents' level of school connectedness.

Methods

Data

Data were collected in the school year 2016–2017 as part of the SILNE-R project (http://silne-r.ensp.org). Seven European cities were chosen in seven European countries: Namur (Belgium), Tampere (Finland), Hannover (Germany), Dublin (Ireland), Latina (Italy), Amersfoort (the Netherlands), and Coimbra (Portugal). These cities were chosen as they reflect the respective national averages in terms of demography, unemployment rate, income, and proportion of migrants.[23] A total of 55 secondary schools were included, 6–12 in each city.

Self-administered paper and pencil questionnaires were completed in the classroom, under surveillance of a teacher or research assistant, by all adolescents within a school in the two grades that mainly enrolled students aged 14–16. The total adolescent population consisted of 13 061 adolescents. The participation rate was 79.9%.

Adolescents were excluded from the analysis if they were aged 12, 13, 17, 18, or 19 years (n = 1680). Due to the sampling in specific grades, younger and older adolescents probably are

nonrepresentative of their respective age groups. For instance, older adolescents could be the more problematic and difficult subset of older adolescents who have to repeat a grade. Another reason for exclusion was that these age groups were unevenly distributed over the cities, most likely due to differences in country's educational systems.

Adolescents were also excluded if they had missing information on any of the following: gender (n = 15), smoking status (n = 60), two or more statements on the school connectedness scale (n = 166), or any of the outcome variables (n = 487). The analysis included a total of 10 653 adolescents across the 55 schools.

Self-administered paper and pencil questionnaires were also distributed among staff members (N = 315) of the same schools. Staff members could be in teaching positions, senior management positions, and supportive positions (eg, janitors, care professionals). The aim was to include at least one staff member in each of these functions, yet the persons within each of the functions were selected conveniently. The majority of respondents were teachers. Staff in one Finnish low-socioeconomic status school did not provide data, and therefore, the Finnish researchers that collected the data in this school filled out the form indicating the school rules.

Ethical Approval

All procedures were in accordance with the ethical standards of the respective institutional and/or national research committees and in accordance with the Helsinki Declaration and its later amendments or comparable ethical standards. Ethical approval was obtained separately for each of the cities to comply with the national standards (Supplementary File 1).

Variables

Outcome Variables

Adolescents' perception of antismoking norms by best friends and teachers were determined by the questions: "How would your [best friends/teachers] react if they thought/knew you were smoking?". For best friends and teachers, a separate variable was created in which the four possible answers were dichotomized into strong antismoking norm (*they [would] disapprove a lot* [coded 1]), versus no strong antismoking norm (*they [would] approve, they [would] not mind,* or *they [would] disapprove a little* [coded 0]). These questions are based on numerous studies asking adolescents about their perceptions of (dis)approval by significant others.[24]

We dichotomized all outcome variables because the values for teacher antismoking norms were not normally distributed. Also, we wanted to focus on strong antismoking norms because the meaning of *they (would) not mind* and *they (would) disapprove a little* was relatively close, and we preferred a clearer cut-off point.

Adolescents' perception of antismoking norms by society at large was determined by the statement: "Most people think less of a person who smokes". The four possible answers were dichotomized into strong antismoking norm (*strongly agree* [coded 1]), versus no strong antismoking norm (*agree*, *disagree*, or *strongly disagree* [coded 0]). This statement was based on a widely used scale to assess the perceived stigmatization of people with a mental illness.[10]

School-Level Independent Variables

The strength of SFSPs were measured independently from both staff and adolescent perspectives, as staff reports may represent the existing rules that staff members are aware of, and the perspective of adolescent may reflect the actual implementation of SFSPs.[25,26] Government legislation in each of the participating cities banned smoking in the school area at the time of data collection. The only exception was Amersfoort (the Netherlands), though most schools in Amersfoort voluntarily prohibited smoking on the premises.

Staff-reported SFSPs measured the smoking rules that, according to staff members, apply to adolescents and staff members during school hours. Individual staff members answered eight relevant questions. Six questions measured whether the smoking policy applied for (1) adolescents and/or (2) staff members at, respectively, three places: (1) in the school building (2) on the school premises, parking lots and sport fields and (3) during events organized by school that take place outside the school area. Each item was worth 0.5 point if answered *Yes*. Two questions asked whether there is a smoking room or area for (1) adolescents and/or (2) staff members, worth 0.5 point each when answered *No*. An aggregated mean score, calculated by summing the means of all staff members within a school was assigned for each, with a minimum of zero (weakest) and maximum of four (strongest).

Adolescents answered four questions about SFSPs. The first question was about the rules on adolescent smoking. (1) "Are adolescents allowed to smoke on the school premises?" Answer options were: *No, adolescents are not allowed to smoke and this is strictly enforced*; *No, adolescents are not allowed to smoke, but this rule is not strictly enforced*; *Yes, adolescents are allowed to smoke in certain areas, Yes, adolescents are allowed to smoke anywhere on the school premises* and *Don't know*, receiving 1, 1, 0.5, 0, and 0 points, respectively. The option Don't know received 0 points because it denotes that adolescents cannot benefit from the thought that adolescent smoking is prohibited. Not only the first, but also the second answer received one point, because we used this question for measuring the formal rules adolescents think that apply, irrespective of their actual enforcement. Enforcement was, in turn, measured more adequately by the second question: (2) "How often do you see adolescents smoking on school premises?" Possible answers were: *never*, *sometimes*, *often*, and *always*, receiving 1, 0.5, 0, and 0 points per statement, respectively. The options often and always were treated equally because both indicate a weak enforcement of the rules. The same questions were asked for teacher smoking. (3) "Are teachers allowed to smoke on the school premises?" Response options were: *No, teachers are not allowed to smoke*; *Yes, teachers are allowed to smoke in certain areas*; *Yes, teachers are allowed to smoke anywhere on the school premises*; and *Don't know*, receiving 1, 0.5, 0, and 0 points, respectively. The option Don't know received 0 points because it denotes that adolescents cannot benefit from the thought that teacher smoking is prohibited. (4) "How often do you see teachers smoking on school premises?", with the same response options as for the second question. We first calculated an aggregated mean score per question and per school, excluding the individuals with missing values from each calculation (ie, no exclusion from the sample), by summing and averaging the scores for all adolescents within a school. Then, for each school an overall score was calculated by the sum of the abovementioned aggregate scores, varying between 0 (weakest) and 4 (strongest).

Weekly smoking prevalence among all respondents in the same school was included as a school-level confounder. We did not control for adolescents' own smoking status because this may be influenced by the outcome measure of interest, that is, their perception of antismoking norms, particularly those of best friends.

Individual-Level Independent Variables

School connectedness was determined by five statements based on a validated scale[27]: "I feel close to people at my school," "I feel I am part

of my school," "I am happy to be at my school," "I feel the teachers at my school treat me fairly," and "I feel safe in my school." Adolescents could answer *strongly agree*, *agree*, *disagree*, or *strongly disagree* to each statement, receiving 1–4 points per statement, respectively. A school connectedness score was calculated as the sum of all items, divided by the number of statements an adolescent answered, with higher scores indicating less school connectedness. Adolescents were then categorized into two groups: connected (1.00–2.00) and unconnected (2.20–4.00), so that those categorized as connected on average responded between *strongly agree* and *agree*.

Age (in years), gender, city, parents' migration background (zero, one, or two parents not from country of residence), parental smoking (zero, one, or two smokers), mother's educational level, and father's educational level were measured as possible confounders at the individual level.[28] We did not control for smoking by siblings and friends because these likely are subject to the same SFSPs.[28] Adolescent-reported parental educational level was measured in country-specific categories that were later standardized into low, middle, and high education. In most countries, low corresponded with primary school and/or lower level of secondary school, middle corresponded to higher level of secondary school and/or lower level college, and high corresponded to college or university degree.[29]

Statistical Analysis

First, antismoking norms were described by level of SFSPs implementation divided into tertiles, for adolescent-perceived (1.34–2.29; 2.30–2.90; 2.91–3.70) and staff-reported (1.50–2.85; 2.90–3.40; 3.50–4.00) SFSPs separately.

Second, we tested the associations of continuous variables of adolescent-perceived and staff-reported SFSPs with antismoking norms, using multilevel logistic regression models, presenting odds ratio (ORs) with 95% confidence intervals (CIs). We adjusted the model for age, gender, city, parents' migration background, parental smoking, mother's educational level, father's educational level, school connectedness, and school-level adolescent smoking prevalence. Also, a random intercept at the school level was included to account for variation in smoking norms between schools that were not accounted for by the included variables. The analysis thereby controlled for differences between cities with respect to diverse factors such as cultural backgrounds and educational systems.

Third, we derived the association between SFSPs and smoking norms separately for adolescents who feel relatively connected and unconnected to the school, from models that included interaction between school connectedness and adolescent-perceived and, respectively, staff-reported SFSPs. We adjusted for the same variables as in the model described above.

We performed two sensitivity analyses. First, we included SFSPs as tertiles when assessing their association with antismoking norms. These associations were similar to those reported for continuous variables of SFSPs. Second, we included school connectedness as tertiles instead of a continuous variable. We found similar interactions for both ways.

R version 3.4.3 was used for the analyses.

Results

Table 1 presents the characteristics of the study population and the distribution of these characteristics according to adolescent-perceived SFSPs and staff-reported SFSPs. The median age of adolescents was 15 years. There were slightly more girls than boys. The overall weekly smoking prevalence was 10.1%. Smoking prevalence in schools with strong, intermediate, and weak adolescent-perceived SFSPs was 6.2%, 9.0%, and 14.0%, respectively. For strong, intermediate, and weak staff-reported SFSPs, it was 8.4%, 8.1%, and 12.8%, respectively. A third of adolescents were categorized as unconnected to their school.

Supplementary File 2 presents the number of schools per tertile of adolescent-perceived and staff-reported SFSPs over the different cities. Finland had the highest percentage of schools with strong adolescent-perceived SFSPs, whereas those in Italy were perceived as the weakest. Staff-reported SFSPs were strongest in Finland and weakest in the Netherlands. The correlation between adolescent-perceived SFSPs and staff-reported SFSPs was 0.44.

Table 2 presents the distribution of adolescents across the scores for antismoking norms by best friends, teachers, and society at large, according to adolescent-perceived SFSPs and staff-reported SFSPs. Overall, 25.8% of adolescents perceived antismoking norms by best friends, 41.8% by teachers, and 12.6% by society at large. There is a clear pattern of more antismoking teacher norms with increases in adolescent-perceived and staff-reported SFSPs. No clear patterns can be distinguished for best friends and society at large.

Table 3 presents associations between adolescent-perceived SFSPs and norms, controlling for school connectedness, sociodemographics, school smoking prevalence, and city. Adolescent-perceived SFSPs was positively associated with antismoking norms by teachers (OR: 1.46, 95% CI: 1.15–1.85), negatively with antismoking norms by best friends (OR: 0.81, 95% CI: 0.67–0.99), but not significantly with antismoking norms by society at large (OR: 0.87, 95% CI: 0.74–1.02). Staff-reported SFSPs, adjusted for the same covariates, was not associated with antismoking norms by best friends (OR: 0.97, 95% CI: 0.90–1.05), teachers (OR: 1.03, 95% CI: 0.93–1.14), and society at large (OR: 1.02, 95% CI: 0.96–1.09) (not reported in a table).

Table 3 also presents associations between norms and other covariates. Adolescents aged 14 perceived stronger antismoking norms by all three actors than older adolescents. Females perceived stronger antismoking norms by best friends and teachers, whereas males perceived stronger antismoking norms by society at large. Adolescents whose parents smoke perceived weaker antismoking norms by best friends and society at large than those without smoking parents. Parental smoking was not associated with adolescents' perception of antismoking norms by teachers. There was no clear trend in the association between mother's/father's educational level and antismoking norms. Adolescents in school with a higher smoking prevalence perceived weaker antismoking norms by best friends and teachers, but stronger antismoking norms by society at large.

Table 4 presents the associations between SFSPs and norms per subgroup of school connectedness. We found positive associations (ie, more antismoking) between adolescent-perceived SFSPs and antismoking norms by teachers for both connected (OR: 1.44, 95% CI: 1.12–1.83) and unconnected (OR: 1.52, 95% CI: 1.16–2.00) adolescents. There was a negative association between adolescent-perceived SFSPs and antismoking norms by best friends for unconnected adolescents (OR: 0.74, 95% CI: 0.58–0.94), but not for connected adolescents (OR: 0.84, 95% CI: 0.69–1.03). All other associations were statistically nonsignificant.

Table 5 presents the ORs for interaction between SFSPs and school connectedness. Adolescent-perceived SFSPs showed no significant interaction with school connectedness for the antismoking

Table 1. Sample Characteristics School Smoking Prevalence, Stratified by Adolescent-Perceived SFSPs and Staff-Reported SFSPs

	Total population	Adolescent-perceived SFSPs			Staff-reported SFSPs		
	(%)	Weak (%)	Intermediate (%)	Strong (%)	Weak (%)	Intermediate (%)	Strong (%)
Total (*N*)	10 653	3949	3854	2850	4260	2569	3824
(%)	100.0	37.1	36.2	26.7	40.0	24.1	35.9
Age							
14	31.9	34.0	34.4	31.6	41.6	27.0	31.3
15	45.6	39.2	33.9	27.0	39.5	23.9	36.6
16	22.5	37.2	43.4	19.4	38.7	20.4	40.9
Gender							
Female	51.2	38.4	32.1	29.5	35.7	25.4	38.8
Male	48.8	35.7	40.4	23.9	44.5	22.7	32.8
City							
Namur	13.6	0.0	73.9	26.1	54.4	25.0	19.5
Tampere	15.1	0.0	29.1	70.9	0.0	13.6	86.4
Hannover	9.9	7.1	55.8	37.1	18.6	65.8	15.6
Dublin	16.6	6.7	48.6	44.6	29.2	29.4	41.4
Latina	15.6	100.0	0.0	0.0	76.2	3.4	20.4
Amersfoort	15.8	81.5	18.5	0.0	81.5	18.5	0.0
Coimbra	13.4	50.6	38.7	10.8	7.2	28.3	64.6
Migration background							
None	76.4	39.8	34.3	25.9	40.9	21.9	37.2
One parent	12.3	30.4	39.2	30.4	39.3	26.0	34.7
Two parents	11.3	25.9	44.4	28.7	34.5	36.8	28.7
Parental smoking							
No smoker	65.7	35.7	34.7	29.6	40.6	22.9	36.5
One smoker	22.3	39.8	37.9	22.3	40.0	25.2	34.8
Two smokers	12.0	39.6	40.7	19.7	36.5	28.7	34.7
Mother education level							
Low	13.1	56.6	35.1	8.3	41.5	27.2	31.3
Middle	32.4	39.2	37.8	23.1	39.3	22.9	37.8
High	39.5	32.7	33.4	33.9	42.6	22.6	34.8
Unknown	15.0	26.9	41.0	32.0	33.4	27.7	38.7
Father education level							
Low	17.2	51.8	37.7	10.6	40.4	24.6	35.0
Middle	29.2	39.7	36.4	23.8	39.6	22.9	37.5
High	35.4	33.6	31.4	35.1	44.4	22.1	33.6
Unknown	18.2	25.8	43.7	30.5	31.6	29.7	38.7
School connectedness							
Connected	66.3	38.4	34.2	27.5	41.1	23.2	35.7
Unconnected	33.7	34.5	40.1	25.4	37.7	26.0	36.3
Smoking prevalence							
%	10.1%	14.0	9.0	6.2	12.8	8.1	8.4

Percentages is rows. SFSPs = smoke-free school policies.

Table 2. Individual-Level Antismoking Norms (in %) at the Best Friend, Teacher, and Societal Levels, Stratified by Adolescent-Perceived SFSPs and Staff-Reported SFSPs

	Total population	Adolescent-perceived SFSPs			Staff-reported SFSPs		
		Weak	Intermediate	Strong	Weak	Intermediate	Strong
Total	100.0	37.1	36.2	26.7	40.0	24.1	35.9
Best friend norms							
No strong antismoking	74.2	79.0	69.7	73.6	76.5	68.9	75.3
Strong antismoking	25.8	21.0	30.3	26.4	23.5	31.1	24.7
Teacher norms							
No strong antismoking	58.2	66.7	58.7	45.5	64.1	57.6	51.9
Strong antismoking	41.8	33.3	41.3	54.5	35.9	42.4	48.1
Societal norms							
No strong antismoking	87.4	89.2	84.9	88.4	86.7	84.2	90.3
Strong antismoking	12.6	10.8	15.1	11.6	13.3	15.8	9.7

Percentages in columns. SFSPs = smoke-free school policies.

Table 3. Associations Between Adolescent-Perceived SFSPs and the Antismoking Norm Outcomes, While Controlling for All Covariates

	Odds ratio (95% confidence interval)		
	Best friend norms	Teacher norms	Societal norms
Adolescent-perceived SFSPs	0.81 (0.67–0.99)*	1.46 (1.15–1.85)*	0.87 (0.74–1.02)
School connectedness			
Connected	Ref.	Ref.	Ref.
Unconnected	0.74 (0.67–0.82)*	0.64 (0.58–0.71)*	0.86 (0.76–0.98)*
Age			
14	Ref.	Ref.	Ref.
15	0.76 (0.68–0.85)*	0.82 (0.74–0.91)*	1.00 (0.87–1.14)
16	0.70 (0.61–0.80)*	0.70 (0.61–0.80)*	0.76 (0.63–0.90)*
Gender			
Female	Ref.	Ref.	Ref.
Male	0.52 (0.47–0.58)*	0.90 (0.83–0.99)*	1.30 (1.16–1.47)*
City			
Namur	Ref.	Ref.	Ref.
Tampere	0.32 (0.24–0.43)*	2.91 (2.02–4.20)*	0.38 (0.29–0.50)*
Hannover	0.43 (0.31–0.59)*	1.62 (1.12–2.34)*	1.93 (1.51–2.47)*
Dublin	0.95 (0.70–1.29)	10.01 (6.76–14.83)*	0.80 (0.62–1.03)
Latina	0.28 (0.20–0.40)*	2.63 (1.70–4.09)*	0.14 (0.10–0.20)*
Amersfoort	0.33 (0.23–0.49)*	1.93 (1.22–3.08)*	1.08 (0.81–1.44)
Coimbra	0.66 (0.48–0.89)*	2.29 (1.55–3.38)*	0.50 (0.38–0.65)*
Migration background			
None	Ref.	Ref.	Ref.
One parent	1.07 (0,93–1.22)	0.95 (0.83–1.09)	1.01 (0.85–1.21)
Two parents	1.32 (1.14–1.53)*	0.82 (0.71–0.95)*	1.30 (1.09–1.54)*
Parental smoking			
No smoker	Ref.	Ref.	Ref.
One smoker	0.76 (0.68–0.86)*	1.08 (0.97–1.20)	0.80 (0.69–0.93)*
Two smokers	0.63 (0.54–0.73)*	1.14 (1.00–1.31)	0.80 (0.66–0.98)*
Mother's education level			
Low	Ref.	Ref.	Ref.
Middle	0.93 (0.79–1.10)	0.96 (0.83–1.09)	0.96 (0.77–1.19)
High	1.01 (0.85–1.20)	0.82 (0.71–0.95)*	1.02 (0.81–1.28)
Unknown	1.05 (0.85–1.30)	0.93 (0.76–1.14)	1.11 (0.85–1.45)
Father's education level			
Low	Ref.	Ref.	Ref.
Middle	1.01 (0.87–1.18)	1.00 (0.87–1.15)	0.99 (0.81–1.22)
High	1.16 (0.99–1.36)	1.14 (0.98–1.33)	1.06 (0.86–1.30)
Unknown	1.10 (0.91–1.33)	1.14 (0.96–1.37)	0.98 (0.77–1.25)
School smoking prevalence (per 10% increase)	0.87 (0.77–1.00)*	0.81 (0.70–0.95)*	1.16 (1.03–1.32)*

Odds ratio represents the odds of strong antismoking norms (vs. no strong antismoking norm) with a one point higher score for the covariate. SFSPs = smoke-free school policies.

*Statistical significance at the .05 level.

norms by best friends (OR: 0.88, 95% CI: 0.73–1.06), teachers (OR: 1.06, 95% CI: 0.89–1.26), and society at large (OR: 0.93, 95% CI: 0.75–1.16). Staff-reported SFSPs also showed no significant interaction with the school connectedness for antismoking norms by best friends (OR: 0.98, 95% CI: 0.91–1.06), teachers (OR: 1.02, 95% CI: 0.95–1.09), and society at large (OR: 0.96, 95% CI: 0.87–1.05).

Discussion

Key Findings

Adolescent-perceived SFSPs associated with higher odds of perceiving antismoking norms by teachers, with lower odds of perceiving antismoking norms by best friends, but not significantly with perceiving antismoking norms by society at large. Adolescent-perceived SFSPs showed no significant interaction with school connectedness. Staff-reported SFSPs did not associate with any perceived antismoking norm.

Limitations

Four limitations should be taken into account when interpreting the findings. First, our main independent variable, SFSPs, was measured at the school level. Due to the relatively low number of schools (55 in total), the statistical power at the school-level may have been limited. More precise effect estimates would have been reported with a larger number of schools.

Second, the survey statements used for the measurement of SFSPs did not include some city-specific nuances. One example is that schools in Tampere prohibit any smoking during the school hours, including smoking outside the school premises. Another example is that schools in Amersfoort apply different rules for different age groups.

Table 4. The Association of Adolescent-Perceived SFSPs and Staff-Reported SFSPs With Antismoking Norm Outcomes, per Subgroup of School Connectedness

	Odds ratio (95% confidence interval)			
	Total population	Best friend norms	Teacher norms	Societal norms
Adolescent-perceived SFSPs	10 653			
School connectedness[a]				
Connected	7066	0.84 (0.69–1.03)	1.44 (1.12–1.83)*	0.89 (0.75–1.05)
Unconnected	3587	0.74 (0.58–0.94)*	1.52 (1.16–2.00)*	0.83 (0.66–1.04)
Staff-reported SFSPs				
School connectedness[a]				
Connected	7066	0.98 (0.90–1.06)	1.02 (0.92–1.14)	1.04 (0.97–1.11)
Unconnected	3587	0.96 (0.87–1.06)	1.04 (0.93–1.17)	0.99 (0.81–1.08)

SFSPs = smoke-free school policies.
[a]The main effect within the different groups was calculated with the same interaction model, by changing the reference group for school connectedness and reporting the odds ratio for the SFSPs variable.
*Statistical significance at the .05 level.

Table 5. Interaction Tests Between SFSPs and School Connectedness, With the Antismoking Norm Outcomes. Student Connected to School Were Coded 0, Whereas Unconnected Students Were Coded 1.

	Odds ratio (95% confidence interval)		
	Best friend norms	Teacher norms	Societal norms
Adolescent-perceived SFSPs			
SFSPs[a]	0.84 (0.69–1.03)	1.44 (1.12–1.83)*	0.89 (0.75–1.05)
School connectedness[a,b]	1.02 (0.63–1.65)	0.55 (0.35–0.86)*	1.03 (0.58–1.81)
SFSPs × connectedness	0.88 (0.73–1.06)	1.06 (0.89–1.26)	0.93 (0.75–1.16)
Staff-reported SFSPs			
SFSPs[a]	0.98 (0.90–1.06)	1.02 (0.92–1.14)	1.04 (0.97–1.11)
School connectedness[b]	0.81 (0.50–1.31)	0.57 (0.37–0.90)*	1.13 (0.64–1.98)
SFSPs × connectedness	0.98 (0.91–1.06)	1.02 (0.95–1.09)	0.96 (0.87–1.05)

SFSPs = smoke-free school policies.
[a]Estimate for adolescents with school connectedness is 0.
[b]Estimate for SFSPs is 0.
*Statistical significance at the .05 level. All covariates were controlled for.

Thirdly, we used cross-sectional data, limiting causal inference. SFSPs may lead to antismoking norms, but schools may also be more likely to implement SFSPs when the school climate is such that adolescents perceive more antismoking norms.

Last, the measurement of norms by best friends and teachers related to the underlying construct of disapproval whereas that of society at large related to devaluation. Results for these norms would have been more comparable if we had been able to measure all three norms according to the same underlying construct.

Interpretations of Findings

There was a positive association between adolescent-perceived SFSPs and perceived antismoking norms by teachers. This association corresponds with existing qualitative evidence[12–14] and could underpin that strong SFSPs may cause adolescents to think that teachers (would) personally disapprove their smoking. An alternative explanation could be that staff's enforcement of SFSPs is better when they strongly disapprove smoking of adolescents.[30]

We found an inverse association between adolescent-perceived SFSPs and perceived antismoking norms by best friends. One explanation could be that adolescents oppose the SFSPs, discuss among their friends that the rules are unreasonable, and consequently perceive less disapproval toward smoking by their best friends. Another explanation could be that strong SFSPs increase the likelihood that adolescents discuss the school rules with their best friends, and consequently find out that their best friends do not or would not disapprove their smoking as strongly as they initially thought (ie, perception of antismoking norm becomes more informed). Both explanations correspond with findings that adolescents in the Netherlands generally disapprove smoking, but simultaneously believe it is important to respect other's choice to smoke.[31]

We found no association, or possibly even an inverse association, between adolescent-perceived SFSPs and perceived antismoking norm by society at large. This contrasts earlier qualitative studies on the impact of smoke-free bans in hospitality venues, which found that smoke-free policies caused an increase in the perception of smoking as a socially unacceptable behavior and the stigmatization of smokers.[9,15] We put forward two possible explanations for this discrepancy. First, smoke-free bans in hospitality venues commonly involve a national policy that is accompanied by considerable media attention, whereas this study focused on the strength of implementing SFSPs in individual schools. Second, said studies involved experiences of young adult (ex-)smokers with the implementation of smoke-free bans in hospitality venues, while our analysis involved mostly adolescent never-smokers about smoke-free bans in the school context. Never-smokers are not the objects of

stigmatization and may therefore respond differently to smoke-free policies.

School connectedness did not moderate the associations between SFSPs and antismoking norms. This contradicts our expectation that unconnected adolescents, when compared with connected adolescents, would show a lower increase in perceived antismoking norms in response to SFSPs. The most likely explanation is that school connectedness has such a strong main effect on adolescents' perception of antismoking norms by others (see Table 3) that SFSPs do not influence this relationship. Possibly, moderation of school connectedness would have been found for adolescents' aligning of their own norms with those held by the school (eg, "I (would) disapprove the smoking of teachers"), but unfortunately, we only had data about adolescents' perception of disapproval by others.

Staff-reported SFSPs, in contrast to adolescent-perceived SFSPs, was not associated with any of the antismoking norms. An explanation for this difference could be that the adolescent perspective takes better account of the actual SFSPs implementation (eg, enforcement, communication). This explanation, however, contrasts recent findings that staff-reported SFSPs associate more strongly with adolescents' smoking-related beliefs than adolescent-perceived SFSPs.[4] We therefore think it is important to study what both perspectives precisely measure to help understand our findings as well as the findings of previous studies that report on both measurements separately.[25,26,29]

A recent literature review suggested that SFSPs may cause adolescents to perceive stronger antismoking norms, which may subsequently decrease adolescent smoking behavior.[5] However, we found that SFSPs were not clearly associated with adolescents' increased perception of antismoking norms, only with increased antismoking norms by teachers. We even found potential adverse influences of SFSPs on the perception of antismoking norms by best friends, which are known to have a strong influence on risk-taking behavior during adolescence.[32,33] It, therefore, remains uncertain whether SFSPs contribute to decreasing adolescent smoking behavior through increasing adolescents' perception of antismoking norms. This should by no means be interpreted as evidence that SFSPs are ineffective in decreasing adolescent smoking behavior because antismoking social norms merely represent one of the potential mechanisms connecting SFSPs and smoking.[5]

Conclusion

Smoke-free school policies associated with adolescents' perception of more antismoking by teachers, but concurrently associated with the perception of less antismoking norms by best friends. We, therefore, consider that it is important to complement SFSPs with programs that specifically target antismoking norms in adolescent peer groups.

Supplementary Material

Supplementary data are available at *Nicotine and Tobacco Research* online.

Funding

This study is part of the SILNE-R project, which is supported by the European Union's Horizon 2020 research and innovation program, under grant agreement 635056.

Declaration of Interests

The authors declare that they have no conflict of interest.

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