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THEMATIC ARTICLE

Changes in tobacco use and associated factors among Brazilian adolescents: National Student Health Survey

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Abstract *This cross-sectional study used data from Brazil's National Student Health Survey (PeNSE), from 2015 and 2019, to compare consumption of tobacco products among adolescent students in Brazil and identify associated factors. The study variables were current cigarette smoking, use of other tobacco products and use of any tobacco product. Pearson's Chi-square test was used to ascertain associations between the variables; bivariate and multivariate analyses were performed using logistic regression. Cigarette smoking remained stable between 2015 (6.6%) and 2019 (6.8%), but use of any tobacco product increased (from 10.6% in 2015 to 14.8% in 2019), involving particularly hookahs (7.8%) and e-cigarettes (2.8%). Cigarette smoking was greater among adolescents aged 16 and 17, whose skin colour was black or brown, who missed classes without permission, who reported having no friends, displayed other risk factors, such as drinking alcoholic beverages, or who were passive smokers. The prevalence of smoking has increased over the years and is associated with sociodemographic aspects and other health risk behaviour, highlighting the need for lifelong health promotion actions.*

Key words *Tobacco use disorder, Adolescent, Health surveys, Tobacco products, Risk factors*

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Introduction

Evidence of the evils of tobacco use is well established in the literature, and includes rising mortality from cardiovascular diseases, cancer (of the lungs, oral cavity and breast), chronic respiratory diseases, intrauterine growth restriction and predisposition to premature births, as well as its being considered one of the main risk factors for non-communicable diseases (NCD)[1-3].

The Global Burden of Disease study found that smoking, including passive exposure, ranked fourth among the greatest risk factors in the burden of disease worldwide[3] and fourth in Brazil, where it accounted for 167,657 deaths in 2017[1].

Health risk behaviour often begins or intensifies in adolescence, due to physical, mental, emotional and social changes that take place at that stage of life and can predispose to new experiences, such as licit and illicit substance use[4]. Tobacco use by adolescents is also associated with other situations, such as state of mental health and passive smoking at home, together with lack of family supervision and support, and influence of friends[5-7].

Behaviour acquired during adolescence tends to persist into adult life and contributes to increased youth morbidity and mortality[8,9]. It is thus important that healthy lifestyles be adopted in adolescence in order to reduce the burden of disease in later life. Therapeutic counselling should be made available, given that there is insufficient evidence to support the use of drug-based therapy among the young[10].

Use of tobacco in whatever form is harmful and there is no safe level of exposure to tobacco[11]. Cigarettes are the commonest form of use worldwide, although other products, such as e-cigarettes, hookahs, cigars and pipes, do exist and are also harmful to health[11]. Use of these products, particularly e-cigarettes, has increased considerably among young people[11,12]. Prevalence of tobacco use by adults is decreasing globally and in Brazil[13,14], but cigarette smoking has held stable among Brazilian adolescents[9], making it a public health concern.

Given that scenario, it is crucial to monitor health risk factors to inform surveillance and planning measures and develop and implement effective policies to promote health and prevent disease, especially in more vulnerable populations, because adolescence is an important stage in establishing healthy life habits.

In that light, this study compared consumption of different tobacco products by adolescent schoolchildren in Brazil, between 2015 and 2019, to identify factors associated with their use.

Methods

This cross-sectional study used data from Brazil's National Student Health Survey (*Pesquisa Nacional de Saúde do Escolar*, PeNSE) for 2015 and 2019. The PeNSE is conducted by the official bureau of statistics, the *Instituto Brasileiro de Geografia e Estatísticas* (IBGE), in partnership with the Ministry of Health and with support from the Ministry of Education. The PeNSE forms part of Brazil's surveillance of risk and protective factors for non-communicable diseases and is the first national survey to address various aspects of adolescent life including habits, care, risk and protective health factors. The survey was conducted in 2009, 2012, 2015 and 2019[15].

In 2015 two distinct sampling plans were used, one contemplating ninth-year students (in the final year of lower secondary school) and the other of schoolchildren from 13 to 17 years old attending years 6 to 9 (lower secondary school) and years 1 to 3 of upper secondary school. That was the sample used in this study, in which 10,926 Brazilian students enrolled in and attending 371 schools and 653 classes, in the country's five main geographical regions, were investigated, together with the overall total in private and public schools nationwide[16]. In 2019, the IBGE used a single sample of students from 13 to 17 years old in public and private schools, at the following geographical levels: Brazil, major regions, units of the federation, municipalities of state capitals and the Federal District. Data were collected from 4,242 schools, 6,612 classes and 159,245 schoolchildren[17]. Sampling loss from enrolled and non-respondent students was approximately 2.4% in 2015 and 15.4% in 2019. Further details of the samples can be found in other publications[16,17].

The sample was scaled to estimate population parameters for students from 13 to 17 years old enrolled and attending public and private schools at the following geographical levels: Brazil, major regions, units of the federation, municipalities of state capitals and the Federal District[17].

The students were informed in advance as to the aims and main characteristics of the survey and that their participation was voluntary and could be interrupted at any time. Those who agreed to take part responded to a structured questionnaire, which was self-applicable on smartphone under supervision of IBGE researchers[17]. The

PeNSE data base and questionnaires are available for public access and use on the IBGE website at: https://www.ibge.gov.br/estatisticas/sociais/saude/9134-pesquisa-nacional-de-saude-do-escolar.html?edicao=31442&t=resultados.

This study assessed and compared three indicators of tobacco use in 2015 and 2019: cigarette smoking in the past 30 days (current use), use of other tobacco products (except for cigarettes) and use of any tobacco product, by way of the questions below:

1. *Cigarette smoking*: "In the past thirty days, on how many days did you smoke cigarettes?". The response options were: On no day in the past 30; 1 or 2 days; 3 to 5 days; 6 to 9 days; 10 to 19 days; 20 to 29 days; Every day. The response of at least one day in the past 30 was considered to constitute current use.

2. *Use of other tobacco products*: In 2015, a single question was used: "In the past thirty days, on how many days did you use other tobacco products (straw or hand-rolled cigarettes, cigar, pipe, cigarillo, Indian or Kretek cigarette, hookah, snuff, chewing tobacco etc.)? (excluding common cigarettes)". The response options were: I did not use other tobacco products on any day in the past 30 (0 days); 1 or 2 days in the past 30; 3 to 5 days in the past 30; 6 to 9 days in the past 30; 10 to 19 days in the past 30; 20 to 29 days in the past 30; Every day in the past 30.

3. *Use of any tobacco product*: this indicator represents the sum of cigarette smoking and use of other tobacco products. The response categories were Yes or No.

In 2019, the single question on other tobacco products was discontinued and replaced by five different questions: "In the past thirty days, which of these other tobacco products did you use: hookah (water pipe)?", "In the past thirty days, which of these other tobacco products did you use: e-cigarette?", "In the past thirty days, which of these other tobacco products did you use: clove cigarettes (Kretek cigarettes)?", "In the past thirty days, which of these other tobacco products did you use: hand-rolled cigarettes (straw or paper)?", "In the past thirty days, which of these other tobacco products did you use: others?". The response options were: Yes or No. If respondents answered "Yes" to at least one of the questions above, that was considered to be "use of other tobacco products".

The explanatory variables examined were: *sociodemographic*: sex (male or female), age group (13-15, 16-17 years), skin colour (white, black, yellow, brown or indigenous), living with father or mother (No and Yes); *family supervision*: parents or guardians really know what the student did in their free time in the past 30 days (Yes or No), missing classes without permission (Yes or No); *mental health*: feeling that no-one cares about them in the past 12 months (Yes or No), feeling sad (Yes or No), having close friends (one or more or No); *substance use*: use of alcoholic beverages in the past 30 days (yes: having drunk at least one glass or measure of an alcoholic beverage in the past 30 days prior to the survey and no: none of the previous 30 days) and regular use of drugs in the past 30 days (yes: having used drugs in the last 30 days prior to the survey and no: none of the previous 30 days); *influence of people who are close*: passive smoker/people who smoke in your presence (Yes or No) or parents or guardians who smoke (Yes or No).

The descriptive analysis included calculating prevalences and respective 95% confidence intervals (95%CIs). The Pearson chi-square test was used to examine for associations between the independent variables, by groups, to statistical significance of p-value≤0.05.

The magnitude of the associations was estimated by odds ratio (OR), with respective 95%CIs. The method used for the multivariate regression was to insert variables to build the multivariate model; all related variables of interest with level of statistical significance of less than 0.05 in the bivariate analysis were included, and were inserted one at a time. The final model also considered variables with p-value≤0.05.

The statistical analysis was performed on Stata software, version 14.1 (StataCorp LP, College Station, United States), using the *survey* module, which considers post-stratification weights.

The PeNSE complied with Brazil's guidelines and regulatory standards for research involving human subjects and was approved by the national research ethics commission of the Ministry of Health (CONEP/MS), under ethics assessment application certificates (CAAEs) No. 1.006.487[18] and 3.249.268.

Results

In Brazil, in 2015, prevalence of use of any tobacco product was 10.6% (95%CI 9.4-11.8%), with 6.6% (95%CI 5.8-7.3%) of adolescents smoking cigarettes in the prior 30 days and 7.2% (95%CI 6.1-8.2%) using other tobacco products (such as straw or hand-rolled cigarettes, cigars, pipes, cigarillos, Indian or Kretek cigarettes, hookahs,

snuff or chewing tobacco) in the prior 30 days. Meanwhile, in 2019 prevalence of consumption of any tobacco product was 14.83% (95%CI 14.22-15.45%), with 6.80% (95%CI 6.32-7.31%) of adolescents smoking cigarettes in the prior 30 days and 12.39% (95%CI 11.85-12.59%) using other tobacco products (Figure 1).

Cigarette smoking in the prior 30 days held stable between 2015 and 2019, although use of other tobacco products increased; of the latter, in 2019, the highest prevalence was use of hookahs, at 7.8% (95%CI 7.3-8.4%), followed by e-cigarettes, at 2.8% (95%CI 2.6-3.0%), and straw cigarettes, at 2.6% (95%CI 2.3-2.8%) (Figure 2).

In 2019, prevalence of cigarette smoking among adolescents was 6.80% (95%CI 6.32-7.31%), but higher among those from 16 to 17 years old (10.02%; 95%CI 9.29-10.79%), those whose skin colour was black (8.33%; 95%CI 7.45-9.31%), who reported not living with their father or mother (10.90%; 95%CI 9.71-12.21%), who were not supervised by the family (11.40%; 95%CI 10.49-12.38%) or who missed classes without parental permission (14.23%; 95%CI 13.14-15.39%). Cigarette smoking was also commoner among those who felt that no-one cared about them (8.28%; 95%CI 7.66-8.94%), felt sad (7.62%; 95%CI 7.02-7.62%) or who had no friends (10.16%; 95%CI 8.26-12.46%), as well as among those who reported using other tobacco products (35,09%; 95%CI 32.81-37.44%), alcoholic beverages (18.97%; 95%CI 17.76-20.25%) and other drugs (57.21%; 95%CI 53.69-60.66%), those who were passive smokers (11.75%; 95%CI 10.81-12.77%) or who had parents who smoked (11.17%; 95%CI 10.04-12.41%) (Table 1).

The highest odds of smoking cigarettes were found among adolescents 16 to 17 years old (OR=1.26; 95%CI 1.08-1.47), those whose skin colour was black (OR=1.21; 95%CI 1.01-1.46) or brown (OR=1.26; 95%CI 1.11-1.43), who missed classes without permission (OR=1.62; 95%CI 1.41-1.85), who reported having no friends (OR=1.43; 95%CI 1.08-1.87%), who used other tobacco products (OR=5.95; 95%CI 5.21-6.80%), alcoholic beverages (OR=3.87; 95%CI 3.37-4.45%) or other drugs (OR=7.04; 95%CI 5.86-8.47%) or who were passive smokers (OR=1.65; 95%CI 1.44-1.89%). On the other hand, the lowest odds of smoking occurred among adolescents who were supervised by their families (OR=0.58; 95%CI 0.51-0.66%) (Table 1).

Prevalence of use of other tobacco products among adolescents was 12.39% (95%CI 11.85-12.95%) and the odds of using these products were higher among those who missed classes without permission (OR=1.39; 95%CI 1.24-1.56%), who felt that no-one cared about them (OR=1.32; 95%CI 1.21-1.44%), who used cigarettes regularly (OR=5.56; 95%CI 4.84-6.39%), drank alcoholic beverages (OR=5.25; 95%CI 4.74-5.82%), used other drugs (OR=4.60; 95%CI 3.91-5.41), were passive smokers (OR=1.23; 95%CI 1.09-1.39%) or whose parents or guardians smoked (OR=1.40; 95%CI 1.22-1.60%). The lowest odds of using these products were among adolescents who were female (OR=0.80; 95%CI 0.72-0.89%) or whose race/skin colour was brown (OR=0.83; 95%CI 0.74-0.93%) or indigenous (OR=0.67; 95%CI 0.50-0.88%) (Table 2).

Prevalence of use of any tobacco product was 14.83% (95%CI 14.22-15.55%), with highest odds among adolescents who missed classes without their parents' permission (OR=1.71; 95%CI 1.54-1.90%), who felt no-one cared about them (OR=1.21; 95%CI 1.12-1.31%), who had no friends (OR=1.27 95%CI 1.01-1.60%), who drank alcoholic beverages (OR=6.51; 95%CI 5.96-7.10%), used other drugs (OR=12.19; 95%CI 10.13-14.67%), were passive smokers (OR=1.40; 95%CI 1.26-1.55%) or whose parents or guardians smoked (OR=1.41; 95%CI 1.23-1.63%). Once again, the lowest odds of use occurred among adolescents who were supervised by their families (OR=0.73; 95%CI 0.66-0.80%) (Table 3).

Discussion

This study compared consumption of various different tobacco products among adolescent schoolchildren in Brazil between 2015 and 2019 to identify factors associated with their use. In that period, cigarette smoking held stable, but use of any tobacco product increased from 10.6% in 2015 to 14.8% in 2019, involving particularly hookahs and e-cigarettes. Associated factors that returned highest odds of smoking cigarettes were adolescents 16 to 17 years old, whose skin colour was black or brown, who missed classes without permission, who reported having no friends or felt that no-one cared about them, who used other tobacco products, alcoholic beverages or other drugs, or were passive smokers. On the other hand, the lowest odds of smoking were among adolescents who were supervised by their families.

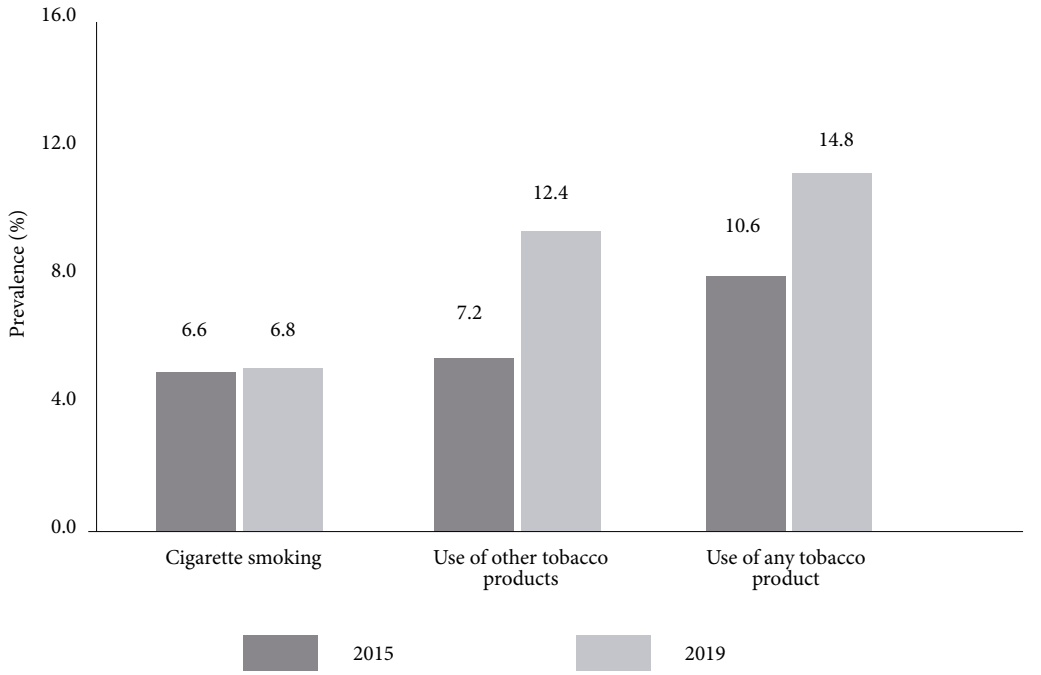

Figure 1. Comparison of use of cigarettes, other tobacco products and any tobacco product among adolescents. PeNSE 2015 and 2019.

Source: Authors.

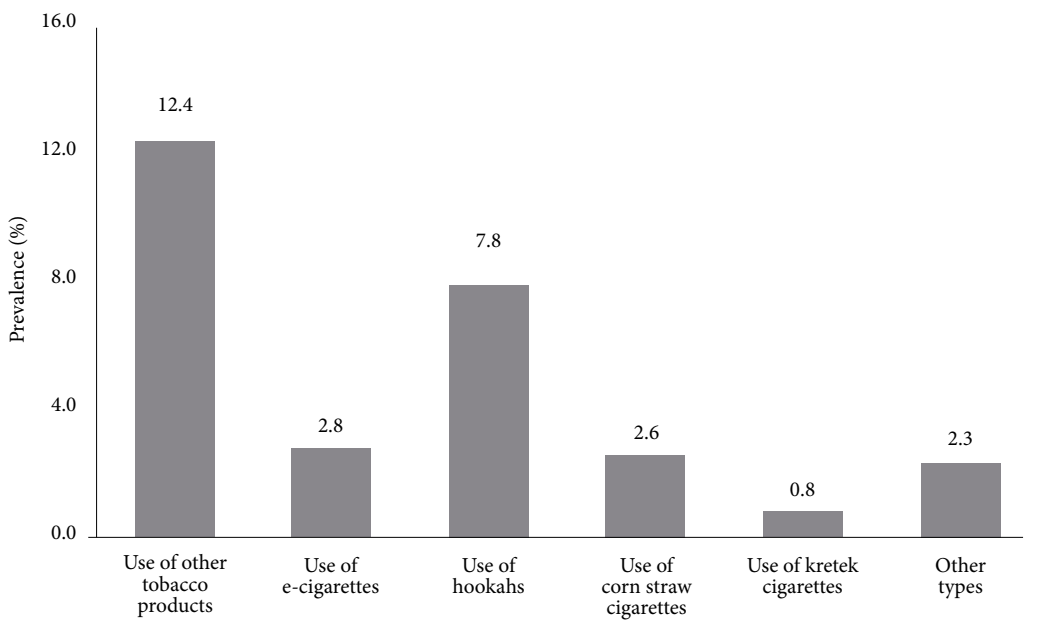

Figure 2. Prevalences of use of other products among adolescents. PeNSE, 2019.

Source: Authors.

Table 1. Prevalence of cigarette smoking in prior 30 days and associated factors among Brazilian adolescents. PeNSE 2019.

Variable	%	CI(95%)		Bivariate Analysis				Final model*			
		Lower	Upper	OR	CI(95%)		p	OR*	CI(95%)		p
					Lower	Upper			Lower	Upper	
Total	**6.80**	**6.32**	**7.31**								
Age											
13 to 15 years	5.04	4.47	5.70	1.00				1.00			
16 to 17 years	**10.02**	**9.29**	**10.79**	2.09	1.81	2.42	**<0.001**	**1.26**	**1.08**	**1.47**	**0.00**
Sex											
Male	7.10	6.60	7.65	1.00							
Female	6.50	5.81	7.25	0.91	0.80	1.03	0.13				
Skin colour											
White	6.45	5.80	7.15	1.00				1.00			
Black	**8.33**	**7.45**	**9.31**	1.32	1.16	1.51	**<0.001**	**1.21**	**1.01**	**1.46**	**0.04**
Yellow	6.58	5.41	7.98	1.02	0.80	1.30	0.86	1.12	0.83	1.51	0.46
Brown	6.64	6.10	7.22	1.03	0.93	1.14	0.55	1.26	1.11	1.43	<0.001
Indigenous	6.70	5.25	8.50	1.04	0.80	1.35	0.76	1.35	0.96	1.87	0.08
Living with mother or father											
No	**10.90**	**9.71**	**12.22**	1.00							
Yes	6.49	6.01	7.00	0.57	0.50	0.64	**<0.001**				
Supervised by family											
No	**11.40**	**10.49**	**12.38**	1.00				1.00			
Yes	4.80	4.42	5.20	0.39	0.35	0.43	**<0.001**	**0.58**	**0.51**	**0.66**	**<0.001**
Missed classes without permission											
No	4.97	4.56	5.41	1.00				1.00			
Yes	**14.23**	**13.14**	**15.39**	3.17	2.87	3.50	**<0.001**	**1.62**	**1.41**	**1.85**	**<0.001**
Felt no-one cared about them											
No	4.98	4.54	5.47	1.00							
Yes	**8.28**	**7.66**	**8.94**	1.72	1.57	1.89	**<0.001**				
Sadness											
No	5.13	4.62	5.69	1.00							
Yes	**7.62**	**7.02**	**7.62**	1.53	1.35	1.72	**<0.001**				
Friends											
1 or more	6.59	6.13	7.09	1.00				1.00			
None	**10.16**	**8.26**	**12.44**	1.60	1.27	2.02	**<0.001**	**1.43**	**1.08**	**1.87**	**0.01**
Other tobacco products											
No	2.75	2.51	3.02	1.00				1.00			
Yes	**35.09**	**32.81**	**37.44**	19.10	17.10	21.34	**<0.001**	**5.95**	**5.21**	**6.80**	**<0.001**
Alcoholic beverages											
No	2.01	1.77	2.28	1.00				1.00			
Yes	**18.97**	**17.76**	**20.25**	11.43	10.08	12.96	**<0.001**	**3.87**	**3.37**	**4.45**	**<0.001**
Used drugs regularly											
No	4.05	3.70	4.43	1.00				1.00			
Yes	**57.21**	**53.69**	**60.66**	31.71	27.09	37.12	**<0.001**	**7.04**	**5.86**	**8.47**	**<0.001**
Passive smoker											
No	4.89	4.48	5.33	1.00				1.00			
Yes	**11.75**	**10.81**	**12.77**	2.59	2.33	2.88	**<0.001**	**1.65**	**1.44**	**1.89**	**<0.001**
Parents or guardians smoke											
No	5.37	5.01	5.76	1.00							
Yes	**11.17**	**10.04**	**12.41**	**2.21**	1.98	2.48	**<0.001**				

*Adjusted by significant variables in the model.

Source: Authors.

Table 2. Prevalence of use of other tobacco products and associated factors among Brazilian adolescents. PeNSE 2019.

Variable	%	CI(95%)		Bivariate Analysis				Final model*			
		Lower	Upper	OR		CI(95%)	p	OR*		CI(95%)	p
				Lower	Upper			Lower	Upper		
Total	**12.39**	**11.85**	**12.95**								
Age											
13 to 15 years	10.29	9.68	10.94	1.00							
16 to 17 years	**16.25**	**15.24**	**17.30**	1.69	1.53	1.87	**<0.0001**				
Sex											
Male	12.83	12.21	13.47	1.00				1.00			
Female	11.97	11.15	12.84	0.92	0.84	1.01	0.10	**0.80**	**0.72**	**0.89**	**<0.001**
Skin colour											
White	13.46	12.68	14.28	1.00				1.00			
Black	13.62	12.48	14.83	1.01	0.90	1.15	0.83	0.85	0.73	1.00	0.04
Yellow	12.56	10.64	14.77	0.92	0.75	1.14	0.45	0.96	0.74	1.25	0.78
Brown	11.30	10.57	12.07	0.82	0.75	0.90	**<0.0001**	**0.83**	**0.74**	**0.93**	**0.00**
Indigenous	**10.22**	**8.50**	**12.25**	0.73	0.59	0.90	**0.00**	**0.67**	**0.50**	**0.88**	**0.00**
Lives with mother or father											
No	**16.22**	**14.57**	**18.01**	1.00							
Yes	12.10	11.56	12.66	0.71	0.63	0.80	**<0.0001**				
Supervised by family											
No	**16.87**	**15.93**	**17.85**	1.00							
Yes	10.51	9.95	11.09	0.58	0.54	0.63	**<0.0001**				
Missed classes without permission											
No	10.11	9.64	10.60	1.00				1.00			
Yes	**21.82**	**20.35**	**23.36**	2.48	2.27	2.71	**<0.0001**	**1.39**	**1.24**	**1.56**	**<0.001**
Felt no-one cared about them											
No	9.36	8.77	9.99	1.00				1.00			
Yes	**14.93**	**14.26**	**15.63**	1.70	1.58	1.82	**<0.0001**	**1.32**	**1.21**	**1.44**	**<0.001**
Sadness											
No	9.77	9.07	10.52	1.00							
Yes	**13.74**	**13.12**	**14.39**	1.47	1.36	1.60	**<0.0001**				
Friends											
1 or more	12.24	11.69	12.81	1.00							
None	**15.25**	**12.90**	**17.93**	1.28	1.05	1.57	**0.01**				
Smoked regularly											
No	8.62	8.17	9.10	1.00				1.00			
Yes	**64.32**	**61.95**	**66.62**	19.10	17.10	21.33	**<0.0001**	**5.56**	**4.84**	**6.39**	**<0.001**
Alcoholic beverages											
No	4.75	4.41	5.12	1.00				1.00			
Yes	**31.91**	**30.57**	**33.28**	9.39	8.57	10.28	**<0.0001**	**5.25**	**4.74**	**5.82**	**<0.001**
Used drugs regularly											
No	9.36	8.89	9.85	1.00				1.00			
Yes	**68.04**	**65.00**	**70.93**	20.61	18.06	23.52	**<0.0001**	**4.60**	**3.91**	**5.41**	**<0.001**
Passive smoker											
No	9.88	9.41	10.37	1.00				1.00			
Yes	**19.01**	**17.80**	**20.28**	2.14	1.96	2.33	**<0.0001**	**1.23**	**1.09**	**1.39**	**<0.001**
Parents or guardians smoked											
No	10.23	9.76	10.71	1.00				1.00			
Yes	**19.16**	**17.80**	**20.61**	2.08	1.89	2.29	**<0.0001**	**1.40**	**1.22**	**1.60**	**<0.001**

*Adjusted by significant variables in the model.

Source: Authors.

Table 3. Prevalence of use of any tobacco product and associated factors among Brazilian adolescents. PeNSE 2019.

Variable	%	CI(95%)		Bivariate Analysis				Final model*			
		Lower	Upper	OR	CI(95%) Lower	CI(95%) Upper	p	OR*	CI(95%) Lower	CI(95%) Upper	p
Total	**14.83**	**14.22**	**15.45**								
Age											
13 to 15 years	12.20	11.45	12.98	1.00							
16 to 17 years	19.65	18.62	20.71	1.76	1.60	1.94	**<0.001**				
Sex											
Male	15.32	14.65	16.01	1.00							
Female	14.34	13.43	15.30	0.93	0.85	1.01	0.08				
Skin colour											
White	15.24	14.37	16.15	1.00							
Black	17.27	16.02	18.59	1.16	1.04	1.30	**0.01**				
Yellow	15.01	12.97	17.30	0.98	0.81	1.19	0.85				
Brown	13.89	13.09	14.73	0.90	0.82	0.98	**0.02**				
Indigenous	12.49	10.52	14.77	0.79	0.65	0.97	**0.02**				
Lived with mother or father											
No	20.04	18.34	21.85	1.00							
Yes	14.43	13.84	15.05	0.67	0.61	0.75	**<0.001**				
Supervised by family											
No	21.06	19.99	22.18	1.00				1.00			
Yes	12.15	11.57	12.76	0.52	0.48	0.56	**<0.001**	**0.73**	**0.66**	**0.80**	**<0.001**
Missed classes without permission											
No	11.91	11.38	12.46	1.00				1.00			
Yes	26.80	25.23	28.43	2.71	2.49	2.95	**<0.001**	**1.71**	**1.54**	**1.90**	**<0.001**
Felt no-one cared about them											
No	11.35	10.72	12.02	1.00				1.00			
Yes	17.71	16.93	18.51	1.68	1.57	1.79	**<0.001**	**1.21**	**1.12**	**1.31**	**<0.001**
Sadness											
No	11.71	10.96	12.49	1.00							
Yes	16.41	15.70	17.14	1.48	1.37	1.60	**<0.001**				
Friends											
1 or more	14.60	14.00	15.23	1.00				1.00			
None	18.61	16.11	21.40	1.34	1.12	1.60	**0.00**	**1.27**	**1.01**	**1.60**	**0.04**
Alcoholic beverages											
No	5.86	5.47	6.28	1.00				1.00			
Yes	37.70	36.31	39.12	9.72	8.94	10.57	**<0.001**	**6.51**	**5.96**	**7.10**	**<0.001**
Use drugs regularly											
No	11.33	10.81	11.87	1.00				1.00			
Yes	78.89	75.92	81.59	29.26	24.81	34.50	**<0.001**	**12.19**	**10.13**	**14.67**	**<0.001**
Passive smoker											
No	11.71	11.20	12.25	1.00				1.00			
Yes	22.96	21.67	24.30	2.25	2.07	2.43	**<0.001**	**1.40**	**1.26**	**1.55**	**<0.001**
Parents or guardians smoked											
No	12.24	11.74	12.75	1.00				1.00			
Yes	22.84	21.29	24.46	2.12	1.93	2.33	**<0.001**	**1.41**	**1.23**	**1.63**	**<0.001**

*Adjusted by significant variables in the model.

Source: Authors.

Brazil has managed to make considerable progress in reducing tobacco use, notably in its adhesion to the Framework Convention on Tobacco Control in 2006 and its 2014 tobacco-free environments law, inclusion of health warnings of the dangers of tobacco use, prohibition of publicity, sponsorship and sale to the under-18s, as well as higher taxes on, and prices of, tobacco products. It has also aligned with the Sustainable Development Goals (SDG) goal by committing to reducing prevalence of tobacco use by 40% by 2030[18]. These measures have contributed to reducing smoking in Brazil and to low prevalences among adolescents, which have also held stable over the years. However, it is important to alert to the increased use of other tobacco products, particularly hookahs and e-cigarettes[19]. One session of hookah use, which generally lasts 60 minutes, can be equivalent to smoking 100 or more cigarettes[20]. Hookahs have been a factor in introducing young people to smoking, because they are used collectively and involve substances, such as flavouring, to improve acceptance among adolescents[20]. In 2012, Brazil's national health surveillance agency (*Agência Nacional de Vigilância Sanitária*, Anvisa) prohibited the use of additives in tobacco products. In 2013, that measure was suspended by a preliminary court order granted to the tobacco industry, which was not revoked until 2018. The prohibition has not yet been implemented, however, and the tobacco industry lobby constitutes a major threat to tobacco control and to efforts to reduce health risks[21]. E-cigarettes, besides being harmful to health, are unsafe, in spite of the growing marketing using false arguments that they are not harmful[20,22]. Products such as hookahs and e-cigarettes may be the first step in fixing a tobacco habit and dependence. Accordingly, these new tobacco products must now be the prime concern and health managers and the health profession should make it their priority that new measures be introduced to regulate these products and clear messages used about the harm they cause[23].

Adolescents from 16 to 17 years old returned higher odds of cigarette smoking. The older adolescents were also more likely to accumulate behavioural risk factors[24]. This may be explained by their parents' or guardians' relaxing the social constraints placed on them at this stage in their lives, enabling them to make more independent choices, by greater exposure to stressful situations and social pressures in the final stage of adolescence and by the circles they move in, particularly as a result of peer influence[24-26]. All this, in addition to their being more prone to the habit-forming effects of the nicotine in cigarettes, given that experimentation and initiation occur earlier and earlier[27].

Previous studies have also found higher prevalences of cigarette smoking among adults and adolescents whose skin colour was black or brown[28,29]. The variable "race/skin colour" can be considered an important predictor of population state of health, a marker for social inequalities and social determinants of health and thus for those most exposed to risk factors and in worse conditions of health[30]. Note also that smoking may be initiated or intensified as a result of stressful events, many of which occur more often in more vulnerable populations[31]. That is why reducing socioeconomic disparities among ethnic groups tends to reduce exposure to health risk factors[32].

Adolescents who reported having no close friends and who felt that no-one cared about them also returned higher odds of using tobacco. These variables are related to mental health and recourse is often made to licit and illicit drugs in order to alleviate pain, sadness, depressive symptoms[31] or stress[33,34].

Tobacco use was associated with use of alcohol and other drugs. Importantly, behavioural risk factors tend to come into play simultaneously, due to the synergic relations among them, and expose individuals to even greater risk of developing various diseases[35]. The probability of engaging in multiple types of risk behaviour also increases over the course of a lifetime[36]. Tobacco use may also encourage adolescents to use other, even more harmful, substances[37], which can produce dependence[32]. That behaviour is related to characteristics of this age group, which is more willing to run risks and experience new sensations[33].

The adolescents' family and social context may predispose to health risk factors and exert an adverse influence. The people closest to them, whether parents, guardians or friends, tend to play a fundamental role in their deciding whether or not substance use will start or become established[38]. In that regard, adolescents who missed classes without permission and who were passive smokers were associated with greater tobacco use, which may relate to lack of supervision of their life activities by parents or guardians and their frequenting other smokers influencing their life habits. On the other hand, supervision by the family was found to associate with lower odds of tobacco use, which may relate to concern on the part of parents or guardians, pointing to

dialogue and the ability to offer children guidance on promoting health and adopting healthier life habits[7,37].

Given this scenario, it is important to mention that Brazil has gone through periods of political and economic crisis, and austerity policies have been introduced. This has affected health systems and social programmes adversely and, consequently, aggravated inequalities and contributed to worsening population health conditions and lifestyles[39]. Also the government's regulatory role has been weakened, as shown by stable tobacco prices and lack of oversight of e-cigarette sales, as well as a growing illicit cigarette trade[40,41]. These issues have also contributed to greater exposure to health risk factors, such as tobacco use, especially among adolescents, who are at a stage of intense changes, which is influenced by the political, economic, social, cultural, family and collective context.

These study findings are subject to certain limitations. These relate firstly to the appropriateness of the question about use of other tobacco products, which is estimated by individual questions about each product, unlike the 2015 data obtained by a single question. Asked in this way, the questions may result in overestimation: when asked about consumption of individual tobacco products, adolescents tend to respond more precisely and remember better and, as a result, memory bias may occur[37]. Secondly, under-reporting of tobacco use and other habits is possible, because they constitute risk behaviour, and some are even illegal. However, the PeNSE was based on leading international surveys, such as the Global School-Based Student Health Survey, the Health Behaviour in School-Aged Children and the Youth Risk Behavior Surveillance System, which validated the questionnaire after reproducibility and validity analyses had returned satisfactory results. Lastly, the PeNSE depicts adolescents in school and may thus exclude participation by those out of school and at greater risk of substance use. Even given its limitations, though, the study does portray the realities of adolescents from 13 to 17 years old who are in school.

Although tobacco use held stable between 2015 and 2019, use of other tobacco products, particularly hookahs and e-cigarettes, increased considerably. In addition, tobacco use was associated with sociodemographic factors, such as age and skin colour, the presence of other types of risk behaviour, such as use of drugs and alcoholic beverages, as well as with family context and mental health considerations. Exposure to health risk factors may be influenced by specific conditions. Notable was the Anvisa's prohibiting the sale of e-cigarettes in 2009, reiterated in 2022. These measures, however, face numerous threats and industry attempts to change the regulatory framework. Here, the position of organised civil society has been fundamental to defending the regulatory framework[42]. This highlights the importance of advancing in policies for social protection and tobacco product oversight and regulation, in addition to introducing inter-sector policies to foster improved conditions of life and health, especially among more vulnerable adolescents and their families.

Collaborations

DC Malta participated in study conception, planning and design, interpretation of the statistical analyses and results, drafting of the first version of the article and critical review of the article. JB Souza participated in the statistical analyses, drafting of results and critical review of the article. EAH Morais, CS Gomes, AG Silva, FM Santos and CA Pereira participated in analysis and interpretation of the results and critical review of the article.

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