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Prevalence of electronic cigarette use among medical students in Colombia, 2023

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Abstract

Objective: To determine the prevalence and factors associated with the use of electronic cigarettes in medical students in four Colombian cities.
Methos: Descriptive study of prevalence in 594 medical students in the cities of Medellin, Santa Marta, Villavicencio and Pasto, selected with a non-probabilistic sampling. The prevalence of lifetime, daily or almost daily use of electronic cigarettes was determined.
Results: The mean age was 21.9 ± 4.1 years; 68.5 % were women; the prevalence of lifetime use of electronic cigarettes was 18.5 % (n = 100) and the prevalence of daily or almost daily use was 7.7 % (n = 46). Prevalence was significantly higher in men (adjusted OR = 3.1, 95 % CI = 1.6-5.8) and in those reporting household incomes less than minimum wage (adjusted OR = 4.3, 95 % CI = 1.5-11.9).
Conclusion: A high prevalence of electronic cigarette use was found, consistent with what has been described in other studies worldwide. This finding highlights the need to implement actions to promote awareness of the risks associated with the use of electronic cigarettes. Furthermore, as future health professionals and those responsible for prevention and public health, physicians in training have a crucial model role to play in promoting healthy practices and supporting policies that regulate the sale and consumption of these products.

----------*Keywords:* electronic cigarette, vapor electronic cigarette, medical students, smoking

Prevalencia de uso de cigarrillos electrónicos en estudiantes de Medicina en Colombia, 2023

Resumen

Objetivo: Determinar la prevalencia y los factores asociados al uso de cigarrillos electrónicos en estudiantes de Medicina de cuatro ciudades de Colombia.
Métodos: Estudio descriptivo de prevalencia en 594 estudiantes de Medicina de las ciudades de Medellín, Santa Marta, Villavicencio y Pasto, seleccionados con un muestreo no probabilístico. Se determinó la prevalencia de uso de cigarrillos electrónicos en la vida, y a diario o casi a diario.
Resultados: La edad promedio fue de 21,9 ± 4,1 años; el 68,5 **%** fueron mujeres; la prevalencia de uso de cigarrillos electrónicos en la vida fue del 18,5 **%** (*n* = 100) y la prevalencia de uso diario o casi a diario fue de 7,7 **%** (*n* = 46). La prevalencia fue significativamente más alta en los hombres (OR ajustado = 3,1; IC 95 **%** = 1,6-5,8) y en quienes refieren ingresos del hogar menores a un salario mínimo (OR ajustada = 4,3, IC 95 **%** = 1,5-11,9).
Conclusión: Se encontró una alta prevalencia de uso de cigarrillos electrónicos, coherente con lo descrito en otros estudios del ámbito mundial. Este hallazgo pone de manifiesto la necesidad de implementar acciones para promover la conciencia sobre los riesgos asociados con el uso de cigarrillos electrónicos. Además, como futuros profesionales de la salud y responsables de la prevención y la salud pública, los médicos en formación tienen un papel modélico crucial para fomentar prácticas saludables y respaldar políticas que regulen la venta y el consumo de estos productos

----------*Palabras clave:* cigarrillo electrónico, cigarrillo electrónico a vapor, estudiantes de Medicina, tabaquismo.

Prevalência do uso de cigarros eletrônicos entre estudantes de medicina na Colômbia, 2023

Resumo

Objetivo: Determinar a prevalência e os fatores associados ao uso de cigarros eletrônicos em estudantes de medicina em quatro cidades da Colômbia.
Métodos: Estudo descritivo da prevalência em 594 estudantes de medicina nas cidades de Medellín, Santa Marta, Villavicencio e Pasto, selecionados por amostragem não probabilística. Foi determinada a prevalência do uso vitalício, diário ou quase diário de cigarros eletrônicos.
Resultados: A idade média foi de 21,9 ± 4,1 anos; 68,5% eram mulheres; a prevalência do uso de cigarros eletrônicos durante toda a vida foi de 18,5% (n = 100) e a prevalência do uso diário ou quase diário foi de 7,7% (n = 46). A prevalência foi significativamente maior em homens (OR ajustado = 3,1, 95% CI = 1,6-5,8) e naqueles que relataram renda familiar abaixo de um salário mínimo (OR ajustado = 4,3, 95% CI = 1,5-11,9).
Conclusão: Foi encontrada uma alta prevalência de uso de cigarros eletrônicos, consistente com outros estudos em todo o mundo. Esse achado destaca a necessidade de implementar ações para promover a conscientização sobre os riscos associados ao uso de cigarros eletrônicos. Além disso, como futuros profissionais de saúde responsáveis pela prevenção e pela saúde pública, os médicos em formação têm um papel fundamental a desempenhar na promoção de práticas saudáveis e no apoio a políticas que regulamentem a venda e o consumo desses produtos.

---------*Palavras-chave:* cigarro eletrônico, cigarro eletrônico de vapor, estudantes de medicina, uso de tabaco, tabagismo

Introduction

The global smoking epidemic has reached pandemic proportions, with approximately 1.3 billion tobacco users and 6 million deaths annually. This epidemic also entails significant healthcare, social, and economic costs in high-, middle-, and low-income countries [1].

Smoking refers to the use of products that contain nicotine in any form. This includes conventional or electronic cigarettes, pipes, cigars, and even forms like chewing tobacco, snus, or snuff [2]. Electronic cigarettes (also known as "electronic nicotine delivery systems" —ENDS— or "electronic non-nicotine delivery systems" —ENNDS—) are electronic nicotine delivery systems. They are composed of a mouthpiece, an atomizer, a cartridge, and a battery. The atomizer heats the liquid to produce an aerosol, which usually contains nicotine, propylene glycol, vegetable glycerin, and various flavorings [3,4]. They were initially invented as a harmless means to quit smoking; however, the use of these cigarettes is associated with some harmful health consequences, including the addictive effects of nicotine consumption, the toxic substances and heavy metals that reach the user through the aerosol, and the risk of battery explosion [5].

Cherian et al. collected information from various studies demonstrating that the use of electronic cigarettes causes acute lung injury [6]; in the United States, more than 2,600 cases were reported by 2019, leading to the term "E-cigarette, or Vaping, product use Associated Lung Injury" (EVALI) [7]. Results from a study published in the New England Journal of Medicine (NEJM) in 2020 showed that among hospitalized patients with EVALI, chronic heart and lung diseases were common [8]. Additionally, research conducted in 2019 evaluated the potentially harmful effects of electronic cigarettes on the developing brain and concluded that both nicotine and non-nicotine components could play a role in social dysfunction, including learning and academic performance impairments, aggression, poor sleep quality, attention deficits, depression, and suicidal ideation [9].

Although the efficacy and safety of electronic cigarettes for smoking cessation is controversial [10], their use has drastically increased in recent years, especially among adolescents and young adults. As these devices continue to increase in popularity, their impact on public health has become a growing concern. Reports published in NEJM showed a 10% increase in e-cigarette use among American teenagers from 2017 to 2018, with a continued increase from 2018 to 2019 [11,12]. In Colombia, according to the results of the most recent "National Survey of Psychoactive Substance Use" (Encuesta Nacional de Consumo de Sustancias Psicoactivas, ENCSPA), conducted in 2019, 5% of the population aged 12 to 65 had used e-cigarettes in their lifetime, with the highest prevalence observed in the 18 to 24 age group [13]. These figures are similar to those found in the United States in 2018, where 8.1 million adults used e-cigarettes, and the 18 to 24 age group had the highest prevalence [14].

This has drawn the attention of researchers to the analysis of this issue among the university students. A study conducted in Colombia revealed that during the pandemic, the prevalence of ENDS use among students from higher education institutions in Bogotá was higher than the results reported in the 2019 ENCSPA. This study also highlighted that age between 18 and 26 years old is a risk factor for the use of these devices [15].

Understanding the prevalence and consumption habits of electronic cigarettes among medical students is of utmost importance in the context of public health. As future health professionals, these students will play a crucial role in promoting healthy lifestyles and preventing diseases. A study conducted at a Saudi university in 2017 found that 27.7% of Health Sciences students used electronic cigarettes, approximately double the number of students who smoked conventional cigarettes [16]. In the same country, another study conducted in 2020 found that the prevalence of vaping was 12.2% among medical students, with a strong association with gender, as men were three times more likely to vape than women [17]. In the United States, a study carried out in Minnesota in 2018 showed that 14.7% of medical students had ever used electronic cigarettes [18]. At the University of Jordan, 37.4% of health sciences students reported having used electronic cigarettes at least once in their lives, and 20% were current users of electronic cigarettes [19]. In Colombia, the results of a study conducted in Bogotá indicated that the prevalence of electronic cigarette use among medical students was 31.4%, a high rate compared with other countries [20]. However, it is important to highlight that significant research gaps still exist regarding ENDS/ENNDS consumption in this population in other cities across Colombia.

Given the increasing trend of electronic cigarette use among adolescents and young adults, specifically among university students, it is necessary to increase awareness and strengthen education about electronic cigarette use. More specifically, medical students represent an important target, as they will be future health professionals responsible for providing appropriate knowledge and promoting healthy habits among their patients, considering the role model effect of healthcare professionals in preventing the risk factors associated with the use of such substances [17,18].

In the Americas region, considerable progress has been made in controlling tobacco use through the Pan American Health Organization initiative. This trend is reflected in the decrease in the prevalence of tobacco

users, from 28% in 2000 to 16.3% in 2020, making it the second lowest rate globally. Despite these achievements, innovative and emerging nicotine, and tobacco products, such as e-cigarettes, are increasingly available and accessible in this region, posing a threat to tobacco control [21]. To date, 8 nations in the Americas have enacted bans on the sale of e-cigarettes; 13 have adopted partial or total regulatory measures on the sale, consumption, and advertising of e-cigarettes and smokeless tobacco products; and 14 countries have no regulatory framework in this regard [22].

Despite advances in understanding the risks associated with electronic cigarettes and efforts to regulate their use, there is a notable knowledge gap regarding the extent and characteristics of use among medical students in Colombia. Therefore, this study aimed to determine the prevalence and factors associated with electronic cigarette use among medical students in four Colombian cities.

Method

A descriptive prevalence study follows the guidelines of Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) for cross-sectional studies [23].

Study Subjects

This research was conducted with medical students from four cities where a private university is present, all over 18 years old and who voluntarily agreed to participate in the study.

Data were collected in the second semester of 2023 at the campuses in Medellín (N = 1100), Pasto (N = 950), Santa Marta (N = 950), and Villavicencio (N = 700).

The final sample size consisted of 594 students, distributed as follows: Medellín (n = 352), Pasto (n = 30), Santa Marta (n = 122), and Villavicencio (n = 90). The sample size could not be calculated, and no random selection of participants was made, as participation in the study was based on voluntary consent.

Data Collection Instrument

A self-administered survey was used, including questions about the city of residence, gender, age group, and training stage. The training stages were classified as basic for students in semesters 1 to 5, clinical for students in semesters 6 to 10, and professional for students in semesters 11 and 12.

In addition, questions were asked about household income, which was measured as minimum wages.

Finally, the questionnaire included questions about lifetime or regular use of electronic cigarettes; the latter category included those who reported using them daily or almost daily.

Data Collection

Four strategies were used to distribute the questionnaire to the students:

An invitation to participate in the study was sent via institutional email to medical students at the university's campuses in the four cities.

The invitation was extended to all students to ensure representation from all semesters.

The researchers requested time in some classes to personally invite students to participate and complete the questionnaire.

The questionnaire was also sent to professors in other faculties to invite their students to participate.

The questionnaire was self-administered and completed online.

Analysis Plan

The demographic characteristics of the participants were described by calculating absolute and relative frequencies. The overall prevalence of electronic cigarette use and the specific prevalence according to demographic characteristics were calculated using the chi-square test and crude odds ratios (OR). Finally, a binary logistic regression model was conducted to identify confounding variables and calculate adjusted ORs. In all analyses, p-values less than 0.05 were considered statistically significant.

The data were stored and analyzed using IBM® SPSS® Statistics for Windows, Version 29.0.2.0 Armonk, NY: IBM Corp., licensed to Universidad Cooperativa de Colombia.

Ethical Considerations

This study was approved by the Bioethics Subcommittee of the Universidad Cooperativa de Colombia, in accordance with the bioethical concept BIO528, as recorded in Act 10/2023 on October 26, 2023.

Since the questionnaire was virtual and self-administered, the platform where it was designed had two sections: 1) a section containing all the information related to informed consent, which could only be accessed through an institutional email, and 2) a section containing the questionnaire. The ability to access the questionnaire was a prerequisite for the acceptance of informed consent.

Results

A total of 594 medical students from the cities of Medellín, Santa Marta, Villavicencio, and Pasto were included. Of these, 68.5% were women, 43.4% were aged between 18 and 20 years, 50.2% were in the basic training stage, and 5.6% reported that their household income was below one minimum wage (see Table 1).

Table 1. Description of the demographic characteristics of medical students

Demographic Characteristics		n	%
City	Medellín	352	59.3
	Santa Marta	122	20.5
	Villavicencio	90	15.2
	Pasto	30	5.0
Gender	Female	407	68.5
	Male	187	31.5
Age Group	18 to 20 years	258	43.4
	21 to 23 years	215	36.2
	Over 23 years	121	20.4
Training Stage	Basic (semesters 1 to 5)	298	50.2
	Clinical (semesters 6 to 10)	256	43.1
	Professional (semesters 11 and 12)	40	6.7
Household Income	Less than one minimum wage	33	5.5
	Between 1 and 2 minimum wages	190	32.0
	Between 3 and 4 minimum wages	193	32.5
	More than 4 minimum wages	178	30.0

The lifetime prevalence of electronic cigarette use was 18.5% (n = 100), while the prevalence of regular use (daily or almost daily) of electronic cigarettes was 7.7% (n = 46).

Given that the regular use of electronic cigarettes poses a health risk, bivariate analysis was conducted using this variable. The analysis revealed that the prevalence is significantly higher among males (13.9%) and among those who reported that their household income is less than one minimum wage (24.1%) (see Table 2).

In the binary logistic regression model, the associations found in the bivariate analysis persisted in the multivariate analysis. After adjusting for other variables, the frequency of e-cigarette use among men is 3.1 times higher than that among women, and the frequency among those reporting household income below one minimum wage is 4.3 times higher than that among those reporting income above four minimum wages (see Table 3).

Table 2. Specific prevalence of regular (daily or almost daily) electronic cigarette use according to demographic characteristics

Demographic Characteristic		No		Yes		Crude OR	p-value
		n	%	n	%		Chi-square
City	Medellín	331	94.0	21	6.0	1	0.214
	Santa Marta	109	89.3	13	10.7	1.9 (0.9-3.9)	
	Villavicencio	80	88.9	10	11.1	2.0 (0.9-4.3)	
	Pasto	28	93.3	2	6.7	1.1 (0.2-5.1)	
Gender	Female	387	95.1	20	4.9	1	< 0.001*
	Male	161	86.1	26	13.9	3.1 (1.7-5.7)	
Age Group	18 to 20 years	237	91.9	21	8.1	1	0.663
	21 to 23 years	201	93.5	14	6.5	0.8 (0.4-1.6)	
	Over 23 years	110	90.9	11	9.1	1.1 (0.5-2.4)	
Training Stage	Basic (semesters 1 to 5)	274	91.9	24	8.1	1.7 (0.4-7.3)	0.793

Demographic Characteristic		No		Yes		Crude OR	p-value
		n	%	n	%		Chi-square
	Clinical (semesters 6 to 10)	236	92.2	20	7.8	1.6 (0.4-7.2)	
	Professional (semesters 11 and 12)	38	95.0	2	5.0	1	
Household Income	Less than one minimum wage	25	75.8	8	24.2	4.1 (1.5-10.8)	0.003*
	Between 1 and 2 minimum wages	180	94.7	10	5.3	0.7 (0.3-1.6)	
	Between 3 and 4 minimum wages	178	92.2	15	7.8	1.1 (0.5-2.3)	
	More than 4 minimum wages	165	92.7	13	7.3	1	

* Statistically significant difference.

Table 3. Logistic regression model of the prevalence of electronic cigarette use

Demographic Characteristic		Wald	Adjusted OR (95% CI)	p-value
City	Medellín	Ref.	1	
	Santa Marta	1.568	1.7 (0.7-4.2)	0.211
	Villavicencio	2.362	1.9 (0.8-4.5)	0.124
	Pasto	0.008	0.9 (0.2-4.4)	0.927
Gender	Female	Ref.	1	
	Male	11.617	3.1 (1.6-5.8)	< 0.001*
Age Group	18 to 20 years	Ref.	1	
	21 to 23 years	0.502	0.7 (0.4-1.7)	0.479
	Over 23 years	0.019	1.1 (0.4-2.7)	0.890
Training Stage	Basic (semesters 1 to 5)	0.010	1.1 (0.2-5.8)	0.919
	Clinical (semesters 6 to 10)	0.001	1.0 (0.2-5.5)	0.970
	Professional (semesters 11 and 12)	Ref.	1	
Household Income	Less than one minimum wage	7.575	4.3 (1.5-11.9)	0.006*
	Between 1 and 2 minimum wages	0.558	0.7 (0.3-1.7)	0.455
	Between 3 and 4 minimum wages	0.270	1.2 (0.6-2.7)	0.603
	More than 4 minimum wages	Ref.	1	

Ref.: Reference variable.

Discussion and Conclusions

The prevalence of electronic cigarette use among university students, especially those in the fields of medicine and health sciences, has been investigated in various contexts and regions around the world. In our study, which included 594 medical students from four Colombian cities, 18.5% of participants had used electronic cigarettes at some point in their lives.

When comparing our figures with other studies, we observed significant variability in the reported prevalence; for example, studies conducted with medical students in countries such as Brazil [24] and Poland [25] reported markedly different rates of 61.8% and 3.5%, respectively. These differences in the prevalence of electronic cigarette use may be attributed to cultural differences, government regulations, and product accessibility, but they highlight a concerning global trend toward the use of electronic cigarettes in academic settings.

Table 4 presents the prevalence figures for electronic cigarette use at some point in life, currently and daily, as reported in other studies conducted in various countries, where these differences are apparent.

Table 4. The prevalence of electronic cigarette use among health sciences students reported in other studies

Population[a]	Country	Sample size	Sampling method	Lifetime use prevalence (%)	Current use prevalence (%)	Daily Use Prevalence (%)	Study
Health Sciences Students	Saudi Arabia[b]	1007	Non-probabilistic	N. A.	27.7	4.1	[16]
Medical Students	Saudi Arabia[b]	401	Non-probabilistic	12.2	7.2	N. A.	[17]
Medical Students	United States[c]	658	Non-probabilistic	14.7	7.6	N. A.	[18]
Health Sciences Students	Jordan[c]	679	Non-probabilistic	37.4	20	N. A.	[19]
Medical Students	Poland[c]	1318	Non-probabilistic	3.5	N. A.	N. A.	[25]
University Students	Saudi Arabia[b]	775	Probabilistic	21	8.6	N. A.	[27]
Medical Students	Saudi Arabia[b]	910	Non-probabilistic	28.2	8.8	5.9	[27]
Medical Students	Brazil[b]	316	Non-probabilistic	61.8	20.1	N. A.	[24]
University Students	Palestine[b]	548	Non-probabilistic	18.4	13.3	13.3	[28]
Public Health Students	Thailand[b]	2302	Probabilistic	20.8	3.9	Less than 1%	[29]
Health Sciences Students	United States[c]	853	Non-probabilistic	24.2	20.6	N. A.	[30]
Medical Students	Pakistan[d]	500	Non-probabilistic	N. A.	6.2	N. A.	[31]
Medical Students	Saudi Arabia[b]	399	Probabilistic	36.6	11.5	11	[32]
Medical Students	Pakistan[d]	500	Probabilistic	N. A.	6.2	1.2	[33]
Medical Students	Chile[d]	354	Non-probabilistic	32.9	1.1	N. A.	[34]
Medical Students	Paraguay[c]	506	Non-probabilistic	N. A.	43.3	26.9	[35]
Medical Students	Colombia[c]	51	Non-probabilistic	31.4	N. A.	N. A.	[20]

a. Some studies include only medical students, while others encompass students from Medicine, Nursing, Dentistry, and other fields, grouped under the term "Health Sciences."

b. Countries where sales are prohibited.

c. Countries with partial prohibition or some regulation.

d. Countries with no regulation [36].

N. A.: Data not available

In this study, 7.7% of medical students reported using electronic cigarettes daily or almost daily. This finding is similar to analyses conducted in Saudi Arabia, which show daily use frequencies ranging from 4.1% to 11% [16,27,32]. However, the value found in this study is lower than the 26.9% reported in a study conducted in Paraguay [35]. Frequent use of electronic cigarettes is a concern because it has been independently associated with higher odds of experiencing a myocardial infarction (OR = 1.79) [37].

Some researchers have described curiosity and the desire to experience different flavors as reasons for using electronic cigarettes. The variety of flavored liquids can be appealing to young people [27,28,34]; however, this represents an additional concern, as the risk of pulmonary or cardiovascular disease depends not only on the frequency of use but also on the variety of substances consumed [8,37].

Regarding factors associated with electronic cigarette use, our analyses revealed a significant association between frequent use and male sex. This finding is consistent with other research indicating that men have a significantly higher prevalence of electronic cigarette use [17,29,38], including a study conducted in Colombia with university students [15].

Our study also highlights the influence of socioeconomic factors, particularly low income. Although research on the association between economic income and electronic cigarette use is limited, a recent study also reported that low income was associated with a higher likelihood of electronic cigarette use among adolescents [39]. However, other analyses in this same population that examined the associations between economic income and electronic cigarette use found no such association [40,41]. In adults, preliminary evidence suggests that higher income is associated with electronic cigarette use [42]. In this regard, the evidence is controversial; thus, further research is needed to elucidate the relationship between economic determinants and the use of these devices.

Previous studies have found that electronic cigarette use is higher among medical students than among students in other fields [26,43]. Among these students' perceptions about electronic cigarette use, a notable belief is that healthcare professionals do not need to serve as non-smoking role models for their patients and the public [29]. In fact, Alzahrani et al.'s research indicates that 35.9% of medical students agreed or strongly agreed that electronic cigarettes are better for patients than tobacco products, and 17.5% would likely recommend electronic smoking to their patients as a way to quit smoking [32]. Although our study does not investigate this, understanding the motivations for cigarette use among university students, particularly medical students, is essential for developing prevention strategies targeted at this population.

Previous analyses have also observed that a common motivation for using electronic cigarettes among university students is the intention to quit smoking traditional cigarettes. This motivation is linked to the availability of electronic cigarettes with different nicotine concentrations [16,25-27,32,34,35,43]. Although quitting smoking is a frequent motivation, studies have shown that most people who use electronic cigarettes become dual users rather than quitting smoking [31]. Additionally, it has been observed that electronic cigarette use often leads to future traditional cigarette consumption among young people [44,45].

On the other hand, the belief that electronic cigarettes are less harmful than traditional cigarettes are a recurrent motivation [25,27,28,32,34,35]. Some studies suggest that a lack of knowledge about the composition of electronic cigarettes and the actual risks associated with their use may contribute to their adoption [26,27,35,43]. However, the evidence supporting the notion that vaping is a less harmful or alternative substitute to conventional smoking is controversial [46].

Furthermore, it has been reported that the consumption of electronic cigarettes can be influenced by information from manufacturing companies. In surveys conducted among racial or ethnic minority groups or those with low income or education levels, it was found that these individuals trusted electronic cigarette companies as much as or more than healthcare professionals [47]. This suggests that underserved populations require targeted educational strategies to counteract misleading messages from electronic cigarette manufacturers and even from healthcare professionals who may not fully recognize the harm these products can cause to human health.

In Colombia, between January 2020 and July 2022, 245 cases of vape-related illnesses and 59 deaths were reported [48]. Currently, there are no regulations governing the commercialization and sale of electronic cigarettes in the country. However, 8 countries in the Americas have already banned the use and sale of these devices due to their addictive and harmful health effects, as well as aggressive marketing by tobacco companies [22]. Recently, a bill was approved in Colombia to establish differentiated regulations for vaping, including a ban on sales to minors, restrictions on the use of these cigarettes in enclosed and public spaces, and the inclusion of graphic health warnings on electronic cigarette packaging and ENDS/ENNDS [49].

Regarding the use of these devices as aids for quitting conventional cigarettes, it has been noted that while electronic cigarettes might facilitate the cessation process, there is no evidence of a decrease in physical

nicotine dependence, and there is an increased risk of simultaneous use of both electronic and conventional cigarettes. Various scientific societies, such as the American Thoracic Society, the Latin American Thoracic Association, and the Spanish Society of Pneumology and Thoracic Surgery, do not recommend the use of electronic cigarettes for smoking cessation due to insufficient evidence [50]. In Colombia, scientific societies support this stance, and the Clinical Practice Guidelines for Tobacco Cessation strongly recommend against the use of electronic systems, with or without nicotine, for patients who wish to quit smoking [51].

Additionally, it is important to highlight that electronic cigarettes have not been approved as a therapy for smoking cessation by either the U.S. Food and Drug Administration or the National Institute for Food and Drug Surveillance in Colombia.

The recommendation is to provide tobacco users, including those using electronic cigarettes, with evidence-based interventions such as counseling and approved pharmacological therapy for tobacco dependence. Additionally, it is recommended that the implementation of the National Tobacco Cessation Program be strengthened in various settings, including educational environments.

Among the limitations of this study is that the sampling method was non-probabilistic; therefore, the results cannot be generalized to all cities or the country. Additionally, it is important to note that the information was collected through self-reporting. Although privacy was ensured and honesty was encouraged, the results may have underestimated the actual frequency. Furthermore, there are inherent limitations of the cross-sectional design; thus the associations are exploratory in nature. This study did not include variables related to the characteristics of the liquids or flavors consumed by young people in electronic cigarettes or their use of tobacco or alcohol; it is important for future research to address this issue. Despite these limitations, this study with 594 medical students is the largest conducted in this population in Colombia.

This research on electronic cigarette use among medical students is the largest conducted nationwide. The results show that consumption prevalence is significantly higher than the national average, highlighting the need for targeted interventions for this group to demonstrate the harmful health effects. Similarly, this underscores the necessity for regulatory measures on the use and marketing of these products, as tobacco companies' aggressive marketing campaigns increasingly attract young people.

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Conflict of interest statement

The authors declare that they have no conflicts of interest.

Responsibility Statement

The results presented in the article are the responsibility of the authors and do not reflect the position of the institutions involved.

Author contributions statement

All authors contributed to the study design, data analysis and interpretation, and the writing and final review of the manuscript. Santiago Rendon-Marin and Diana Maryory Gómez contributed to data collection, and Luis Felipe Higuita contributed to data processing.

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