

## Original Investigation

# Socioeconomic Status and Tobacco Consumption Among Adolescents: A Multilevel Analysis of Argentina's Global Youth Tobacco Survey

Bruno Linetzky, M.D., M.Sc.,<sup>1</sup> Raul Mejia, M.D., Ph.D.,<sup>2,3</sup> Daniel Ferrante, M.D., M.Sc.,<sup>1</sup> Fernando G. De Maio, Ph.D.,<sup>4</sup> & Ana V. Diez Roux, M.D., Ph.D.<sup>5</sup>

<sup>1</sup> Ministerio de Salud de la Nación, Dirección de Promoción de la Salud y Control de Enfermedades No Transmisibles, Buenos Aires, Argentina

<sup>2</sup> Hospital de Clínicas José de San Martín, Universidad de Buenos Aires, Argentina

<sup>3</sup> Centro de Estudios de Estado y Sociedad, Argentina

<sup>4</sup> Department of Sociology, DePaul University, Chicago, IL

<sup>5</sup> Center for Social Epidemiology and Population Health, Department of Epidemiology, University of Michigan, Ann Arbor, MI, USA

Corresponding Author: Bruno Linetzky, M.D., M.Sc., Dirección de Promoción de la Salud y Control de Enfermedades No Transmisibles, Ministerio de Salud de la Nación, Av 9 de julio 1925 9no, Ciudad de Buenos Aires, C1073ABA, Argentina.

Telephone: +54-11-4379-9271; E-mail: blinetzky@msal.gov.ar

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## Abstract

**Introduction:** The relationship between poverty and tobacco consumption among adolescents has not been extensively studied, and what evidence exists has come almost entirely from developed countries. Moreover, the impact of contextual factors—such as school-level poverty—remains unclear.

**Methods:** We obtained information about smoking behavior from the Global Youth Tobacco Survey in Argentina in 2007. School-level characteristics were derived by matching schools to census areas from the 2001 Census. Additional school-level information was obtained from the Ministry of Education. Random intercept models were used to evaluate the associations of school-level variables (poverty in the census area of the school, school receipt of social assistance, and public or private status) with current smoking, intention to quit, secondhand smoke exposure outside the home, support for smoke-free laws, purchase of single cigarettes among smokers, and susceptibility to smoking in 5 years among nonsmokers.

**Results:** After controlling for age and sex, students attending schools receiving social assistance were more likely to smoke (odds ratio [OR] 1.35, 95% CI 1.02–1.80) and to purchase loose cigarettes (OR 1.66, 95% CI 1.08–2.54), whereas school poverty was significantly associated with secondhand smoke exposure (OR 1.27, 95% CI 1.04–1.58).

**Conclusion:** This study shows that an association exists between unfavorable contextual school characteristics and tobacco consumption and related measures among youth in Argentina. Efforts to prevent smoking may need to address the school-level factors that place youth at higher risk.

## Introduction

Tobacco consumption in adolescents is a major public health problem as most adult smokers start smoking before the age of 18 (Giovino, 1999; Richardson et al., 2009) and smokers who start smoking in adolescence have less chances of quitting than those who start later in life (Khuder, Dayal, & Mutgi, 1999). Tobacco companies are also known to consider youth a priority for promotion and sponsorship campaigns (Braun, Mejia, Ling, & Perez-Stable, 2008; Gilpin, White, Messer, & Pierce, 2007; Ling & Glantz, 2002).

The relationship between poverty and tobacco consumption in adults has been extensively studied (Diez Roux, Merkin, Hannan, Jacobs, & Kiefe, 2003; Fukuda, Nakao, & Imai, 2007; Laaksonen, Rahkonen, Karvonen, & Lahelma, 2005; Samet, Howard, Coultas, & Skipper, 1992; Webb & Carey, 2008), showing a higher smoking prevalence among low socioeconomic status (SES) groups compared with high SES groups (Ciapponi, 2011). This relationship is structured by a country's stage in the tobacco epidemic (Lopez, Collishaw, & Pihla, 1994), which predicts a shift in the gradient over time (Nierkens, de Vries, & Stronks, 2006). It is thought that as countries pass through the stages of the tobacco epidemic, socioeconomic gradients steepen.

Argentina, a country in Stage 4 of the epidemic, is experiencing decreases in smoking prevalence in both men and women (Ministerio de Salud de la Nación, 2006; 2011). While there are no published studies comparing sex-specific rates of tobacco-related mortality in the country, there is evidence that mortality from lung cancer is decreasing for men but increasing for women (Boletín de vigilancia, 2009). National survey data from

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2005 suggest a strong socioeconomic patterning for tobacco consumption among adults, with steep gradients for both men and women in the 18–24 age group (Fleischer, Diez Roux, Alazraqui, Spinelli, & Lantz, 2011). However, less is known about the strength of this relationship among adolescents. Although an inverse relationship between parent's SES and prevalence of smoking by adolescents has been reported in developed countries (Blow, Leicester, & Windmeijer, 2005; Borland, 1975; Soteriades & DiFranza, 2003), we have found only one study of the association of SES with tobacco use in adolescents from developing nations (Doku, Koivusilta, Raisamo, & Rimpela, 2010).

Several mechanisms may generate an unequal social distribution of tobacco consumption. Adolescents from families with low SES may be exposed more frequently to parental smoking, with a corresponding increase in the chance of smoking initiation (Barreto et al., 2011; Wilkinson, Shete, & Prokhorov, 2008). In addition, adolescents from families with low SES may use tobacco for coping with economic problems (Stead, MacAskill, MacKintosh, Reece, & Eadie, 2001; Wiltshire, Bancroft, Parry, & Amos, 2003). Research also suggests that smoking cessation treatments may be less effective among individuals with lower SES (Bauld, Judge, & Platt, 2007). These effects are likely accentuated by a higher exposure to advertising of tobacco products in neighborhoods with disadvantaged economic indicators (Seidenberg, Caughey, Rees, & Connolly, 2010).

Along with the SES of their families, young peoples' behaviors are also influenced by their schools. The socioeconomic environment where the school is located may influence the smoking behaviors of students through several mechanisms, including exposure to tobacco advertising (Barreto et al., 2011; Seidenberg et al., 2010), availability of tobacco products, and the development of social norms that facilitate or detract from youth smoking (Lovato et al., 2010). However, we could not find studies in developing countries that address the impact of socioeconomic context of the school among youth. Our primary goal was to analyze the relationship between the socioeconomic environment of the school and smoking attitudes and behaviors of adolescents in Argentina.

## Methods

We obtained information about smoking behavior from the Global Youth Tobacco Survey (GYTS) in Argentina in 2007 (Ministerio de Salud de la Nación, 2009). This survey, developed by the World Health Organization and the Centers for Disease Control and Prevention (CDC; Warren et al., 2000), has been used widely for surveillance of tobacco consumption among youth (Warren et al., 2008, 2009).

The 2007 GYTS was a representative sample of students aged 13–15 from high schools across Argentina. The survey was based on a 2-staged sampling procedure. The first stage consisted of randomly selecting schools from across the country as the primary sampling units with a probability of selection that was proportional to the number of students enrolled. This was followed by the selection of approximately three classes per school through systematic sampling of classrooms. All students within selected classrooms were invited to participate.

## Smoking Variables

Questions on smoking were modeled on those suggested by the CDC (Warren et al., 2000) and included tobacco use, second-hand smoke exposure, susceptibility to smoking in the future, beliefs and perceptions about tobacco, access to cigarettes or tobacco products, and exposure to tobacco ads. In addition, questions with particular relevance to Argentina, including questions on whether students bought single cigarettes, were included.

The dependent variables used in the analysis are:

**Current smoking:** Those who had smoked at least one puff in the previous 30 days.

**Secondhand smoke exposure outside their homes:** Nonsmokers who had been to public places where people were smoking at least once over the past 7 days.

**Intention to quit:** Current smokers who were willing to quit at the moment of the survey.

**Susceptibility to smoking:** Nonsmokers who envisioned themselves smoking in 5 years.

**Adolescents who are in favor of banning smoking in public spaces.**

**Purchase of single cigarettes:** Adolescents who usually bought single cigarettes (among those who usually bought cigarettes).

## Socioeconomic Variables at the School Level

We used data from Argentina's 2001 National Population Census (*Censo Nacional de Población, Hogares y Vivienda 2001. Base de datos. Versión 1.2*) to generate a measure of socioeconomic level for each school in our study. We matched schools to their corresponding census area. These census areas, created by the National Institute of Statistics and Census, include on average 300 households and are used to distribute the fieldwork for the National Population Census (Marco de Muestreo Nacional Urbano, 1999). To estimate the SES of each school's neighborhood, we measured the presence of convergent poverty, which is defined as the presence of households in the area with both material deprivation (homes built with precarious material or without flush toilets) and with resource deprivation (households with insufficient economic capacity to purchase basic goods and services for subsistence; INDEC, 2004). The status of the school (public or private) and whether the school received social assistance (provision of free breakfast or lunch for students) were also considered. This information was provided by the Ministry of Education.

## Statistical Analysis

The analysis took into account the complex survey design. Distributions of independent and dependent variables were assessed using weighted counts and percentages. We examined the prevalence of tobacco consumption and related measures according to sex, age, and school-level socioeconomic category (public or private school, school with social assistance, and school located in a census area with convergent poverty) using weighted percentages. Chi-square tests were used to assess bivariate relationships.

## SES and tobacco consumption among adolescents

Logistic multilevel models with a random intercept for each school were used to account for residual correlation of the dependent variable in each school (Rabe-Hesketh & Skrondal, 2008). Model 1 examines the independent effect of each school-level socioeconomic variable on each dependent variable adjusted for age and sex. Model 2 considers all the socioeconomic variables together. *p* values <.05 were considered statistically significant. Statistical analysis was performed using Stata 10.0.

### Results

The 71 participating schools included 4,926 students, 52.0% of whom were girls. The overall prevalence of current smoking was 29%. The prevalence of other dependent variables is described in Table 1.

A majority of respondents (56.1%) attended public schools, and 35.1% went to schools receiving social assistance. Nearly 79% of respondents attended schools with convergent poverty in the surrounding area (Table 1). These socioeconomic variables were related, as public schools received more social assistance and were located more often in areas with convergent poverty than private schools. Moreover, school in areas with convergent poverty received social assistance more frequently than those in areas without convergent poverty (Table 2).

Smoking was more frequent in girls (31.1%) than in boys (25.6%), and prevalence increased with age (see Table 3). No differences in adolescents susceptible to smoking or smokers interested in quitting were found by sex or age. Girls bought single cigarettes more often than boys (44.6% vs. 37.2%), and as age increased, there was a decrease in the percentage of adolescents who bought single cigarettes ( $\leq 13$  years 60.6%, 14 years 50.8%, 15 years 34.0%, and  $\geq 16$  years 33.9%). Younger adolescents were less exposed to secondhand smoke and were less likely to support the banning of smoking in public spaces.

Table 4 describes the prevalence of dependent variables according to school-level SES; most of the tobacco indicators were higher among disadvantaged schools.

The multilevel analysis shows that the schools that received social assistance had a higher prevalence of smoking. This association was statistically significant before and after adjustment for other school-level variables (odds ratio [OR] 1.37, 95% CI 1.06–1.76 in Model 1 and OR 1.35, 95% CI 1.02–1.80 in Model 2). We found no differences in smoking prevalence between private or public schools or schools located in census areas with convergent poverty or not (Table 5).

Smoking adolescents who attended schools located in areas with convergent poverty were more interested in quitting than those who attended other schools; however, this difference was not statistically significant (OR 1.41, 95% CI 0.96–2.08) in

**Table 1. Characteristic of the Population, Type of School Attended, Tobacco Consumption, and Related Behaviors**

		Weighted count	%
Sex	Female	852,382	52.0
	Male	1,090,851	48.0
Age	13	441,498	23.1
	14	485,255	25.4
	15	495,529	26.0
	16 or more	486,329	25.5
Current smokers <sup>a</sup>	Yes	536,535	29.0
	No	1,315,716	71.0
Smokers who want to quit <sup>b</sup>	Yes	177,022	52.3
	No	161,449	47.7
Buyers of single cigarettes <sup>c</sup>	Yes	216,611	41.2
	No	309,651	58.8
Susceptibility to smoking <sup>d</sup>	Yes	80,529	9.8
	No	741,727	90.2
Favors ban smoking in public spaces <sup>a</sup>	Yes	1,532,071	81.3
	No	352,073	18.7
Secondhand smoke exposure <sup>d</sup>	Yes	1,354,770	70.8
	No	559,874	29.2
Type of school attended	Private school	852,382	43.9
	Public school	1,090,851	56.1
Attending a school that receive social assistance	Yes	682,054	35.1
	No	1,261,179	64.9
Attending a school located in area with convergent poverty	Yes	417,215	21.5
	No	1,526,018	78.5

Note. <sup>a</sup>From the whole population.

<sup>b</sup>From current smokers.

<sup>c</sup>From adolescents who buy cigarettes.

<sup>d</sup>From nonsmokers.

**Table 2. Distribution of Students According to School Socioeconomic Variables**

	Receive social assistance		Located in an area with convergent poverty		Receive social assistance	
	No	Yes	No	Yes	No	Yes
Distribution of students, by type of school and social assistance						
Type of school						
Private (%)	84.1	15.9				
Public (%)	49.9	50.1				
Distribution of students, by type of school and convergent poverty						
Type of school						
Private (%)			26.2	73.8		
Public (%)			17.8	82.2		
Students distribution, by type of school and convergent poverty						
Located in an area with convergent poverty						
No (%)					86.6	13.5
Yes (%)					59.0	41.0

Note. *p* < .001.

Model 1 and then disappeared altogether in the complete model. Attending a school that received social assistance was also positively associated with the desire to quit among smokers although these associations were not statistically significant in either model.

In Model 1, purchase of single cigarettes was associated with convergent poverty (*OR* 1.55, 95% *CI* 1.03–2.34) and with schools receiving social assistance (*OR* 1.92, 95% *CI* 1.31–2.82). The association with social assistance was also statistically significant in the complete model (*OR* 1.66, 95% *CI* 1.08–2.54).

Susceptibility to smoke in the future was more frequent in schools with convergent poverty (*OR* 1.45, 95% *CI* 1.00–2.09), and there was a borderline significant association with schools receiving social assistance (*OR* 1.42, 95% *CI* 0.99–2.03); these associations disappeared in the complete model. Secondhand smoke exposure was more frequent in schools located in areas with convergent poverty in both models (*OR* complete model = 1.27, 95% *CI* 1.04–1.58).

The single explanatory variable models showed that support of banning smoking in public spaces was lower in schools located in areas with convergent poverty (*OR* 0.78, 95% *CI* 0.62–0.88)

and in schools that received social assistance (*OR* 0.74, 95% *CI* 0.59–0.94), but this relationship did not persist in the full model.

## Discussion

We found a relationship between socioeconomic characteristics of schools and tobacco consumption among adolescent students in Argentina. Smoking prevalence, the probability of purchasing single cigarettes, susceptibility to smoking, and secondhand smoke exposure were higher among students from schools with disadvantaged SES measured by convergent poverty in the area where the school was located and/or the school having received social assistance. Students in schools with convergent poverty or receiving social assistance also supported the ban of smoking in public places less frequently than in schools of higher SES.

Of the three indicators examined, convergent poverty and receipt of social assistance were the ones most consistently related to the outcomes. Attending a public or private school was not significantly associated with any of the indicators (although

**Table 3. Tobacco Consumption and Related Behaviors According to Age and Sex**

Adolescents	Sex		<i>p</i> Value	Age (years)				<i>p</i> Value
	Boys (%)	Girls (%)		≤13 (%)	14 (%)	15 (%)	≥16 (%)	
Current smokers <sup>a</sup>	25.6	31.1	<.001	19.9	22.1	31.1	45.3	<.001
Smokers who want to quit <sup>b</sup>	51.1	53.5	.570	51.9	48.2	51.9	54.4	.756
Buyers of single cigarettes <sup>c</sup>	37.2	44.6	.033	60.6	50.8	34.0	33.9	<.001
Susceptibility to smoking <sup>d</sup>	10.1	9.3	.822	11.8	10.4	8.1	7.5	.203
Favors ban smoking in public spaces <sup>a</sup>	82.8	80.3	.076	85.2	85.0	80.0	75.8	<.001
Secondhand smoke exposure <sup>d</sup>	68.8	72.7	.015	63.4	65.1	74.9	78.9	<.001

Note. <sup>a</sup>From the whole population.

<sup>b</sup>From current smokers.

<sup>c</sup>From adolescents who buy cigarettes.

<sup>d</sup>From nonsmokers.

**Table 4. Tobacco Consumption and Related Behaviors According to Socioeconomic Conditions of Schools**

Adolescents	Convergent poverty			Private or public school			Receive social assistance		
	No (%)	Yes (%)	<i>p</i>	Public (%)	Private (%)	<i>p</i>	No (%)	Yes (%)	<i>p</i>
Current smokers <sup>a</sup>	25.0	30.1	.006	31.7	25.6	.000	27.2	32.4	.002
Smokers who want to quit <sup>b</sup>	43.3	54.4	.025	53.1	51.1	.632	51.2	54.3	.465
Buyers of single cigarettes <sup>c</sup>	38.9	41.7	.492	42.5	39.1	.300	36.0	49.0	.000
Susceptibility to smoking <sup>d</sup>	7.3	10.6	.059	9.62	9.98	.822	8.8	11.9	.066
Favors ban smoking in public spaces <sup>a</sup>	84.5	80.4	.011	79.8	83.3	.010	82.4	79.3	.033
Secondhand smoke exposure <sup>d</sup>	66.7	71.9	.058	67.5	73.3	.000	70.7	71.0	.848

Note. <sup>a</sup>From the whole population.

<sup>b</sup>From current smokers.

<sup>c</sup>From adolescents who buy cigarettes.

<sup>d</sup>From nonsmokers.

point estimates suggested associations of public schools with smoking prevalence and buying single cigarettes). In fully adjusted models, social assistance was related to smoking prevalence and to the purchase of loose cigarettes, whereas convergent poverty was significantly associated with secondhand smoke exposure. Both indicators were also related to greater desire to

quit among smokers and to lower support for smoking bans (although these associations were not statistically significant in fully adjusted models).

We investigated three alternate measures of the school socioeconomic environments because they may be tapping into

**Table 5. Odds Ratios (ORs) of Tobacco Consumption and Related Behaviors Associated With Socioeconomic Characteristics of the Schools: Model 1 With One Socioeconomic Variable and Model 2 With All the Socioeconomic Variables**

	Model 1		Model 2	
	OR	95% CI	OR	95% CI
Current smokers				
Convergent poverty	1.01	0.77–1.30	0.92	0.71–1.20
Receive social assistance	<b>1.37</b>	<b>1.06–1.76</b>	<b>1.35</b>	<b>1.02–1.80</b>
Public school	1.24	0.97–1.57	1.13	0.88–1.45
Smokers who want to quit				
Convergent poverty	1.41	0.96–2.08	1.33	0.88–2.02
Receive social assistance	1.27	0.84–1.92	1.18	0.75–1.86
Public school	0.97	0.66–1.41	0.94	0.64–1.39
Buyers of single cigarettes				
Convergent poverty	<b>1.55</b>	<b>1.03–2.34</b>	1.32	0.87–2.01
Receive social assistance	<b>1.92</b>	<b>1.31–2.82</b>	1.66	<b>1.08–2.54</b>
Public school	1.34	0.91–1.97	1.18	0.80–1.73
Susceptibility to smoking				
Convergent poverty	<b>1.45</b>	<b>1.00–2.09</b>	1.32	0.90–1.92
Receive social assistance	1.42	0.99–2.03	1.36	0.91–2.03
Public school	0.98	0.70–1.38	0.89	0.63–1.26
Favors ban smoking in public spaces				
Convergent poverty	<b>0.78</b>	<b>0.62–0.88</b>	0.83	0.65–1.16
Receive social assistance	<b>0.74</b>	<b>0.59–0.94</b>	0.81	0.63–1.05
Public school	0.88	0.70–1.09	0.93	0.73–1.25
Secondhand smoke exposure				
Convergent poverty	<b>1.28</b>	<b>1.05–1.56</b>	<b>1.27</b>	<b>1.04–1.58</b>
Receive social assistance	1.02	0.9–1.39	1.01	0.8–1.28
Public school	1.02	0.85–1.24	1.03	0.85–1.25

Note. ORs that are statistically significant at the 0.05 level are in bold font. Model 1 with only one socioeconomic explanatory variable at school level adjusted by sex and age. Model 2 includes all socioeconomic explanatory variables at school level adjusted by sex and age.

different aspects of social disadvantage. The poverty measure reflects the conditions in the surrounding neighborhood, whereas social assistance is a more proximal measure of deprivation among the students attending the school. The public versus private status may reflect other aspects of school organization and norms. Although all three indicators were associated, there was also at least some variability in one across levels of another. However, the strong associations between several of these measures (such as over 80% of public schools being located in areas with convergent poverty) also make it difficult to disentangle their effects. For this reason, we report associations with each indicator separately as well as adjusted for each other. In addition, limited variability in some measures may limit their usefulness as explanatory variables.

Our findings suggest that various social dimensions may relate to smoking outcomes differently. For example, receiving social assistance (an indicator of deprivation of the students in the school) was strongly associated with smoking prevalence and with buying single cigarettes after adjustment, whereas neighborhood poverty (which could relate to smoking in other associated environments and public places visited locally by students) was related to secondhand smoke exposure. Additional studies are needed to better examine the social processes influencing smoking among poor adolescents.

Our results also suggest that the desire to quit smoking may be more frequent in poorer schools. This association may have not been statistically significant due to the relatively small sample size, since only smokers were included in this analysis. However, this trend may show the need to increase access to interventions aimed at facilitating quitting (such as cognitive therapies and motivational incentives) in these types of schools, given that they have proven efficacy in adolescents (Grimshaw & Stanton, 2006).

The purchase of single cigarettes was more frequent among students from poor schools. This finding is congruent with the scarce literature available (Thrasher et al., 2009). The purchase of single cigarettes enables vulnerable populations to buy cigarettes without paying the price of the whole package (Smith et al., 2007) and favors smoking among the poorest (WHO, 2008). To avoid this, the National Congress, following Framework Convention on Tobacco Control (FCTC) recommendations, has passed a law banning the sale of packs with fewer than 10 cigarettes and the sale of single cigarettes (WHO, 2003).

Our results also suggest that vulnerable populations are more likely to be exposed to secondhand smoke and yet are less likely to support laws for smoke-free environments. Even though such laws are a clear public health priority, it is not clear that banning smoking in public places decreases exposure to secondhand smoke equally in all social classes, particularly among children and youth (Akhtar et al., 2010; Sims et al., 2010). As far as the support of smoking bans is concerned, a report of the GYTS found that knowledge of harm caused by secondhand smoke was the main variable associated with the support of the laws against smoking in public places (Koh et al., 2011). Raising awareness among teens, especially those attending disadvantaged schools, about the damage caused by secondhand smoke could be useful to increase their support to smoke-free environment legislation.

This is the first study showing an association between tobacco consumption among youth and poverty in Latin America. Other studies have explored the relationship between tobacco and poverty, mainly in developed countries (Blow et al., 2005; Borland, 1975; Doku et al., 2010; Harrell, Bangdiwala, Deng, Webb, & Bradley, 1998; Lowry, Kann, Collins, & Kolbe, 1996; Soteriades & DiFranza, 2003; Zhu, Liu, Shelton, Liu, & Giovino, 1996). This study has several limitations. First, an important limitation is that the GYTS does not include questions about individual-level SES, which prevented the investigation of individual-level SES as a confounder or effect modifier. Thus, we cannot differentiate contextual from compositional effects. Second, the estimation of school-level SES was done based on information from the 2001 national census, and the GYTS survey was administered in 2007; the SES status of the census area could have changed in the intervening period introducing measurement error. However, no other census area-level datasets exist. Data on school-level social assistance correspond to the same year as the survey, and it was this measure that yielded the clearest associations in our analyses.

This study provides information about how disadvantage affects smoking behavior among youth. The results of this study could be used to advocate for the implementation of effective policies that have shown to have a higher impact among more disadvantaged adolescents, such as raising tobacco products' prices (WHO, 2008) and banning advertising, promotion, and sponsorship of tobacco products (Lovato, Linn, Stead, & Best, 2003).

Finally, our study demonstrates a method through which socioeconomic inequalities can be examined, even when the primary dataset used has not collected socioeconomic data. We show that it is feasible to integrate public health surveys such as the GYTS, with other data sources, including the national census. Doing so enables analysis of the importance of contextual factors, including area-level poverty.

## Conclusion

This study suggests that an association exists between unfavorable school conditions and tobacco consumption among youth. Smoking, exposure to secondhand smoke, and vulnerability to smoking were more frequent in students who attended schools with poorer SES indicators. The method used for the analysis could add value to the GYTS, a surveillance tool that has been implemented worldwide for more than 10 years. Further studies are required to understand the way in which area-level contextual factors may interact with the compositional characteristics of youth to influence smoking behaviors and attitudes.

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## Declaration of Interests

*None declared.*

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