



# Use of electronic cigarettes and hookah in Brazil: a new and emerging landscape. The Covitel study, 2022

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## ABSTRACT

**Objective:** To estimate the prevalence of current commercial cigarette smoking, as well as those of e-cigarette and hookah experimentation and current use among adults ( $\geq 18$  years of age) in Brazil. **Methods:** This study was based on a countrywide cross-sectional telephone-based survey conducted in 2022. The sample was designed to be representative of the five macroregions in Brazil and included 1,800 individuals from each of the regions. Telephone numbers, using a random digit dialing procedure, were proportionally selected for each direct distance dialing code in each region and then electronically validated (i.e., 900 cell and 900 landline phone numbers per region). Information on current commercial cigarette smoking (regardless of frequency/amount), as well as lifetime history of or current e-cigarette and hookah use (regardless of amount), were collected. **Results:** The prevalence of lifetime history of e-cigarette and hookah use was identical (7.3%; 95% CI: 6.0-8.9), whereas the prevalence of current commercial cigarette smoking was 12.2% (95% CI: 10.4-14.1). Young adults (18-24 years) had the highest prevalence of e-cigarette experimentation (19.7%; 95% CI: 15.1-17.0) and hookah experimentation (17%; 95% CI: 12.2-23.2). E-cigarette and hookah use was more common in the Central-West region and among those with a high level of education, whereas current commercial cigarette smoking was more common among those with a lower level of education. Individuals who used the three forms of nicotine delivery corresponded to 1.5% of the sample (nearly 2 million individuals based on the estimated size of the Brazilian adult population). **Conclusions:** Surveillance is essential for the monitoring and prevention of these new forms of nicotine consumption.

**Keywords:** Electronic nicotine delivery systems; Smoking water pipes; Nicotine; Tobacco products; Adults.

## INTRODUCTION

Over the past few years, the world has been facing a smoking paradox: on the one hand, there has been a decline in commercial cigarette smoking due to long-term public policies. On the other hand, there has been a rise in other forms of smoking or vaping, such as electronic cigarettes (e-cigarettes) and hookah (also known as water pipe or shisha).<sup>(1-3)</sup> While health institutions and governments have been fighting against and banning all kinds of tobacco, the industry finds other ways to profit through creative means. Vaping mainly targets young people and, most importantly, is advertised as harmless and safe.<sup>(1,4)</sup> Despite that industry message, it is known that most of the new vaping devices contain nicotine (the concentration of which is unknown in some cases) hidden by colors, flavors, and a variety of other disguises to reach new customers.<sup>(1,4-8)</sup>

Brazil has achieved one of the most significant declines in the prevalence of smoking in the world: a nearly 70% decline among adults ( $\geq 20$  years of age) from

1990 to 2017 (35.3% to 11.3%).<sup>(2)</sup> This resulted from a series of regulatory measures and anti-tobacco policies implemented in the country.<sup>(9)</sup> However, the new nicotine delivery systems, already very common in the USA and elsewhere,<sup>(1,10)</sup> are fashionable in Brazil, not only among teenagers but also among young adults.<sup>(11-13)</sup> Today, health care providers and researchers must inquire patients not only on the use of commercial cigarettes but also on other types of smoking/vaping, the type of device, and the frequency of use (or number of sessions), since subjects can use more than one type (known as the dual use).<sup>(14,15)</sup>

According to surveys in Brazil, the most recent prevalence estimates of electronic nicotine delivery systems (ENDS) experimental use among adults varied from 1.6% in 2013<sup>(13,16)</sup> to 6.7% in 2019.<sup>(17)</sup> A previous national survey carried out in 2013 found that the prevalence of hookah use among adults who self-reported its use was 1.2%.<sup>(13,16)</sup> However, these surveys differed in the wording of the questions, the interview strategies (face-to-face or via

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telephone) and the sampling strategies. A countrywide cross-sectional telephone-based survey (designated Covitel) was launched in 2022 to estimate the burden of risk factors for noncommunicable diseases in Brazil. The objective of the present study was to estimate the prevalence of commercial cigarette smoking, focusing on e-cigarette and hookah experimentation in adults ( $\geq 18$  years of age).

## METHODS

This study was based on a countrywide cross-sectional telephone-based survey carried out during the first trimester of 2022 in Brazil. The survey was designed to represent the country and its five macroregions for the population aged 18 years or older. The sample size was calculated with a 95% CI and a margin of error of prevalence estimates of up to three percentage points. This resulted in a sample of 1,800 (900 cell phones and 900 landline phones) individuals per region, totaling 9,000 people.

Telephone numbers were selected using a random digit dialing procedure proportionally for each direct distance dialing code in each region (primary sampling unit). The telephone numbers were electronically checked, and those validated in each region were randomly selected for interview. In the case of cell phones, the person who answered the call was interviewed if he/she met the inclusion criterion ( $\geq 18$  years of age); as for landline phones, a list of all household members aged 18 years or older was made before a random selection of one individual living in the household.

Participants were presented with an informed consent form, and those who accepted it gave verbal consent. All interviews were recorded and securely stored. The Research Ethics Committee of the *Escola Superior de Educação Física* of the *Universidade Federal de Pelotas* approved the research project (CAAE no. 53255321.9.0000.5313; approval protocol no. 5125635).

A brief questionnaire was administered to those who agreed to participate. The three outcome variables were based on the following questions: (1) "Currently, do you smoke (commercial cigarettes)?"; (2) "Have you ever used electronic cigarettes to smoke or vape?"; (3) "Have you ever used hookah to smoke or vape?" For e-cigarettes and hookahs, we additionally asked about the frequency of use. We considered as current users those who answered "yes, daily" or "yes, but not daily."

Other variables collected for the analyses were sex (male/female); self-reported skin color (white, black, brown, and other); age, in completed years (18- to 24-year, 25- to 34-year, 35- to 59-year, and  $\geq 60$  year age groups); level of education, in completed years of schooling (0-8, 9-11, and  $\geq 12$  years); and country macroregion (Central-West, Northeast, North, Southeast, and South).

In the statistical analysis, we first described the prevalence of the three outcomes according to the

characteristics of the sample, presenting the point estimate and the corresponding 95% CI. For specific analysis, we calculated the prevalence of each outcome by sex and region. Finally, we made a Venn diagram to understand the co-occurrence of the three outcomes. All analyses were carried out using the sample weight calculated to represent the Brazilian population, considering the regions of residence, sex, years of schooling, and age brackets; the software Stata, version 14.0 (Stata Corp LP, College Station, TX, USA) was used for the statistical analyses.

## RESULTS

We evaluated 9,004 individuals, corresponding to an extrapolated 134 million Brazilians aged 18 years or older. Table 1 describes the characteristics of the sample regarding tobacco/nicotine consumption. The prevalence of current commercial cigarette smoking, lifetime history of e-cigarette use, and lifetime history of hookah use was, respectively, 12.2%, 7.3%, and 7.3%. The prevalence of all three was higher in men than in women.

Current commercial cigarette smoking was more prevalent among those in the 25-to 34-year age bracket, whereas a lifetime history of e-cigarette and hookah use was more common in younger adults (18-24 years). A history of e-cigarette and hookah use was lower among those with a lower level of education (0-8 years of schooling), whereas the prevalence of current commercial cigarette smoking was lower among those with a higher level of education.

Figure 1 displays current commercial cigarette smoking and lifetime history of e-cigarette and hookah use in men and women in Brazil and in the five macroregions of the country. Nearly 20% of males in the Central-West, Southeast, and South regions, as well as 14% of females in the South region, reported being current cigarette smokers. In both men and women, a history of e-cigarette (14.6% vs. 7.9%) and hookah use (17.4% vs. 10.2%) was highest in the Central-West region.

The categorized frequencies of e-cigarette and hookah use by macroregion and sex are shown in Figure 2. Regarding e-cigarettes, 1.4% of women in the Central-West region reported using them daily, as did 0.9% and 1.0% of men in the Central-West and North regions, respectively. Among men in the South region, 5.7% reported using e-cigarettes sporadically. In the Southeast region, 1.1% of men reported smoking hookah daily, whereas, in the South, 5.5% of men and 3.0% of women reported using it sporadically.

Figure 3 displays a Venn diagram of commercial cigarette, e-cigarette, and hookah use co-occurrence. One in every five individuals was a current smoker or had a lifetime history of e-cigarette or hookah use, accounting for more than 25 million adults in Brazil. Individuals who used all three products corresponded to 1.5% of the sample (nearly 2 million individuals). Among the almost 20 million individuals who had a

**Table 1.** Sample<sup>a</sup> characteristics and prevalence of commercial cigarette smoking and lifetime history of electronic cigarette and hookah use in the first trimester of 2022. The Covitel study, 2022.

Characteristic	Total (estimate)		Commercial cigarette		Electronic cigarette		Hookah		
	n	%	%	95% CI	%	95% CI	%	95% CI	
Sex									
Male	64,896,014	48.2	14.5	12.2-17.2	10.1	8.1-12.4	9.8	7.7-12.3	
Female	69,726,066	51.8	9.9	8.1-12.2	4.8	3.6-6.3	5.0	3.8-6.6	
Skin color									
White	52,096,874	38.7	10.8	9.0-13.1	7.4	5.8-9.4	7.0	5.8-8.4	
Black	17,800,606	13.2	16.4	12.2-21.6	9.3	5.5-15.1	9.3	5.5-15.2	
Brown	55,389,447	41.1	11.1	8.8-14.0	7.2	5.5-9.3	7.1	5.1-10.0	
Other	9,335,153	6.9	17.7	11.8-25.7	4.0	2.2-7.1	6.8	2.8-15.7	
Age in completed years									
18-24	21,117,143	15.7	12.1	8.4-17.1	19.7	15.1-25.2	17.0	12.2-23.2	
25-34	35,765,977	26.6	14.5	9.9-20.9	10.3	7.7-13.8	11.9	9.0-15.4	
35-59	52,159,635	38.7	12.0	9.9-14.4	3.0	2.4-3.8	3.3	2.6-4.1	
60 or more	25,579,326	19.0	9.2	7.1-11.9	1.6	1.0-2.6	1.3	0.8-2.1	
Level of education in completed years of formal education									
0-8	67,991,097	50.5	14.7	12.4-17.3	5.0	3.3-7.6	4.9	3.4-6.9	
9-11	39,731,189	29.5	11.6	9.0-14.7	10.5	8.4-13.1	10.4	8.0-13.4	
12 or more	26,899,807	20.0	6.5	5.4-7.8	8.4	7.1-9.9	9.0	7.5-10.9	
Country region									
Central-West	9,858,685	7.3	12.6	10.3-15.2	11.2	8.5-14.7	13.7	9.8-19.0	
Northeast	35,890,341	26.7	7.9	5.8-10.7	6.1	4.1-8.9	2.9	1.7-4.8	
North	9,926,494	7.4	8.0	6.1-10.4	6.4	4.9-8.3	4.8	3.9-6.0	
Southeast	58,951,426	43.8	14.3	12.0-16.8	6.6	4.6-9.3	8.0	6.1-10.3	
South	19,995,121	14.9	15.5	11.9-19.9	10.2	7.4-14.0	11.5	8.3-15.8	
Total	134,622,080		12.2	10.4-14.1	7.3	6.0-8.9	7.3	6.0-8.9	

<sup>a</sup>≥ 18 years of age.

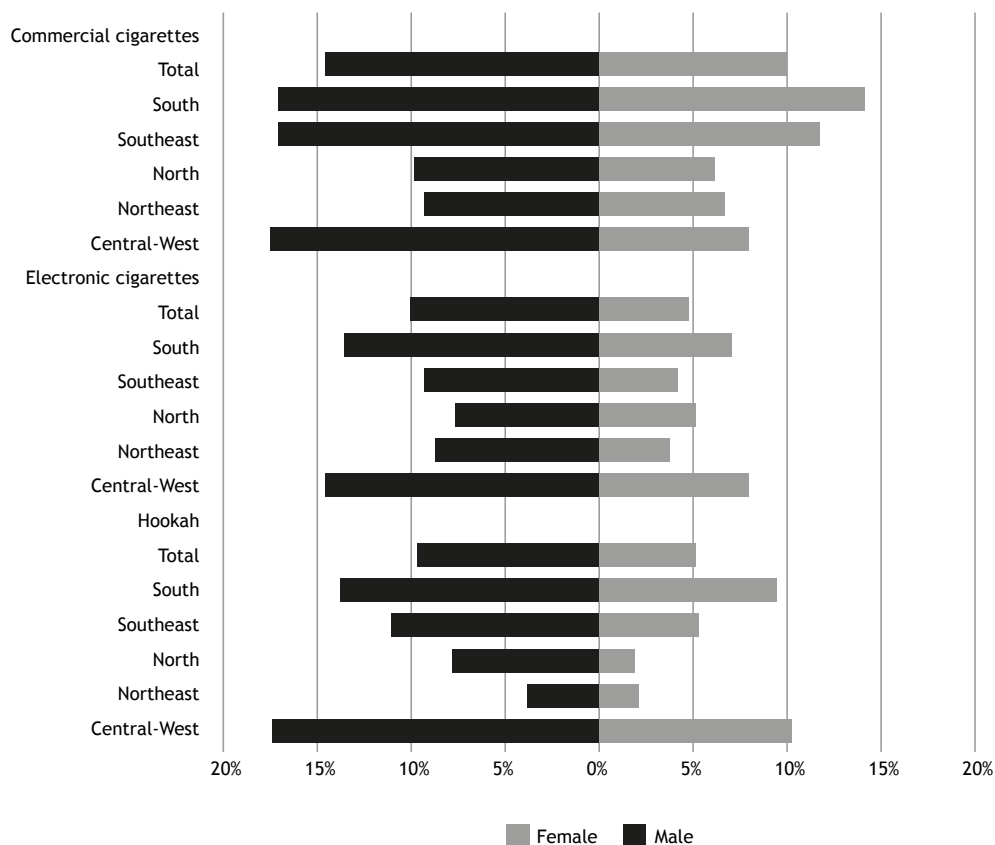
lifetime history of e-cigarette or hookah use, only one third exclusively used these products.

## DISCUSSION

The Covitel findings reinforce our concern about a possible increase in e-cigarette and hookah experimentation and daily use as a new path toward nicotine addiction. The literature has documented that these new forms of vaping/smoking have been used by teenagers mainly, since the industry created special devices targeting this age group (e-cigarettes look very fashionable, and hookah also has an appealing design and can be shared with friends). As per the Covitel results, we should also be concerned about young adults (18-24 years), who had the highest prevalence of e-cigarette/hookah experimentation among all adults. Nicotine is present in most of these devices, and approximately 2.5% of the participants stated being current, albeit not daily, users of e-cigarettes or hookah. It is possible that these young adults will gradually become addicted to nicotine and will increasingly need to consume it. In a study involving 14-year-old adolescents, those who had experimented with e-cigarettes had a two-fold greater likelihood of having heavy smoking patterns at a six-month follow-up.<sup>(18)</sup> In addition, the uncertainty around nicotine concentrations among the different types of e-cigarettes is concerning, because

they vary significantly and can even be higher than those in manufactured cigarettes.<sup>(19)</sup>

There have been few nationwide studies examining the use of e-cigarettes, hookah, or ENDS in adults in Brazil. The first representative survey to investigate the use of e-cigarettes and hookah (as well as commercial cigarette smoking) was the third Brazilian Household Survey on Substance Use (BHSU-3), which was conducted in 2015 and involved people between 12 and 65 years of age.<sup>(12,13)</sup> Prevalence was calculated by means of the question "have you used e-cigarettes within the last 12 months?"; the same wording was applied to hookah (narghile) and commercial cigarettes. The prevalence of e-cigarette, hookah, and commercial cigarette use was 0.4%, 1.7%, and 15.4%, respectively. Other nationally representative surveys involving adults were the *Pesquisa Nacional de Saúde* (PNS, National Health Survey), carried out in 2013 and 2019,<sup>(13,16)</sup> and the *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (VIGITEL, Telephone-based System for the Surveillance of Risk and Protective Factors for Chronic Diseases), carried out between 2006 and 2021.<sup>(17)</sup> ENDS were not investigated in the 2013 PNS (but hookah use was); in the 2019 PNS and throughout VIGITEL surveys, the outcome was ENDS, and prevalence was derived from the following question: "Have you used electronic devices with



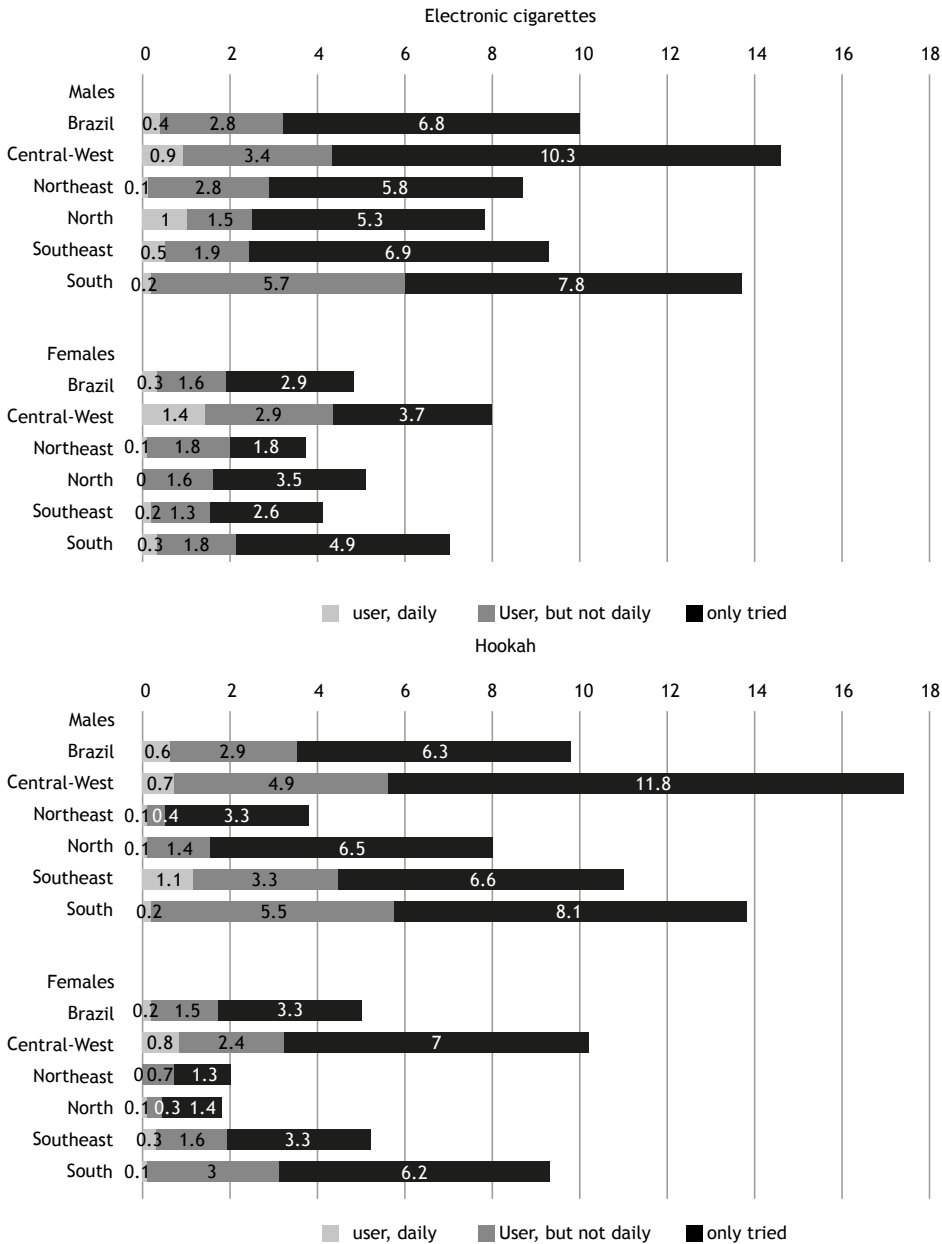
**Figure 1.** Prevalence of current commercial cigarette smoking and lifetime history of electronic cigarette and hookah use by sex, country macroregion, and whole country. The Covitel study, 2022.

liquid nicotine or chopped tobacco leaves (electronic cigarettes, electronic water pipes, heated cigarettes, or other electronic smoking devices) to smoke or vape?"; it should be highlighted that in the 2019 PNS and in the VIGITEL surveys "ENDS" encompassed both electronic and heat-not-burn tobacco devices, and respondents might have misunderstood that definition. Therefore, comparisons between the surveys should be cautious. The prevalence of a lifetime history of ENDS use was 1.6% in the population  $\geq 15$  years of age in the 2019 PNS, whereas it was 6.7% in the 2019 VIGITEL ( $\geq 18$  years of age)<sup>(13,17)</sup>; regarding current hookah use, the 2019 PNS asked about the number of sessions at any frequency (daily, weekly, or monthly), and the prevalence was 0.47%.<sup>(13)</sup>

Although both BHSU-3 and Covitel used yes/no questions regarding the use of e-cigarettes and hookah, the former included a time frame (within the last 12 months), and the latter asked about a lifetime history of their use, making it challenging to compare their point prevalence. Regarding how the questionnaires were administered, a face-to-face approach was used in the BHSU-3 and the PNS, whereas a telephone interview method was used in the VIGITEL and the Covitel. Another characteristic of the Covitel was that the questions were simple, which might have avoided misunderstanding, especially in the elderly population, who could find

it difficult to understand long questions. Also, the questionnaire had been piloted, and the respondents encountered no difficulties to answer the questions.

Another point worth highlighting is the representativeness of Covitel: the sample was designed to represent each of the five Brazilian macroregions and the entire country. Sampling procedures considered the number of registered landline and cell phones in each country region, and the telephone numbers were proportionally selected including all direct distance dialing codes in the respective region. In this sense, it is possible that a selection bias was introduced because most of the landline and cell phone numbers come from large cities and capitals. Although most of the regional populations are concentrated in these locations, a person having more than one cell phone line is common. Therefore, the prevalence of the outcome "experimenting with e-cigarettes and hookah" tends to be overestimated. However, to minimize this bias, we recalculated the sample weights using the projections for the Brazilian population based on the 2010 Brazilian demographic census, considering the expected proportions of sexes, levels of education, and ages. Although this procedure aimed to correct the point estimate of e-cigarette and hookah use at some time in life, we cannot completely rule out some degree of selection bias.

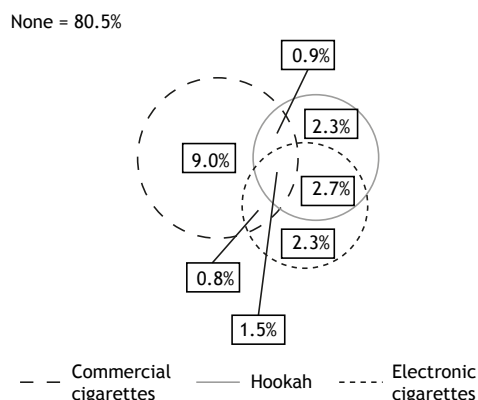


**Figure 2.** Frequency of electronic cigarette and hookah use by sex, country macroregion, and whole country. The Covitel study, 2022.

The abovementioned surveys and the international literature have shown that being a young adult with a high level of education or a high family income is associated with the use of ENDS, e-cigarettes, and hookah.<sup>(12,13,16,17)</sup> On the other hand, cigarette smokers tend to be older and have a lower level of education or lower family income. Covitel revealed that the prevalence of e-cigarette experimentation among young adults was nearly 20%, while that was 1.6% among those aged  $\geq 60$  years. The same occurred regarding hookah experimentation (17% vs. 1.3%).

Concerning the five Brazilian macroregions, the use of e-cigarettes and hookah was more common in the

Central-West region, followed by the South region. Similar results were found in other studies in the country: the prevalence of hookah experimentation was 3.4% in both regions according to the 2013 PNS, and that of ENDS experimentation in the Central-West region was, respectively, 2.8% and 11.59% in the 2019 PNS and in 2019 VIGITEL.<sup>(13,16)</sup> We believe that ENDS experimentation might be related to the smuggling of these devices, since it is forbidden to market, import, and advertise any of these products, in accordance with a Brazilian Health Regulatory Agency resolution issued in 2009.<sup>(20)</sup> Unfortunately, online sales do happen very easily, and these products can also be



Possible combination	Estimated population
None	108,307,774
Commercial cigarettes only	12,115,987
Electronic cigarettes only	3,096,308
Hookah only	3,096,308
Commercial and electronic cigarettes	1,076,977
Commercial cigarettes and hookah	1,211,599
Electronic cigarette and hookah	3,634,796
All three	2,019,331

**Figure 3.** Venn diagram of current commercial cigarette smoking and lifetime history of electronic cigarette and hookah use. The Covitel study, 2022.

found in several places where tobacco is sold in Brazil. However, because free Internet access is not available for everyone and these devices are rather expensive in Brazil, this might be the reason why their use is associated with higher levels of education and income. The highest frequency of daily e-cigarette use (1.4%) was found among women in the South region, which rates second in the consumption of tobacco products in the country. The overall prevalence of commercial cigarette smoking found in this study is in accordance with the decline observed in the last decade in Brazil: the prevalence is higher among males and adults (25-69 years of age), whereas other forms of smoking/vaping are more common in the younger age range.

Although comparisons among studies are difficult, it seems that experimenting with and currently using e-cigarettes and hookah are increasing in Brazil. All efforts should be made to allow for comparisons among international and, mainly, Brazilian studies, including the standardization of the wording used in the questions. According to the core questionnaire of the Global Adult Tobacco Survey,<sup>(21)</sup> questions about different categories of tobacco/nicotine products should be asked separately. For each category, there should be questions such as current use or a lifetime history of use, daily or weekly use, age at initiation and cessation, among others; however, the validity of a single-item question covering many products is unknown. Local specificities will demand adaptations; however, because of the size of the Global Adult Tobacco Survey,<sup>(21)</sup> this can be quite demanding, and only the main questions should be selected to allow us to compare the prevalence of each one of the major products. Continued surveillance in the digital environment, at borders, and at points of sale, as well as educational campaigns in the media,

mainly focusing on young people and adolescents, is essential to preventing smoking/vaping initiation and contributing to regulatory measures and public policies to catalyze a reduction in the use of e-cigarettes and hookah in the future.

Long-term studies in order to monitor the prevalence curve of these products and their harm to health are also fundamental to identify possible impacts on tobacco control policies.

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## AUTHOR CONTRIBUTIONS

AMBM, FCW, LMVS, PCBP, TAC, PAC, and PCH: conceptualization. LMVS, PCBP, and TAC: funding acquisition. AMBM, FCW, PAC, and PCH: formal analysis. AMBM, FCW, LMVS, PCBP, TAC, PAC, and PCH: methodology. LMVS, PCBP, and TAC: project administration. AMBM, FCW, and PCH: supervision. AMBM, FCW, PAC, and PCH: visualization. AMBM, FCW, PAC, and PCH: drafting the manuscript. AMBM, FCW, LMVS, PCBP, TAC, PAC, and PCH: reviewing and editing of the manuscript. All authors approved the final version of the manuscript.

## CONFLICTS OF INTEREST

None declared.

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