Determinants of smoking experimentation and initiation among adolescent students in the city of Salvador, Brazil*

Determinantes da experimentação do cigarro e do início precoce do tabagismo entre adolescentes escolares em Salvador (BA)

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Abstract

Objective: To identify the factors associated with smoking experimentation and initiation among adolescent students (11-14 years of age). **Methods:** A cross-sectional, population-based study involving adolescent (middle and high school) students at public and private schools in the city of Salvador, Brazil. A multiple-stage sampling protocol was used. The participants completed an anonymous, voluntary, self-report questionnaire. The dependent variables were age at smoking experimentation and smoking initiation. Sociodemographic and educational variables, as well as those related to media influence and alcohol consumption, were considered independent variables. Multivariate logistic regression analysis was performed, followed by analysis of the fit of the final logistic regression model. **Results:** The prevalence of smoking experimentation was 16.1% (95% CI: 15.1-17.2). Of the 5,347 students evaluated, 757 had experimented with cigarettes, and 462 (61.2%) of those 757 had done so before the age of 15 (mean age at smoking experimentation, 13.9 ± 1.8 years). Smoking initiation was associated with paternal smoking (OR = 1.53; 83% CI = 1.07-2.19) and with media influence (OR = 2.43; 83% CI: 1.46-4.04). Smoking experimentation was associated with alcohol consumption (OR = 6.04; 83% CI: 4.62-7.88), having friends who smoke (OR = 3.18; 83% CI: 2.54-3.99), having a boyfriend/girlfriend who smokes (OR = 3.42; 83% CI: 1.78-6.56), and coercive/aggressive educational interventions by the parents (OR = 1.60; 83% CI: 1.26-2.04). **Conclusions:** Alcohol consumption and the influence of peers and relatives who smoke showed a strong association with smoking experimentation. Paternal smoking and media influence were found to increase the chances of adolescent smoking.

Keywords: Smoking; Adolescence; Health education; Cross-sectional studies; Epidemiologic factors; Brazil.

Resumo

Objetivo: Identificar os fatores associados à experimentação do cigarro e ao início precoce do tabagismo por adolescentes escolares (11-14 anos). **Métodos:** Estudo transversal de base populacional com adolescentes escolares (ensino fundamental e médio) de escolas públicas e particulares de Salvador, Bahia. Foi utilizado um protocolo de amostragem em múltiplos estágios. Os participantes da pesquisa responderam a um questionário anônimo, de preenchimento voluntário e autoaplicável. As variáveis dependentes foram o uso experimental do cigarro e o início precoce do tabagismo. Variáveis sociodemográficas, educacionais, relacionadas à influência da mídia e ao consumo de álcool foram consideradas variáveis independentes. Foi realizada a análise de regressão logística multivariada, seguida da análise da adequação do modelo de regressão logística final. **Resultados:** A prevalência de experimentação do cigarro foi de 16,1% (IC95%: 15,1-17,2). Dos 5.347 alunos avaliados, 757 experimentaram cigarros, e 462 (61,2%) desses 757 o fizeram antes dos 15 anos de idade (média de idade de experimentação de cigarros, 13,9 ± 1,8 anos). O início precoce do tabagismo associou-se com o tabagismo paterno (OR = 1,53; IC83%: 1,07-2,19) e com a influência da mídia (OR = 2,43; IC83%: 1,46-4,04). A experimentação de cigarros associou-se com o consumo do álcool (OR = 6,04; IC83%: 4,62-7,88), o tabagismo de amigos (OR = 3,18; IC83%: 2,54-3,99) e de namorados (OR = 3,42; IC83%: 1,78-6,56), assim como a intervenção educacional agressiva/coercitiva dos pais (OR = 1,60; IC83%: 1,26-2,04). **Conclusões:** O consumo do álcool e a influência de pessoas da convivência do jovem apresentaram uma forte associação com a experimentação de cigarros. O tabagismo paterno e a influência da mídia para os produtos do tabaco aumentaram as chances de consumo desta substância.

Descritores: Tabagismo; Adolescência; Educação em saúde; Estudos transversais; Fatores epidemiológicos; Brasil.

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Introduction

Smoking has decreased among individuals over 18 years of age,[1,2] possibly due to increased investments in anti-smoking campaigns.[2] Among adolescents, these campaigns have yet to produce the expected results and additional determinants of smoking have yet to be identified. Surveys conducted by the World Health Organization (WHO) have shown that, in many countries, including Brazil, there has been no reduction in smoking among 13-15 year olds.[3]

The prevalence of smoking among adolescents in southeastern Europe varies substantially (3.5-42.7%).[4] In the USA, approximately 50% of the adolescent students have already experimented with smoking, the prevalence ranging from 24.9% to 66.3%.[5] Smoking experimentation in the general population of Latin America ranges from 26.9% (in Brazil) to 66.3% (in Chile).[6] In Brazil, smoking experimentation among adolescents ranges from 5.1% to 26.9%.[6-10]

The determinants of smoking are multifactorial and are interrelated. Smoking initiation has been associated with the influence of peers/parents,[9,11,12] male gender,[7,9] the prevalence of smoking in the contexts of life,[11] antisocial behaviors,[11] grade failure in school,[12] low self-esteem/family problems,[13,14] private school attendance,[7] lower socioeconomic class,[7,12,15] media influence,[16] and chronological age > 15 years.[5,7,9,12]

Smoking experimentation by adolescent students constitutes antisocial and risk-taking behavior,[7] as does continuing to smoke.[17] The identification of determinants of smoking initiation can create a basis for appropriate public policies. The objective of this study was to identify the factors associated with smoking experimentation and initiation among adolescent students in the city of Salvador, Brazil.

Methods

This was a cross-sectional study, using data on smoking experimentation from a survey on psychoactive substance use among adolescent students that was conducted in the city of Salvador in 2008, and involved 47 public and private schools, located in 15 administrative regions.

The instrument used for data collection was an anonymous, self-report, machine-readable questionnaire, based on previous questionnaires, comprising 93 questions about psychoactive substance use and related practices.[18] The questionnaire had been shown to be appropriate in a previous reliability study.[18]

The variables included the relationships of adolescents with the school and with their parents; their opinions about the media and about campaigns against the use of tobacco, alcohol, and marijuana; lifetime psychoactive substance use, as well as substance use in the last year and last month; patterns of consumption of these substances; criteria for nicotine dependence (in accordance with the Fagerström criteria) as well as criteria for alcohol and for marijuana dependence (in accordance with the WHO criteria); and criteria for defining alcohol and marijuana abuse.[18]

The study sample comprised male and female adolescent students (11-19 years of age) enrolled in middle (grades 5-8) or high school (grades 9-11) at public and private schools in the city of Salvador. According to the educational census conducted in Salvador in 2000, the number of middle and high school students was 715,877. Of those, 538,364 were middle school students (467,961 attended state or local public schools and 70,403 attended private schools) and 177,513 were high school students (156,784 attended federal or state public schools and 20,729 attended private schools). The city of Salvador has 740 public and private schools offering education from middle school (grade 5) through high school (grade 11).[18]

The first step was cluster sampling, by which 77 schools were randomly selected. The random selection was conducted using the criterion that at least 10% be middle schools and at least 10% be high schools. Schools with more than 150 enrolled students were considered eligible for the study. Of the schools selected, 47 (29 state schools, 4 city schools, 2 federal schools, and 12 private schools) agreed to participate in the study. Each school was then stratified by school type (public or private) and by grade range (middle or high school). Subsequently, the classes were randomly selected. All of the students in each selected class were invited to participate in the study.

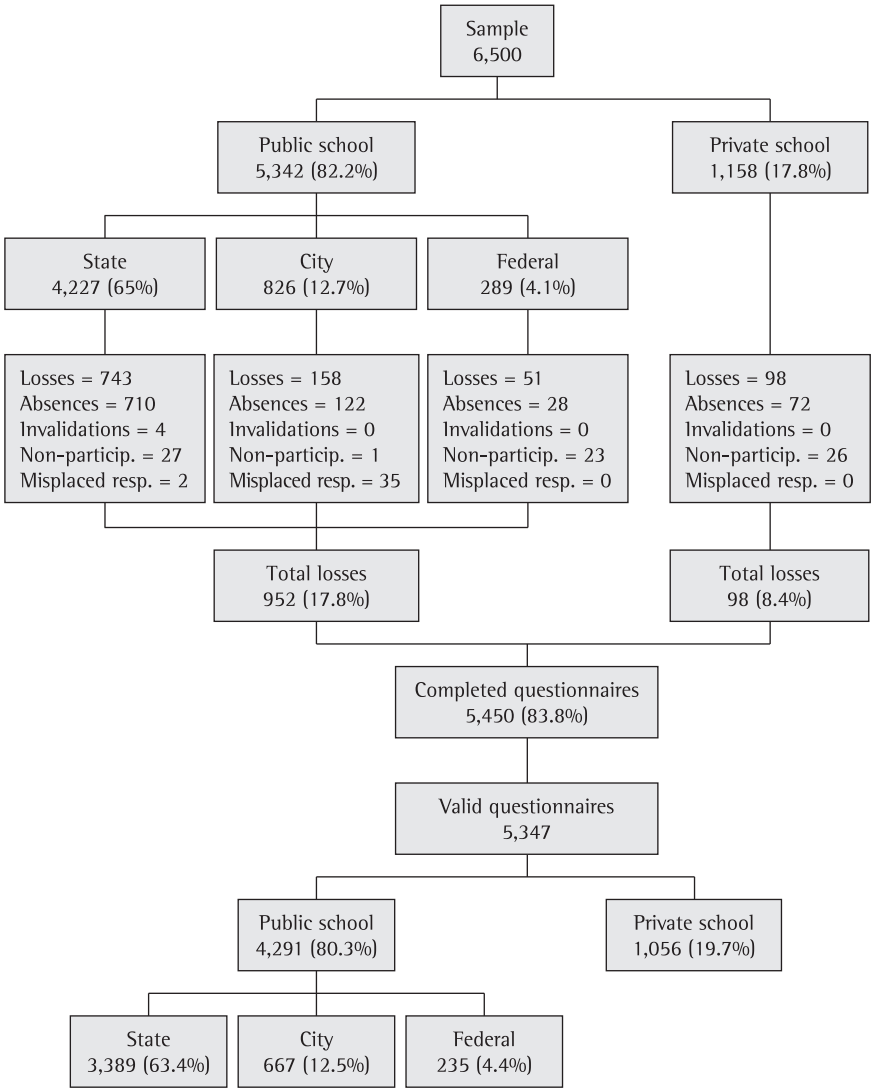

Figure 1 - Flowchart of the sample obtained in the survey on psychoactive substance use among adolescent students in the city of Salvador, Brazil, 2008. Non-particip.: Non-participation; resp.: response.

A total of 6,500 questionnaires were administered. Of those, 3,801 (58.5%) were administered to morning students and 2,699 (41.5%) were administered to afternoon students.[1] The sample composition reflected the proportion of students in the city of Salvador, in terms of school type (public or private) and grade range (middle or high school). Of the students in the sample, 82.2% were public school students and 54.1% were middle school students.

The calculation of the minimum number needed to determine the percentage of consumption of one of the substances involved in the study took into account the following factors: the population of middle and high school students (grades 5-11); the study precision (20.0%); the expected prevalence of consumption;[7] the design effect;[1,5] and the confidence level (95%). For the purpose of calculation, we considered the most widely consumed drug (alcohol), totaling 6,267 students: 1,624 middle school students and 4,643 high school students. We considered a 50% loss, potentially associated with information gaps. This strategy preserved the power of the study regarding the calculation of the relationship

[1] In Brazil, K-12 students attend classes for only half a day, either in the morning or in the afternoon.

Table 1 - Age at smoking experimentation among adolescent students in the city of Salvador, Brazil, 2008.

Age, years	n (%)	95% CI
11	89 (11.8)	9.7-14.3
12-14	373 (49.4)	45.9-52.9
15-18	293 (38.8)	35.4-42.3
Total	755 (100)	

between exposed and unexposed subjects in the comparison of variables. In the present study, the analysis of smoking initiation initially involved 783 students who reported having experimented with cigarettes.

The survey instrument was administered in the schools by medical students of the *Universidade Federal da Bahia* (UFBA, Federal University of Bahia) and by health care agents of the Fátima Cavalcanti Harm Reduction Alliance of the UFBA, both groups having been trained in the correct application of the instrument. The questionnaires were administered to the classes included in the study during their regular class hours, between April 7 and June 13, 2008.

The bogus pipeline method,[19] which is designed to stimulate participants to truthfully respond to questions, was used in order to minimize systematic errors and inconsistent information. The study was approved by the UFBA Research Ethics Committee. Before the questionnaire was administered, the project was presented to the principals of the selected schools, who gave written informed consent and set the date for the instrument to be administered. In accordance with the Ethics Committee guidelines, it was not necessary to obtain written informed consent from each student individually, given the anonymous nature of the instrument.

Students were assured that their data would be kept confidential and that they could choose whether or not to participate in the study, or could choose not to respond to questions they considered inappropriate.

Smoking experimentation (ever) and early smoking initiation (at 11-14 years of age) were defined as dependent variables, whereas independent variables included sociodemographic variables, those related to exposure to smoking of others, and those related to educational aspects and the media, as well as to alcohol consumption in the last year or month (Appendix 1, available in the online version of this journal).[18]

The inclusion criteria consisted of questionnaires being returned in good condition (without tears or erasures affecting readability) and being completed in the classroom by middle or high school (grades 5-11) students between 11 and 19 years of age. Responses in line with the wording of the questions were considered, and, for the analysis of consumption frequency and dependence of a given psychoactive substance, valid responses were those in which the students reported having used that substance at least once in their lifetime, as well as responding to related questions.

The data collected (6,500 records) were transcribed into a database by optical reading. Data analysis was performed with the Statistical Package for the Social Sciences, version 12.0 (SPSS Inc., Chicago, IL, USA), and with WINPEPI software, version 4.1 (Sagebush Press, Salt Lake City, UT, USA). Descriptive variables are expressed as frequency, mean, and overall range (minimum and maximum). The 95% CI was calculated for the precision of prevalence estimates. In the multivariate logistic regression analysis,[20] two criteria were used for selecting the independent

Table 2 - Results of the final model of multivariate logistic regression analysis[a] for age at smoking experimentation among students (11-14 years) in the city of Salvador, Brazil, 2008.

Independent variable	β	SE β	OR	83% CI	p
Male gender	−0.607	0.209	0.54	0.41-0.73	0.004
White or Asian race	−0.309	0.223	0.73	0.54-1.00	0.167
Socioeconomic class: B1-A2	−0.466	0.231	0.63	0.46-0.86	0.044
Paternal smoking	0.423	0.263	1.53	1.07-2.19	0.107
Media influence	0.889	0.370	2.43	1.46-4.04	0.016
Constant	0.863	0.186	2.37		0.000

[a]Variables included in the initial model: school type; gender; race; socioeconomic class; paternal or maternal smoking; having friends who smoke; having a teacher who smokes; media influence; alcohol consumption in the last year or month; teachers addressing the issue of drugs; and frequency with which parents talk about drugs.

variables to be included in the model: variables that showed statistically significant associations ($p \leq 0.25$) in the univariate analysis and variables that showed significant associations with outcomes in the literature.

Variables were retained in the model based on references in the literature, taking into consideration their possible role as a predictor associated with the dependent variable, as well as their p value in the partial models and final model. For variables to be retained in the final model, a value of $p \leq 0.17$ and an 83% CI were required. The fit of the final logistic regression model was assessed with the Hosmer-Lemeshow statistical test and analysis of residuals (unstandardized, standardized, studentized, deviance, leverage, Cook's distance, and DFBETAs).

Results

Of the 6,500 questionnaires distributed, 5,450 (83.8%) were completed. Losses were due, in most cases, to missing information (14.4%), student absences on the day the questionnaire was administered (14.3%), and questionnaires that were found to be invalid (0.1%). Additional losses were due to the loss of the questionnaire itself (1.8%), as well as to students who declined to participate (1.2%) and misplaced responses (0.6%). The total number of valid questionnaires was 5,347 (Figure 1).

The mean age of the students in the sample (n = 4,883) was 15.0 ± 1.8 years (95% CI: 15.0-15.1 years). The prevalence of smoking experimentation was 16.1% (783/4.855; 95% CI: 15.1-17.2). The mean age at smoking experimentation (n = 757) was 13.9 ± 1.8 years (95% CI: 13.8-14.3 years). Smoking experimentation occurred at 11 years of age in 11.8% of the sample, and more than half of the students (462/755; 61.2%; 95% CI: 57.7-65.6%) had experimented with cigarettes before the age of 15 (Table 1).

In the adjusted model, the following variables were found to be independently associated with early smoking initiation: being male; classifying oneself as White or Asian; and belonging to socioeconomic classes B1-A2 (negative beta values). Paternal smoking and media influence were found to be associated with higher ORs (Table 2). The goodness-of-fit test of the final logistic regression model had a chi-square value of 4.291, with 7 degrees of freedom and p = 0.746 for the Hosmer-Lemeshow statistical test. Analysis of the residuals revealed a good fit.

Among the reasons that the adolescents in the sample gave for smoking experimentation, the most common was "curiosity", with a lower proportion of responses mentioning "no influence". Other reasons given were the effect of nicotine (pleasure and relaxation) and the influence of friends (Table 3).

In the multivariate analysis, the private school students, the high school students, and those who self-reported being White or Asian had negative beta values. In the final model, being between 15 and 19 years of age, having separated parents, having family members or peers who smoke (father, mother, siblings, friends, or a boyfriend/girlfriend), having parents who rarely or never talk about drugs, being influenced by the media, and being disciplined aggressively/coercively by the parents were found to be associated with smoking initiation (Table 4). Alcohol consumption showed a strong association with smoking experimentation (OR = 6.04; 83% CI = 4.62-7.88).

The goodness-of-fit test of the logistic model had a chi-square value of 7.516, with 8

Table 3 - Reasons for smoking experimentation given by adolescent students in the city of Salvador, Brazil, 2008.

Reason given	Smoking experimentation		
	n	%	95% CI
Curiosity	460	60.4	56.9-63.8
Influence of friends	134	17.6	15-20.4
Pleasure	105	13.8	11.5-16.4
Relaxation	70	9.2	7.3-11.4
Power	35	4.6	3.3 - 6.3
Reduction of anxiety	25	3.3	2.2 - 4.8
Disinhibition	19	2.5	1.6-3.9
Influence of TV	14	1.8	1.1-3.1
Paternal influence	13	1.7	1-2.9
Influence of peers and relatives	13	1.7	1-2.9
Self-assertion	12	1.6	1-2.7
Difficulty in social relationships	10	1.3	0.7-2.7
Media influence[a]	8	1.0	0.5-2.1
Influence of teachers	6	0.8	0.4-1.7
Maternal influence	4	0.5	0.2 -1.3
No influence	116	15.2	12.8-17.9
Other influences	18	2.4	1.5-3.7

[a]Indirect media: films, shows, etc.

degrees of freedom and p = 0.482. Analysis of the residuals revealed a good fit.

Discussion

The results of the present study are reproducible, considering that the questionnaire used showed an acceptable level of reliability.[18] The schools and the students were randomly selected, the losses due to student declination were lower than 5%, and the sample of schools and students (including public and private schools in 15 administrative regions) was representative of the city of Salvador.

Optical reading reduced possible information bias resulting from the transcription to negligible levels, and the final sample size corresponded to a statistical power of 97%.

The use of logistic regression with the Hosmer-Lemeshow goodness-of-fit method is one of the relevant methodological aspects. Hosmer et al. observed that logistic regression was used in 20% of the 569 articles published in the American Journal of Public Health, whereas the fit of the final logistic regression model was assessed in only 5% of them.[20]

The present study sought to minimize limitations. Information bias (systematic error) when completing the questionnaire, which is inherent to the method itself, was minimized by the reliability study,[18] with the assurance of confidentiality and anonymity combined with the bogus pipeline technique.[19] The role of confounding factors and effect-modifying variables was minimized by using logistic regression. The results of the study are applicable to students attending school in the morning/afternoon, not being applicable to those attending school in the evening or to those not attending school.

The prevalence of smoking experimentation in the present study was lower than those reported in the European Union, where the reported proportion of students (aged 17-18 years) who have smoked at least once in their lifetime ranges from 72% to 82%.[21] In the USA, although there is a trend toward a reduction in smoking,[2] the reported prevalence of smoking experimentation (50.3%) is higher than that found in the present study.[5] The study methodology, sociocultural aspects, and the historical context of each community can influence the prevalence of smoking,[2,3,5,6,21] which would explain the differences observed.

Table 4 - Results of the final model of multivariate logistic regression analysis[a] for smoking experimentation among students in the city of Salvador, Brazil, 2008.

Independent variable	β	SE β	OR	83% CI	p
Private school	–0.377	0.179	0.69	0.54-0.88	0.035
High school	–0.409	0.223	0.66	0.49-0.90	0.067
White or Asian race	–0.397	0.166	0.67	0.54-0.84	0.017
Age 15-19 years	1.227	0.262	3.41	2.38-4.88	0.000
Marital status of parents (live apart)	0.360	0.152	1.43	1.16-1.77	0.018
Paternal smoking	0.781	0.200	2.18	1.66-2.87	0.000
Maternal smoking	0.752	0.237	2.12	1.53-2.93	0.002
Having siblings who smoke	0.488	0.244	1.63	1.17-2.28	0.045
Having friends who smoke	1.157	0.165	3.18	2.54-3.99	0.000
Having a boyfriend/girlfriend who smokes	1.230	0.475	3.42	1.78-6.56	0.010
Parents rarely or never talk about drugs	0.353	0.153	1.42	1.15-1.76	0.021
Media influence	0.691	0.261	1.99	1.39-2.86	0.008
Alcohol consumption in the last year or month	1.798	0.194	6.04	4.62-7.88	0.000
Coercive/aggressive discipline by parents	0.472	0.177	1.60	1.26-2.04	0.008
Constant	–3.961	0.272	0.02		0.000

[a]Variables included in the initial model: school type; gender; race; religion; socioeconomic class; marital status of parents; with whom the adolescent lives; paternal or maternal smoking; having family members who smoke (siblings, cousins, uncles/aunts); having peers who smoke (friends, a boyfriend/girlfriend); having a teacher who smokes; teachers addressing the issue of drugs; frequency with which parents talk about drugs with their children; media influence; parental ban on smoking by their children; parental intervention through dialogue/limit setting; coercive/aggressive discipline by parents; alcohol consumption in the last year or month.

Brazil has the lowest prevalence of smoking experimentation of all Latin American countries, the prevalence in Brazil corresponding to approximately half of that observed in any other Latin American country. In Latin America, the prevalence of smoking experimentation ranges from 26.9% (in Brazil) to 66.3% (in Chile), with a mean prevalence of 42.4%.[6] The data obtained in the present study are similar to those reported in an earlier study of middle and high school students in the city of Salvador, in which 17.7% of the students had smoked at least once in their lifetime.[10] The prevalence observed in the present study was lower than that reported in yet another previous study of students in the city of Salvador (46%),[9] as well as being lower than that reported in a study conducted by the Brazilian National Cancer Institute (29.3%).[22] This finding might be associated with a trend toward a reduction in smoking among adolescents.

In 2006, during the pilot phase of the study, 12.6% of the students were found to have experimented with cigarettes. Despite the fact that it was a pilot study, the power of the sample size to estimate the prevalence of smoking was higher than 90%.[18] The age at smoking experimentation was found to be 11-14 years, a finding that is in agreement with those of other studies.[9,16,18] Male gender, race (White/Asian), and socioeconomic class (B1-A2) reduced the ORs for smoking initiation. These results are in disagreement with data reported in previous studies, in which a higher prevalence of smoking was observed among White adolescents[5] and male adolescents.[3,5] Belonging to a lower socioeconomic class has been associated with smoking.[1,5]

Paternal smoking and indirect media (films and shows) increase the chances of smoking experimentation and initiation. This can be explained by inappropriate parental behavior, which is imitated by children,[11,12] and by the lack of development of social skills in this age group. We found no studies directly addressing early smoking initiation.

Curiosity, pleasure, relaxation, and the influence of friends were the most common reasons given for smoking, and these findings are in agreement with those reported in the literature.[11,12,16,23] A significant proportion of students, however, did not perceive any influence. Typically, there are a number of factors that contribute to psychoactive substance use, and their interrelationship can make it difficult to individualize their relative roles.[6,11,13,24]

The results of our adjusted analysis allow us to infer that attending a private school[12] and being a high school student reduce the chances of smoking experimentation, corroborating findings of a previous study conducted in Brazil,[15] despite being contrary to the findings of other studies.[5,7,12] Studies conducted in the USA and in Latin America identified no association between smoking experimentation and school type.[5,6,16] Agreement or disagreement between the findings of the present study and those of other studies seems to be associated with the characteristics of the sample and the time of data collection of a cross-sectional study. The sociocultural characteristics of each population, as well as their historical contexts, can affect the findings.

Having parents who live apart (living apart being defined, in the present study, as being divorced, separated, single, or widowed) can increase the OR for smoking initiation,[12,25] possibly, in the presence of family conflicts.[13] In the present study, smoking initiation was found to be associated (increased OR) with having parents, siblings, and, especially, peers (friends or a boyfriend/girlfriend) who smoke, as described in previous studies.[9,11,12,26-28]

Having parents who rarely or never talk about drugs and having parents who do not forbid smoking increased the chances of experimental smoking,[13,14,16,29] since the lack of dialogue and the absence of limits can increase the risk of antisocial behaviors, including cigarette smoking and the use of other substances.[11,23] The present study does not corroborate findings of previous studies in terms of the variable "parental ban on smoking by their children", which was not selected for the final model.

Having parents who rarely or never talk about drugs and having parents who discipline aggressively/coercively were found to be associated with increased chances of smoking experimentation. The right attitude on the part of the family can be a protective factor against antisocial behaviors and psychoactive substance use,[11,14] helping the youth to develop social skills.[30] One study revealed that, albeit indirectly, tobacco promotion through the media influences

smoking,[16] as has been observed in the present study.

In the present study, alcohol consumption in the year or month before the questionnaire was administered was a significant risk factor for smoking experimentation. In some studies, alcohol consumption has been found to be associated with the use of other psychoactive substances,[6,28] although there have been no reports of it being associated with smoking experimentation. This finding allows us to infer that success in reducing smoking among youths requires that anti-smoking interventions be integrated with public policies for preventing and monitoring alcohol consumption in this population. Smoking, alcohol consumption, and illicit drug use are interrelated risk behaviors.[5,7]

Cohort studies might be appropriate to confirm the present findings. To that end, however, the adolescents would have to be identified, which could compromise the reliability of the information. The fact that some private schools declined to participate in the present study underscores this difficulty. However, there is evidence that anonymous, self-report questionnaires increase the likelihood of positive responses to questions regarding smoking.[19] In the literature, there are few cohort studies in this specific area.[11,23]

Although the cross-sectional design has limitations, the findings of the present study reveal that a significant proportion of the students in the sample reported having experimented with cigarettes. Having peers and family members who smoke was found to be associated with smoking experimentation, and paternal smoking increased the chances of smoking initiation.

Adolescents between 15 and 19 years of age are more likely to experiment with cigarettes. Curiosity, the effect of the substance (pleasure and relaxation), and the influence of friends were the main reasons given for smoking initiation. The influence of the media, having parents who rarely or never talk about drugs, and having parents who discipline aggressively or coercively were also found to be determinants of smoking initiation. In addition, alcohol consumption showed a strong association with smoking experimentation, this being a differential aspect of the present study.

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