Prevalence and associated factors of experimentation with and current use of water pipes and electronic cigarettes among medical students: a multicentric study in Brazil

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ABSTRACT

Objective: To evaluate the prevalence of and factors associated with experimentation with and current use of water pipes and e-cigarettes among medical students. **Methods:** This was a cross-sectional multicentric study involving a convenience sample of students from medical schools in most Brazilian geographic regions. Information about experimentation with and current use of conventional cigarettes, water pipes, and e-cigarettes; beliefs and attitudes toward tobacco products; religiosity; and demographics were collected by means of an online structured questionnaire. We used descriptive statistics and logistic regression to analyze the association of those factors. **Results:** Our sample comprised 700 individuals from four Brazilian regions. Prevalence of experimentation with and current use of cigarettes, water pipes, and e-cigarettes were, respectively, 39.1% and 7.9%; 42.6% and 11.4%; and 13.1% and 2.3%. Water pipe experimentation was higher among those who had a sibling (adjusted OR = 2.64; 95% CI, 1.24-5.61) or friends (adjusted OR = 2.33; 95% CI, 1.63-3.31) who smoke. The same occurred regarding e-cigarette experimentation: siblings (adjusted OR = 2.76; 95% CI, 1.17-6.50) and friends (adjusted OR = 2.47; 95% CI, 1:45-4.22). Curiosity and scent/taste were the major reasons for water pipe use and e-cigarette experimentation. Although 93% of the responders learned about health damages of smoking during medical school classes, 51.4% reported having experimented with at least one of these tobacco products. Most responders who reported feeling the presence of God/the Holy Spirit in their lives were never experimenters of water pipes (59.2%) or e-cigarettes (55.3%). **Conclusions:** There is a high prevalence of experimentation with tobacco products among medical students whose siblings or friends smoke, despite their knowledge about smoking harms.

Keywords: Education, medical; Health knowledge, attitudes, and practice; Electronic nicotine delivery systems; Smoking water pipes; Religion.

INTRODUCTION

Smoking is associated with 8 million deaths per year, being the number one cause of preventable deaths in the world.[1] Teenagers are daily enticed to try new products such as water pipes and electronic cigarettes (e-cigarettes), which are important risk factors for smoking initiation.[2,3]

In Brazil, the *Pesquisa Nacional de Saúde* (National Health Research) carried out by the *Instituto Brasileiro de Geografia e Estatística* (Brazilian Institute of Geography and Statistics) revealed a significant increase in the prevalence of water pipe smokers, from 0.6% in 2013 to 2.4% in 2019 in people between 18 and 24 years of age, and from 0.01% in 2013 to 0.1% in 2019 in those ≥ 25 years of age.[4,5]

Regarding the use of e-cigarettes with nicotine among Brazilians ≥ 15 years of age, its prevalence was 0.6% in 2019, being even more prevalent in those living in big city centers and among young people with a higher income.[5] The use of these products, which may or may not include nicotine, a potent psychoactive substance, leads to serious health issues.

A lot of young people choose to use the water pipe with non-tobacco products, but with herbal essences, full of pleasant and attractive additives such as various aromas and flavors, because they believe them to be less harmful to their health. However, it is known that except for nicotine, the concentrations of tar, carbon monoxide, polycyclic aromatic hydrocarbons, formaldehyde, acetaldehyde, and others are similar to those of the water pipe when used with tobacco.[6]

The surge in e-cigarette use is a great threat to public policies regarding tobacco control, especially among the young, because many of them are nonsmokers who experiment with the product as a trend and later develop a nicotine addiction. Approximately 40% of American high school students use the e-cigarette for ≥ 20 days a month, and almost a quarter of them use it daily.[7] It is known that the presence of propylene glycol and glycerol alone, the main substances for aerosol formation, causes damage to the health of users.[8]

Brazil has a limited amount of data regarding the use of these products, especially among medical students. This study aimed to evaluate the prevalence, beliefs, attitudes, reasons, and religiosity related to the experimentation with and use of water pipes and e-cigarettes among medical students residing in different regions in Brazil and to compare variables regarding sex, age, ethnicity, region, and income.

METHODS

This was an online survey carried out with medical students by means of a convenience sample of 11 medical schools located in the five geographic regions in Brazil. In all of the regions, two referral universities were invited to participate, except in the Southeast region, where three institutions were invited. The universities were initially contacted via an invitation letter to evaluate if they would be interested in participating in the study. Only the universities that agreed to participate were included in the study, and the research was conducted by a professor of the participating university. Students were invited to participate by the focal point during lectures and via an e-mail sent by the university secretariat. The students could access all information related to the survey, the invitation letter, the informed consent form, and the questionnaire through the link http://trabalhosmed.wix.com/pesquisacigarro.

The information collected in the questionnaire was related to demographics, socioeconomics, and experimentation with and use of smoking products, such as conventional cigarettes, water pipes, and e-cigarettes. Also, we included questions about attitudes, beliefs, and reasons for experimentation with or use of these products. These questions were administered to a pilot group before the beginning of the study and they reflected well what we wanted to investigate. There was no external validation, because our objective was to study the prevalence and profile of experimenters and users of conventional cigarettes, water pipes, and e-cigarettes.

The questionnaire was composed of questions from the Global Adult Tobacco Survey[9] and other published surveys on criteria for dependence, attitudes, beliefs, and religiosity regarding water pipes, e-cigarettes, and additional modules.[10,11]

In this study, the outcomes were experimentation with and current use of cigarettes, water pipes, and e-cigarettes. Individuals were asked about experimentation (yes or no) with each product. Individuals who reported having smoked ≥ 100 cigarettes in their lifetime and continued smoking at the time of the survey were considered cigarette smokers.[12] For water pipes and e-cigarettes, we considered any experimentation during life.

The variables studied were sex (male/female); skin color, categorized as White and non-White (black, brown, and yellow); age group (15-19, 20-24, and 25-29 years); family income (1-5, 6-10, 11-19, and ≥ 20 times the Brazilian national minimum wage at the time); region of the country where the institution is located (South, Southeast, Central-West, North, and Northeast); type of institution (public or private); current semester in medical school (semesters 1-2, 3-6, and 7-12); smokers close to the respondent (yes or no), which included friends, parents, and siblings; and two other questions: "Have you had any classes regarding smoking and its harms at your medical school?" (yes or no); and "Has any health professional ever asked you if you smoke?" (yes or no). Additionally, for those who reported having used or experimented with water pipes and e-cigarettes, we asked the reasons why (yes or no), the alternatives being scent/taste, relaxation, pleasure, curiosity, social belonging, and trend following. Regarding e-cigarettes, respondents were also asked whether their experimentation was related to reducing the consumption of conventional cigarettes or quitting smoking. The experience of religiosity was also studied in relation to whether it was associated to the consumption of tobacco products or not.

For statistical analysis, proportions of each of the outcomes were calculated for the overall population and by sample characteristics. Also, we used crude and adjusted logistic regression models to verify possible associated factors for each outcome. The adjusted model included all variables. Additionally, we described the co-occurrence of experimentation with the three tobacco products using Venn diagrams. The co-occurrence was considered as the experimentation of ≥ 2 tobacco products concomitantly. All analyses were conducted using Stata statistical software package, version 17.1 (Stata Corp LP, College Station, TX, USA).

This study was approved by the Research Ethics Committee of the *Escola de Medicina da Universidade de São Paulo* (Protocol CAAE no. 58935616.1.1001.0065).

RESULTS

The survey was available online between March of 2016 and January of 2018. The overall sample comprised 700 medical students from nine Brazilian medical schools in four of the five Brazilian regions. Despite being invited and agreeing to participate in the study, no responses were obtained from two medical schools in the Northeast region. The number of participants varied a lot among the institutions, being very low at some (Table S1).

Table 1 shows the sample characteristics as well as the prevalence of the outcomes of experimentation with and current use of conventional cigarettes, water pipes, and e-cigarettes. More than half of the sample was female, self-reported being White, were in the 20-24 year-old age group, and lived in the Southeast region. Experimentation with and use of traditional cigarettes and water pipes were lower in females than

Table 1. Sample characteristics and prevalence of experimentation with and current use of conventional cigarettes, water pipes, and electronic cigarettes (N = 700).

Variable	Sample n (%)	Experimentation (%)			Current use (%)		
		Cigarette	Water pipe	Electronic cigarette	Cigarette	Water pipe	Electronic cigarette
Sex		p = 0.003	p = 0.055	p = 0.001	p < 0.001	p = 0.188	p = 0.960
Male	302 (43.1)	45.4	46.7	17.9	12.6	13.3	2.3
Female	398 (56.9)	34.4	39.5	9.6	4.3	10.1	2.3
Skin color		p = 0.002	p < 0.001	p = 0.001	p = 0.122	p = 0.096	p = 0.146
White	554 (79.1)	42.1	46.2	15.3	8.7	12.5	2.7
Non-White	146 (20.9)	28.1	28.8	4.8	4.8	7.5	0.7
Age group, years		p < 0.001	p = 0.005	p = 0.822	p = 0.260	p = 0.733	p = 0.003
15-19	78 (11.1)	25.6	28.2	15.4	3.9	14.1	7.7
20-24	461 (65.9)	37.3	42.3	12.8	7.9	11.1	1.7
25-29	161 (23.0)	50.9	50.3	13.0	9.9	11.2	1.2
Monthly family income, number of times the Brazilian national minimum wage		p = 0.110	p < 0.001	p = 0.068	p = 0.209	p = 0.001	p = 0.359
1-5	168 (24.0)	32.1	29.2	7.1	7.7	4.8	1.2
6-10	187 (26.7)	38.0	41.2	14.4	4.8	8.6	2.1
11-19	200 (28.6)	42.5	48.0	15.0	8.5	15.0	2.0
≥ 20	145 (20.7)	44.1	52.4	15.9	11.0	17.9	4.1
Geographic region		p = 0.006	p < 0.001	p = 0.033	p = 0.008	p = 0.033	p = 0.456
South	32 (4.6)	37.5	40.6	15.6	12.5	6.3	3.1
Southeast	375 (53.6)	44.8	50.1	14.9	10.7	12.3	2.9
Central-west	142 (20.3)	35.2	50.0	15.5	4.2	16.2	2.1
North	151 (21.6)	29.1	17.2	6.0	3.3	6.0	0.7
Type of institution		p = 0.006	p < 0.001	p < 0.001	p = 0.006	p = 0.006	p = 0.051
Public	569 (81.3)	36.7	38.5	10.9	6.5	9.8	1.8
Private	131 (18.7)	49.6	60.3	22.9	13.7	18.3	4.6
Period of the medical course, semester		p = 0.767	p = 0.028	p = 0.721	p = 0.038	p = 0.153	p = 0.683
7-12	279 (39.9)	37.6	44.1	14.0	9.7	13.3	1.8
3-6	278 (39.7)	40.7	46.0	11.9	4.7	11.9	2.9
1-2	143 (20.4)	39.2	32.9	14.0	10.5	7.0	2.1
Has a friend who smokes		p < 0.001	p < 0.001	p < 0.001	p < 0.001	p = 0.002	p = 0.027
No	322 (46.0)	30.1	30.1	7.8	2.8	7.5	0.9
Yes	378 (54.0)	46.8	53.2	17.7	12.2	14.8	3.4
Has a parent who smokes		p = 0.002	p = 0.001	p = 0.227	p = 0.076	p = 0.029	p = 0.449
No	613 (87.6)	37.0	40.1	12.6	7.2	10.4	2.5
Yes	87 (12.4)	54.0	59.8	17.2	12.6	18.4	1.2
Has a sibling who smokes		p = 0.014	p = 0.003	p = 0.022	p = 0.003	p = 0.023	p = 0.237
No	660 (94.3)	38.0	41.2	12.4	7.1	10.8	2.1
Yes	40 (5.7)	57.5	65.0	25.0	20.0	22.5	5.0
Knowledge on the harms of smoking from medical school classes		p=0.581	p = 0.733	p = 0.806	p = 0.308	p = 0.852	p = 0.267
No	49 (7.0)	42.9	44.9	14.3	4.1	12.2	0.0
Yes	651 (93.0)	38.9	42.4	13.1	8.1	11.4	2.5
Any health professional asked if you smoke		p = 0.146	p = 0.001	p = 0.041	p < 0.001	p = 0.091	p = 0.605
No	351 (50.1)	36.5	36.5	10.5	4.3	9.4	2.0
Yes	349 (49.9)	41.7	48.7	15.8	11.5	13.5	2.6
Total	700 (100)	39.1	42.6	13.1	7.9	11.4	2.3

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in males, whereas experimentation with and use of e-cigarettes were similar in both sexes. More than 90% of the participants reported having learned about health damages caused by smoking during medical school classes. More than 50% of the respondents were never asked by any health care professional whether they were smokers or not (Table 1).

Regarding experimentation with tobacco products, 39.1% used conventional cigarettes, 42.6% used water pipes, and 13.1% used e-cigarettes. As for the current use of conventional cigarettes, water pipes, and e-cigarettes, prevalence was 7.9%, 11.4%, and 2.3%, respectively (Table 1).

The mean age of experimentation with cigarettes and water pipes was 16.9 years of age, whereas that of experimentation with e-cigarettes was 20.1 years. Among water pipe users, 86.9% reported sharing the mouthpiece with other users.

Figure 1 shows the co-occurrence of experimentations with cigarettes (n = 223), water pipes (n = 237), and e-cigarettes (n = 99). The majority of the respondents who experimented with water pipes also experimented with conventional cigarettes. Although the prevalence of e-cigarette use was low, the majority of the e-cigarette users also reported using water pipes and/or conventional cigarettes (Figure 1).

Factors associated with the experimentation with cigarettes, water pipes, and e-cigarettes are presented in Table 2. In the adjusted model, being female or non-White was related to lower experimentation with all tobacco products (Table 2).

Cigarette experimentation was higher among those in the 25-29 year-old age group (adjusted OR = 3.22; 95% CI, 1.72-6.02) and those whose siblings (adjusted OR = 2.18; 95% CI, 1.07-4.43), parents (adjusted OR = 2.08; 95% CI, 1.27-3.41), or friends (adjusted OR = 2.00; 95% CI, 1.41-2.82) were smokers (Table 2).
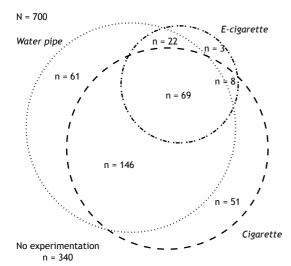
Table 2 shows that water pipe experimentation was more than two times higher for those having siblings (adjusted OR = 2.64; 95% CI, 1.24-5.61), friends (adjusted OR = 2.33; 95% CI, 1.63-3.31), or parents (adjusted OR = 2.25; 95% CI, 1.37; 3.77) who smoked.

E-cigarette experimentation was more than two times higher for those having siblings (adjusted OR = 2.76; 95% CI, 1.17-6.50) or friends (adjusted OR = 2.47; 95% CI, 1.45-4.22) who smoked (Table 2). E-cigarette experimentation was also associated with private institutions (adjusted OR = 3.83; 95% CI, 2.00-7.36).

The current use of cigarettes and water pipes regarding sex and having friends, parents, or siblings who smoked (Table S2) shows a similar pattern to the one seen regarding experimentation with these two products (Table 2). The two main reasons for water pipe use and e-cigarette experimentation were curiosity and scent/taste (Figure 2). Additionally, 13.0% and 26.1% of e-cigarette experimenters reported using the product as an attempt to reduce cigarette smoking and to quit smoking, respectively (Figure 2). However, those who reported using e-cigarettes to quit smoking conventional cigarettes were unable to do it, since none of them quit either.

Water pipe experimenters reported that this product causes more damages to health (42.6%) but is less addictive (69.1%) than are conventional cigarettes (Table 3). In addition, those who had never experimented and those who had experimented with e-cigarettes (55.9% and 72.8%, respectively) reported believing that e-cigarettes are less addictive than are conventional cigarettes (Table 3).

Religiosity aspects of water pipe and e-cigarette experimenters and never experimenters can be found in Table 4. There was a statistically significant difference in all study variables related to the influence of religiosity between water pipe never experimenters and experimenters. However, this relationship was not found between e-cigarette never experimenters and experimenters, except for the topic "my religious belief guides my way of living" (p = 0.016).

Feeling the presence of God/the Holy Spirit in their lives was more often reported among water piper and e-cigarette never experimenters than among experimenters (Table 4). In addition, "my religious belief guides my way of living" was more commonly reported among water pipe never experimenters (Table 4).

DISCUSSION

As far as we know, this is the first Brazilian multicentric study involving medical students with respect to tobacco products that have a great appeal among young people, such as water pipes and e-cigarettes.

One of the main findings of this study was how siblings, friends, or parents who smoked influenced

Figure 1. Co-occurrence of cigarette, water pipe, and electronic cigarette experimentation.

Table 2. Experimentation with conventional cigarettes, water pipes, and electronic cigarettes.

Variable	Experimentation					
	Cigarette		Water pipe		Electronic cigarette	
	Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)
Sex	p = 0.003	p < 0.001	p = 0.055	p = 0.001	p = 0.001	p < 0.001
Male	1.00	1.00	1.00	1.00	1.00	1.00
Female	0.63 (0.47-0.86)	0.53 (0.38-0.74)	0.74 (0.55-1.01)	0.55 (0.39-0.79)	0.48 (0.31-0.76)	0.32 (0.19-0.53)
Skin color	p = 0.002	p = 0.024	p < 0.001	p = 0.057	p = 0.002	p = 0.008
White	1.00	1.00	1.00	1.00	1.00	1.00
Non-white	0.54 (0.36-0.80)	0.59 (0.38-0.93)	0.47 (0.32-0.70)	0.63 (0.40-1.01)	0.28 (0.13-0.61)	0.31 (0.13-0.74)
Age group, years	p < 0.001	p < 0.001	p = 0.004	p = 0.012	p = 0.831	p = 0.157
15-19	1.00	1.00	1.00	1.00	1.00	1.00
20-24	1.73 (1.00-2.97)	1.67 (0.94-2.96)	1.87 (1.10-3.16)	1.53 (0.86-2.75)	0.81 (0.41-1.58)	0.55 (0.26-1.14)
25-29	3.01 (1.66-5.46)	3.22 (1.72-6.02)	2.58 (1.44-4.61)	2.75 (1.43-5.27)	0.83 (0.38-1.78)	0.57 (0.25-1.32)
Monthly family income, number of times the Brazilian national minimum wage	p = 0.099	p = 0.391	p < 0.001	p = 0.036	p = 0.026	p = 0.325
1-5	1.00	1.00	1.00	1.00	1.00	1.00
6-10	1.29 (0.83-2.00)	1.18 (0.73-1.90)	1.70 (1.09-2.65)	1.34 (0.82-2.21)	2.19 (1.07-4.84)	1.88 (0.87-4.05)
11-19	1.56 (1.02-2.39)	1.53 (0.96-2.43)	2.24 (1.45-3.46)	1.96 (1.20-3.19)	2.29 (1.13-4.64)	1.82 (0.86-3.87)
≥ 20	1.66 (1.05-2.64)	1.26 (0.76-2.09)	2.67 (1.68-4.26)	1.74 (1.03-2.93)	2.45 (1.17-5.12)	1.50 (0.68-3.30)
Geographic region	p = 0.701	p = 0.891	p = 0.049	p = 0.092	p = 0.134	p = 0.319
South	1.00	1.00	1.00	1.00	1.00	1.00
Southeast	1.35 (0.64-2.85)	1.11 (0.50-2.47)	1.47 (0.71-3.06)	1.07 (0.48-2.39)	0.95 (0.35-2.57)	0.44 (0.15-1.35)
Central-west	0.91 (0.41-2.00)	0.94 (0.41-2.17)	1.46 (0.67-3.18)	1.59 (0.69-3.68)	0.99 (0.34-2.85)	1.03 (0.33-3.24)
North	0.69 (0.31-1.52)	0.91 (0.39-2.13)	0.30 (0.13-0.69)	0.42 (0.17-1.02)	0.34 (0.11-1.10)	0.47 (0.13-1.65)
Type of institution	p = 0.007	p = 0.068	p < 0.001	p = 0.001	p < 0.001	p < 0.001
Public	1.00	1.00	1.00	1.00	1.00	1.00
Private	1.69 (1.16-2.49)	1.55 (0.97-2.47)	2.43 (1.65-3.58)	2.22 (1.37-3.58)	2.43 (1.49-3.95)	3.83 (2.00-7.36)
Period of the medical course, semester	p = 0.758	p = 0.683	p = 0.047	p = 0.118	p = 0.783	p = 0.683
7-12	1.00	1.00	1.00	1.00	1.00	1.00
3-6	1.13 (0.81-1.60)	1.17 (0.81-1.68)	1.08 (0.76-1.51)	1.15 (0.79-1.66)	0.83 (0.50-1.36)	0.85 (0.50-1.44)
1-2	1.07 (0.71-1.61)	1.13 (0.72-1.77)	0.62 (0.41-0.95)	0.66 (0.41-1.05)	1.00 (0.56-1.79)	1.10 (0.59-2.10)
Has a friend who smokes	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	2.04 (1.49-2.79)	2.00 (1.41-2.82)	2.63 (1.93-3.60)	2.33 (1.63-3.31)	2.56 (1.57-4.16)	2.47 (1.45-4.22)
Has a parent who smokes	p = 0.003	p = 0.004	p = 0.001	p = 0.002	p = 0.229	p = 0.127

Table 2. Experimentation with conventional cigarettes, water pipes, and electronic cigarettes.

Variable	Cigarette		Water pipe		Electronic cigarette	
	Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.99 (1.27-3.14) p = 0.017	2.08 (1.27-3.41) p = 0.032	2.22 (1.40-3.50) p = 0.004	2.25 (1.37-3.77) p = 0.011	1.45 (0.79-2.66) p = 0.026	1.69 (0.86-3.33) p = 0.021
Has a sibling who smokes						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	2.20 (1.16-4.21) p = 0.434	2.18 (1.07-4.43) p = 0.291	2.65 (1.36-5.17) p = 0.733	2.64 (1.24-5.61) p = 0.382	2.35 (1.11-4.98) p = 0.806	2.76 (1.17-6.50) p = 0.923
Knowledge on the harm of smoking from medical school classes						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	0.85 (0.47-1.52) p = 0.157	0.71 (0.37-1.35) p = 0.950	0.90 (0.50-1.62) p = 0.002	0.74 (0.38-1.44) p = 0.428	0.90 (0.39-2.07) p = 0.042	1.05 (0.42-2.58) p = 0.560
Any health professional asked if you smoke						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.25 (0.92-1.70)	0.99 (0.71-1.39)	1.65 (1.22-2.24)	1.15 (0.81-1.63)	1.59 (1.02-2.48)	1.16 (0.71-1.89)

our sample of medical students on experimenting with cigarettes, water pipes, or e-cigarettes. The adjusted ORs for experimentation with cigarettes were significantly higher in those medical students whose siblings, parents, or friends were smokers. These results corroborate studies carried out in Saudi Arabia[13] and Iran.[14] The same was true regarding water pipe users, corroborating a study regarding parental smokers in Iran[14] and an American study regarding the use of the water pipes among friends.[15] Regarding e-cigarette experimentation, the adjusted ORs were higher for those who reported having siblings or friends who smoked. In regard to the use of the three products, there was a correlation between having some kind of relationship with users of these products and the smoking behavior of the respondents.[16]

Another important result regards the knowledge and beliefs of the medical students who experimented with tobacco products. More than 42% of water pipe experimenters recognized that water pipe smoking would be more harmful than would conventional cigarette smoking. A study involving medical students revealed similar data, proving that they have knowledge about the harms of water pipe use.[17] It has been shown that a water pipe smoking session provides nicotine and carbon monoxide levels, respectively, up to 1.7 and 9.0 times higher than those provided by smoking one cigarette and that the inhaled smoke volume in a one-hour water pipe session can be equivalent to inhaling the volume of smoke of 100-200 cigarettes.[18] Regarding e-cigarettes, our study showed that 72.8% of experimenters believed that e-cigarettes are less addictive than are conventional cigarettes. The presence of nicotine salt in e-cigarettes provides the same or higher levels of nicotine than those found in conventional cigarettes, possibly leading to nicotine addiction.[19,20] Nicotine salt arises from the addition of benzoic acid to free-base nicotine. It is usually found in the fourth generation of e-cigarettes and is more addictive than free-base nicotine used in conventional cigarettes. The lower pH of the nicotine salt reduces the harshness and the unpleasant tobacco flavor, making experimentation easier for teenagers. This way, users of e-cigarettes can take deeper puffs that deliver nicotine faster and directly to the structures of the respiratory system, such as bronchi and alveoli, resulting in increased absorption.[21,22] Nicotine impacts the brain in a faster and powerful way leading teenagers and young adults to nicotine addiction in a shorter space of time.[23] At this age, the brain areas that start to suffer neuroadaptations in the presence of nicotine are yet to be fully formed.[24] The spread of the use of nicotine salt is one of the greatest dangers that public health has to face nowadays to prevent teens and young adults from becoming addicted to nicotine.

Experimentation with harmful and addictive products highlights the cognitive distortion observed by the inconsistent relationship between cognition and attitudes, leading to risk exposure because of
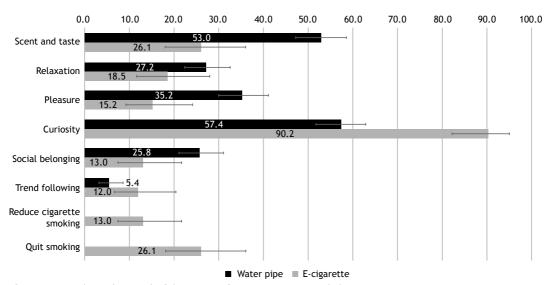
Figure 2. Prevalence (95% CI) of the reasons for water pipe use and electronic cigarette experimentation.

a false perception of personal immunity.[25-27] This is also observed regarding the high prevalence of the unsanitary sharing of the mouthpiece among water pipe users, which equally represents a health risk.[28]

Our study showed that 26.1% of the students reported e-cigarette use as an attempt to quit smoking, which is similar to the results of another study involving medical students that showed that 23.3% of the respondents believed that e-cigarette use is an option for smoking cessation.[29] However, our study observed that, none of those 26.1% managed to treat nicotine addiction because they were unable to stop using conventional cigarettes and/or e-cigarettes.

The use of e-cigarettes as a form of treatment for smoking cessation can lead to the maintenance of nicotine addiction.[30] Even if smokers reduce their cigarette consumption while using e-cigarettes, it is unlikely that there will be any cardiovascular benefit due to the highly nonlinear dose-response relationship between exposure to fine particles and risk of cardiovascular disease.[31-33]

It is worth remembering that the American Thoracic Society recommends using medications, such as varenicline and others, instead of e-cigarettes, for the treatment of smoking cessation.[34] Furthermore, the position of the US Preventive Services Task Force is that there are no conclusive data on the benefits and harms of e-cigarettes in the treatment of smoking cessation.[35] The Brazilian Medical Association, together with the Brazilian Thoracic Society, the Brazilian Pediatrics Society, and other entities, does not recommend the use of e-cigarettes either.[36] Thus, e-cigarettes are not currently seen as a safe and effective alternative for treatment for nicotine addiction, although this belief is present in a significant portion of e-cigarette users. There is an urgent need for public prevention policies and greater discussion on the subject among medical students.

The high proportion of knowledge about the health damages caused by smoking is noteworthy, which contrasts with the relevant prevalence of experimentation with conventional cigarettes, water pipes, and e-cigarettes, especially among men. However, because of our study design and sample size, we could not associate knowledge of the addictive power of water pipe and e-cigarette use as a factor for reducing the experimentation of these products.

As for religiosity, we observed that almost 80% of those who reported that they totally believed that they feel the presence of God/the Holy Spirit in their lives had never experimented with water pipes (40.8%) or e-cigarettes (36.5%). Studies confirm that young people who experience their religiosity are more protected from tobacco use.[37] Religious involvement may lead individuals to assume healthier behaviors. Explanations for this phenomenon can be due to the promotion of self-esteem, self-control, and a sense of mastery.[38]

Other major reasons for water pipe use and e-cigarette experimentation were curiosity, scent/taste, pursuit of pleasure, relaxation, and group belonging. Pleasure and relaxation were also reported to be the most common reasons for the use of water pipes in a systematic review.[39] Curiosity and scent/taste delivered by the attractive additives present in e-cigarettes were also the two major reasons reported in another study that investigated the reasons for e-cigarette experimentation.[40] The World Health Organization has long warned about the appealing flavors in tobacco products that impart attractive taste and scent as a risk factor for smoking initiation.[41]

Our study has some limitations. We intended to make a census of all the medical students of the selected medical schools; thus a sample size calculation was not performed. We used a virtual platform for the feasibility of the study, and the invitation to participate in the research was sent to the students through

Table 3. Beliefs regarding harms to health and addiction caused by water pipes and electronic cigarettes among never experimenters versus experimenters.[a]

Belief	Water pipe/electronic cigarette use	Water pipe			Electronic cigarette		
		Never experimenter (n = 402)	Experimenter (n = 298)	p*	Never experimenter (n = 608)	Experimenter (n = 92)	p*
Harm to health	Not harmful	2 (0.5)	3 (1.0)	0.001	24 (4.0)	4 (4.3)	0.282
	Less harmful than cigarettes	32 (8.0)	50 (16.8)		332 (54.6)	59 (64.1)	
	As harmful as cigarettes	157 (39.1)	118 (39.6)		222 (36.5)	27 (29.4)	
	More harmful than cigarettes	211 (52.5)	127 (42.6)		30 (4.9)	2 (2.2)	
Addiction	Less addictive than cigarettes	169 (42.0)	206 (69.1)	< 0.001	340 (55.9)	67 (72.8)	0.001
	As addictive as cigarettes	179 (44.6)	75 (25.2)		251 (41.3)	20 (21.7)	
	More addictive than cigarettes	54 (13.4)	17 (5.7)		17 (2.8)	5 (5.4)	

[a]Values expressed as n (%). *Chi-square test

Table 4. Influence of religiosity among water pipe and electronic cigarette never experimenters versus experimenters.

Religiosity	Response	Water pipe			Electronic cigarette		
		Never experimenter (n = 402)	Experimenter (n = 298)	p*	Never experimenter (n = 608)	Experimenter (n = 92)	p*
Frequency of going to a church, temple, or religious meetings	Once a week or more	31 (7.7)	7 (2.4)	< 0.001	35 (5.7)	3 (3.3)	0.146
	Once a week	64 (15.9)	16 (5.4)		73 (12.0)	7 (7.6)	
	2-3 times a month	32 (8.0)	17 (5.7)		45 (7.4)	4 (4.4)	
	A few times a year	103 (25.6)	98 (32.9)		167 (27.5)	34 (37.0)	
	Once a year or less	65 (16.2)	52 (17.5)		106 (17.4)	11 (12.0)	
	Never	107 (26.6)	108 (36.2)		182 (29.9)	33 (35.9)	
Frequency of individual religious activities (prayer, meditation, religious text reading)	More than once a day	17 (4.2)	7 (2.4)	0.033	23 (3.8)	1 (1.1)	0.362
	Once a day	100 (24.9)	53 (17.8)		137 (22.5)	16 (17.4)	
	2-3 times a week	54 (13.4)	32 (10.7)		76 (12.5)	10 (10.9)	
	Once a week	25 (6.2)	15 (5.0)		36 (5.9)	4 (4.4)	
	A few times a month	47 (11.7)	45 (15.1)		80 (13.2)	12 (13.0)	
	Rarely or never	159 (39.6)	146 (49.0)		256 (42.1)	49 (53.3)	
I feel the presence of God/the Holy Spirit in my life	Totally true	164 (40.8)	78 (26.2)	0.002	222 (36.5)	20 (21.7)	0.068
	Usually true	74 (18.4)	64 (21.5)		114 (18.8)	24 (26.1)	
	Not sure	49 (12.2)	43 (14.4)		77 (12.7)	15 (16.3)	
	Usually not true	22 (5.5)	25 (8.4)		39 (6.4)	8 (8.7)	
	Not true	93 (23.1)	88 (29.5)		156 (25.7)	25 (27.2)	

Table 4. Influence of religiosity among water pipe and electronic cigarette never experimenters versus experimenters. (Continued...)

Religiosity	Response	Water pipe			Electronic cigarette		
		Never experimenter (n = 402)	Experimenter (n = 298)	p*	Never experimenter (n = 608)	Experimenter (n = 92)	p*
My religious belief guides my way of living	Totally true	71 (17.7)	20 (6.7)	< 0.001	87 (14.3)	4 (4.4)	0.016
	Usually true	119 (29.6)	76 (25.5)		175 (28.8)	20 (21.7)	
	Not sure	49 (12.2)	38 (12.8)		71 (11.7)	16 (17.4)	
	Usually not true	37 (9.2)	35 (11.7)		62 (10.2)	10 (10.9)	
	Not true	126 (31.3)	129 (43.3)		213 (35.0)	42 (45.6)	
I make a lot of effort to live my religion in all aspects of my life	Totally true	59 (14.7)	18 (6.0)	< 0.001	72 (11.8)	5 (5.4)	0.06
	Usually true	99 (24.6)	54 (18.1)		137 (22.5)	16 (17.4)	
	Not sure	62 (15.4)	37 (12.4)		89 (14.6)	10 (10.9)	
	Usually not true	31 (7.7)	52 (17.5)		67 (11.0)	16 (17.4)	
	Not true	151 (37.6)	137 (46.0)		243 (40.0)	45 (48.9)	

aValues expressed as n (%). *Chi-square test.

the focal point and the university secretariat, so the sample was not randomly selected. Because students rarely access their e-mails and are in high demands to participate in research, it might have been difficult for them to adhere. Also, students who smoke or experiment with tobacco products might not have wanted to complete the questionnaire, which could have led to a selection bias. Additionally, the majority of answers were from students in the Southeast region, and no responses were collected from the Northeast region of Brazil, which could have led to a selection bias and impaired the generalization of the results. Therefore, considering all of the impairments, extrapolation should be done cautiously because our findings may not reflect other realities.

In conclusion, smoking and tobacco issues should continue to be discussed and taught in the undergraduate health professional curriculum because, although the majority of the respondents reported having learned about the health damages of tobacco products in medical school classes, more than half of those also reported having experimented with cigarettes, water pipes, and/or e-cigarettes. Also, more studies are necessary to understand the attitudes and beliefs of health professionals regarding the tobacco products available on the market and the risks to public health.

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AUTHOR CONTRIBUTIONS

SRM: study design; coordination, collection, and organization of data for statistical analysis; data analysis; interpretation of results; drafting and revision of the manuscript; and approval of the final version. AJA: study design; coordination, collection, and organization of data for statistical analysis; statistical analysis performance; and interpretation of results. FCW: organization of data for statistical analysis; statistical analysis performance; interpretation of results; revision of the manuscript; and approval of the final version. BMF: data analysis; interpretation of results; drafting and revision of the manuscript; and approval of the final version. RGB: study design; coordination and collection of data; drafting of the manuscript; and approval of the final version. ANCS: coordination and collection of data; drafting of the manuscript; and approval of the final

version. UPS: revision of the manuscript; and approval of the final version.

CONFLICTS OF INTEREST

None declared.

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