Cureus
Part of SPRINGER NATURE

Open Access Original Article

Electronic Cigarette Use Among Brazilian Medical Students: A Cross-Sectional Study

Caio B. Prando [1], Victor M. Bianchini [2], Marcos S. Meireles [3]

1. General Medicine, Escola Superior de Ciências da Santa Casa de Misericórdia de Vitória, Vitória, BRA 2. Medicine, Escola Superior de Ciências da Santa Casa de Misericórdia de Vitória, Vitória, BRA 3. Psychiatry, Escola Superior de Ciências da Santa Casa de Misericórdia de Vitória, Vitória, BRA

Corresponding author: Caio B. Prando, caiobprando@gmail.com

Review began 11/05/2026
Review ended 11/09/2026
Published 11/13/2026

© Copyright 2026
Prando et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI: 10.7759/cureus.119599

Abstract

Introduction

Electronic cigarette use has increased among young adults despite regulatory restrictions and concerns about its health effects. Understanding the prevalence and patterns of use among medical students is essential to support prevention strategies. The objective of the study was to estimate the lifetime prevalence, characterize patterns of use, and identify factors associated with electronic cigarette use among medical students.

Method

This cross-sectional study included 496 medical students. Data were collected through an electronic questionnaire comprising sociodemographic characteristics, mental health indicators, knowledge of the risks associated with electronic cigarettes, patterns of use, and smoking cessation perspective. Associations between categorical variables were assessed using Pearson's chi-square or Fisher's exact test, with a significance level of 5%.

Results

The lifetime prevalence of electronic cigarette use among medical students was 28.8% (143/496), and the prevalence of current regular use was 4.4% (22/496). Among users, occasional use was the most common pattern (107/143; 74.8%). Use occurred predominantly in social settings, particularly at parties and social events (132/143; 92.3%) and gatherings with friends (75/143; 52.4%). Additionally, 87 users (60.8%) reported increased consumption during periods of greater academic workload. Electronic cigarette use was significantly associated with male sex, exposure to tobacco use within the family, and stage of medical training, although no linear trend was observed across training stages. Among users, 105 (73.4%) had attempted to quit, and 119 (83.2%) expressed an interest in cessation.

Conclusion

Electronic cigarette use was highly prevalent among medical students. In bivariate analyses, use was associated with sociodemographic and academic factors, and patterns of use were related to social settings and periods of greater academic workload. These exploratory findings, unadjusted for potential confounders and obtained from a convenience sample at a single institution, suggest the importance of institutional strategies aimed at preventing electronic cigarette use, promoting stress management, and supporting smoking cessation.

Categories: Substance Use and Addiction, Preventive Medicine, Epidemiology/Public Health
Keywords: electronic nicotine delivery systems, medical school students, nicotine addiction, prevalence rate, tobacco use disorder

Introduction

Electronic cigarettes (e-cigarettes), also known as vapes, are battery-powered devices that heat a liquid containing nicotine, flavorings, and other chemicals to produce an inhalable aerosol. Since their introduction in 2003, these products have gained widespread popularity, particularly among adolescents and young adults, driven by the availability of flavored products and the misconception that they are less harmful than conventional cigarettes [1-3].

The increasing use of e-cigarettes has become a public health concern worldwide. In the United States, approximately 2.13 million middle and high school students reported current e-cigarette use in 2023 [4]. In Brazil, despite the prohibition of their sale by the Brazilian Health Regulatory Agency (ANVISA), an estimated 2.4 million people have experimented with these products, with the highest prevalence observed among individuals aged 18-24 years [5].

Nicotine exposure during adolescence and early adulthood has been associated with impaired brain development, addiction, anxiety, depression, and cognitive deficits. In addition, excessive nicotine consumption may cause acute toxicity and increase the risk of long-term cardiovascular and respiratory diseases [1,2]. Furthermore, symptoms of anxiety and depression have been associated with subsequent e-cigarette use among young people [6].

Despite the increasing popularity of e-cigarettes and the growing body of evidence regarding their health effects, data on the prevalence, patterns of use, and factors associated with e-cigarette use among Brazilian medical students remain limited. Medical students represent a particularly relevant population, as they will be responsible for counseling patients on smoking prevention and cessation, and their own attitudes and behaviors toward nicotine products may influence their clinical practice and their credibility as role models. In addition, they receive formal education on the harms of tobacco, which allows examination of whether knowledge alone is sufficient to prevent use, and they face a demanding academic routine that may increase their vulnerability to these products. Addressing this knowledge gap may contribute to the development of targeted prevention and health promotion strategies for this population.

Materials And Methods

This cross-sectional study was conducted among undergraduate medical students enrolled from the first to the twelfth semester at a medical school in southeastern Brazil. Data were collected between July and September 2025 using a researcher-developed electronic questionnaire after participants provided electronic informed consent. The questionnaire was developed based on a review of the relevant literature and included questions on sociodemographic characteristics, self-reported mental health indicators, exposure to tobacco-related content during medical training, electronic cigarette use, patterns of use, and smoking cessation perspectives. The questionnaire did not undergo pilot testing, expert review, or formal validation before administration, and its reliability was not assessed, although it was reviewed and approved by the Research Ethics Committee as part of the study protocol. All items were mandatory in the electronic form, and duplicate responses were prevented; therefore, there were no missing data. In multiple-choice items, unselected options were coded as "no". The full questionnaire is available in Appendix 1.

Among approximately 800 eligible students, 496 participated in the study (response rate: 62%). The minimum required sample size was estimated at 264 participants, assuming a 95% confidence level, a 5% margin of error, and an expected prevalence of 50%. A non-probability convenience sampling strategy was adopted. Students aged ⩾18 years who were regularly enrolled were eligible for inclusion, whereas those with suspended enrollment or on academic leave were excluded.

The study aimed to estimate the lifetime prevalence of electronic cigarette use, characterize patterns of use, and identify factors associated with electronic cigarette use among medical students. For the association analyses, electronic cigarette use was considered the dependent variable. Independent variables included sociodemographic, academic, behavioral, and self-reported mental health characteristics collected from all participants. Variables related to electronic cigarette use, including the setting of first use, reasons for use, increased consumption during periods of greater academic workload, concomitant alcohol use, and cessation-related perspectives, were collected only among users and were analyzed descriptively. Knowledge of the health risks associated with electronic cigarettes was described for the entire sample.

Electronic cigarette use was assessed with a single question with four response options: never used, occasional use ("Yes, but my use is not considered regular"), former regular use, and current regular use. Lifetime use, which defined prevalence, comprised any of the last three categories. Among lifetime users, frequency of use was assessed with a separate question; use at least once a week over the past four weeks was classified as regular, and less frequent use as occasional. This classification was used to describe patterns of use, whereas the four-category variable was used in the association analyses. Because the frequency question did not distinguish current from former occasional use, the prevalence of current occasional use could not be estimated.

Categorical variables were summarized as frequencies and percentages. Associations were assessed using Pearson's chi-square test or Fisher's exact test, as appropriate. In the bivariate analyses, the dependent variable was electronic cigarette use with its four categories; therefore, the degrees of freedom correspond to (number of categories of the independent variable −1) × 3. Sex, financial difficulties, regular physical activity, physician-diagnosed mental disorder, and household tobacco exposure were analyzed as dichotomous variables (df=3). Stage of medical training and living arrangement were analyzed with three categories (df=6); for living arrangement, the categories "with friends" and "alone" were combined only for presentation of results. Age was analyzed using the four response options of the questionnaire (df=9). Most questionnaire items were single questions on objective characteristics or behaviors rather than multi-item scales; therefore, measures of internal consistency were not applicable. When Pearson's chi-square test was significant in contingency tables larger than 2×2, adjusted residual analysis was performed to identify the categories contributing to the observed associations. Statistical significance was set at $p<0.05$. All analyses were performed using IBM SPSS Statistics for Windows, version 29.0 (Armonk, USA).

The study was approved by the Research Ethics Committee (approval no. 7.461.352) and conducted in

accordance with Brazilian National Health Council Resolution no. 510/2016. Participant anonymity and data confidentiality were ensured throughout the study.

Results

A total of 496 undergraduate medical students participated in the study. The sample was predominantly female (295/496; 59.5%), aged 20-23 years (282/496; 56.9%), and enrolled in the preclinical stage of medical training (197/496; 39.7%). Most participants lived with their families (318/496; 64.1%) and reported no financial difficulties (453/496; 91.3%), while 420 (84.7%) reported engaging in regular physical activity. Regarding mental health, 153 participants (30.8%) reported receiving care from a mental health specialist, and 142 (28.6%) reported having a physician-diagnosed mental disorder. The most frequently reported disorders were anxiety (113/496; 22.8%), attention-deficit/hyperactivity disorder (39/496; 7.9%), and depression (34/496; 6.9%). Exposure to tobacco use within the household was reported by 188 participants (37.9%). Nearly all students recognized that electronic cigarettes contain nicotine and are harmful to health (493/496; 99.4%). Most participants also reported having received information during medical school about the health risks associated with nicotine use (431/496; 86.9%) and smoking (435/496; 87.7%; Table *1*).

Characteristic	n	%
Sex		
Female	295	59.5
Male	201	40.5
Age group (years)		
18–19	110	22.2
20–23	282	56.9
≥24	104	20.8
Stage of medical training		
Preclinical	197	39.7
Clinical	169	34
Internship	130	26.3
Living arrangement		
With family	318	64.1
Alone or with friends	178	35.9
Financial difficulties		
No	453	91.3
Yes	43	8.7
Regular physical activity		
Yes	420	84.7
No	76	15.3
Receiving mental health care		
Yes	153	30.8
No	343	69.2
Physician-diagnosed mental disorder		
Yes	142	28.6
No	354	71.4
Anxiety	113	22.8
Attention-deficit/hyperactivity disorder	39	7.9

Depression	34	6.9
Exposure to tobacco use within the household		
Yes	188	37.9
No	308	62.1
Knowledge about electronic cigarettes		
Recognized health risks	493	99.4
Recognized nicotine content	493	99.4
Received information about nicotine risks during medical school	431	86.9
Received information about smoking risks during medical school	435	87.7

TABLE 1: Sociodemographic, behavioral, and mental health characteristics of the study participants (n=496)

Percentages may not total 100% due to rounding. Participants could report more than one mental disorder.

The lifetime prevalence of electronic cigarette use was 28.8% (143/496), and 22 participants (4.4%) reported current regular use. Among lifetime users, occasional use was the predominant pattern (107/143; 74.8%). Most users did not own an electronic cigarette (110/143; 76.9%) and reported using devices borrowed from or shared with friends. Initiation occurred predominantly in social settings, particularly at parties and social events (132/143; 92.3%), and was frequently associated with gatherings with friends (75/143; 52.4%). Among users, 87 (60.8%) reported increased use during periods of greater academic workload, particularly at the end of the semester (61/143; 42.7%) and before examinations (46/143; 32.2%). Alcohol consumption was reported by 136 users (95.1%); overall, 114 users (79.7%) reported concurrent alcohol and electronic cigarette use, while 123 (86.0%) reported an increased desire to use electronic cigarettes after alcohol consumption. Additionally, 105 users (73.4%) had attempted to quit at least once, and 119 (83.2%) expressed a current interest in quitting (Table *2*).

Variable	n	%
Pattern of use		
Occasional use	107	74.8
Regular use	36	25.2
Owns an electronic cigarette		
Yes	33	23.1
No	110	76.9
First use occurred at parties or social events		
Yes	132	92.3
No	11	7.7
First use associated with gatherings with friends		
Yes	75	52.4
No	68	47.6
Reported increased use during periods of greater academic workload		
Yes	87	60.8
No	56	39.2
End of semester	61	42.7
Before examinations	46	32.2
Alcohol consumption		
Yes	136	95.1
No	7	4.9
Concurrent alcohol and electronic cigarette use	114	79.7
Increased desire to use electronic cigarettes after alcohol consumption	123	86
Smoking cessation behavior		
At least one quit attempt	105	73.4
Interested in quitting	119	83.2

TABLE 2: Patterns of electronic cigarette use among users (n=143)

Percentages for some variables may exceed 100% because participants could select more than one response. All percentages were calculated using lifetime users (n=143) as the denominator.

Regular use was defined as use at least once a week over the past four weeks; less frequent use was classified as occasional.

Electronic cigarette use was significantly associated with male sex ($\chi^2(3)=15.263$, $p=0.002$), exposure to tobacco use within the household ($\chi^2(3)=36.631$, $p<0.001$), and stage of medical training ($\chi^2(6)=16.469$, $p=0.011$). No statistically significant associations were found with age group ($\chi^2(9)=16.323$, $p=0.060$), living arrangement ($\chi^2(6)=4.479$, $p=0.612$), financial difficulties ($\chi^2(3)=2.485$, $p=0.478$), regular physical activity ($\chi^2(3)=3.662$, $p=0.300$), or physician-diagnosed mental disorders ($\chi^2(3)=6.920$, $p=0.075$). No significant association was also observed with mental health care follow-up (Table 3).

Variable	χ^2	df	p-value
Sex	15.263	3	0.002
Age group	16.323	9	0.060
Living arrangement	4.479	6	0.612
Financial difficulties	2.485	3	0.478
Regular physical activity	3.662	3	0.300
Physician-diagnosed mental disorder	6.920	3	0.075
Receiving mental health care	6.135	3	0.105
Stage of medical training	16.469	6	0.011
Exposure to tobacco use within the household	36.631	3	<0.001

TABLE 3: Bivariate analysis of factors associated with electronic cigarette use among medical students (n=496)

χ^2 - Pearson's chi-square statistic; df - degrees of freedom

The adjusted residual analysis showed that this association was primarily characterized by a higher frequency of current regular use in the preclinical stage (adjusted residual of 3.6). In contrast, the internship stage showed a higher frequency of students who had never used electronic smoking devices (adjusted residual of 2.0) and a lower frequency of current regular use (adjusted residual of −2.8). Despite this association, no clear linear trend across the stages of medical training could be established (Table 4).

Medical training stage	Never used	Regular use	Occasional use
Preclinical stage	−1.4	3.6*	0.1
Clinical stage	−0.3	−1.1	0.9
Internship	2.0*	−2.8*	−1.1

TABLE 4: Adjusted residuals for the association between medical training stage and electronic smoking device use patterns among medical students

An asterisk (*) indicates a statistically significant adjusted residual (absolute value ≥ 1.96). Positive residuals indicate a higher frequency than expected, whereas negative residuals indicate a lower frequency than expected.

Categories refer to self-reported use: regular use corresponds to current regular use, and occasional use to non-regular use. Former regular use (n=23) showed no significant adjusted residuals and is not shown.

Discussion

This study identified a high prevalence of electronic cigarette use among medical students, consistent with previous studies conducted among Brazilian university students [7]. In addition, electronic cigarette use was more frequent among male students, corroborating findings reported in both national and international studies [7-9]. This association may reflect men's greater propensity to engage in risk-taking behaviors and experiment with psychoactive substances, as well as sociocultural factors that have historically contributed to greater social acceptance of nicotine use among males. Furthermore, the tobacco industry has traditionally targeted men through advertising strategies, and men may be more likely to perceive electronic cigarettes as an alternative to conventional smoking or a smoking cessation aid [8,9].

Another important finding was the significant association between exposure to tobacco use within the household and electronic cigarette use. Previous studies have shown that parental smoking during childhood increases the likelihood of tobacco use in adolescence and adulthood and is associated with greater persistence of smoking behaviors [10]. This relationship may be explained by behavioral modeling, whereby repeated exposure to smoking normalizes nicotine use and reduces the perceived risks associated

with tobacco products. In addition, exposure to secondhand smoke has been identified as an independent risk factor for smoking susceptibility, with adolescents exposed to tobacco smoke being more likely to initiate tobacco use [11]. These mechanisms may also contribute to the uptake of electronic cigarettes among young adults.

A significant association was also observed between electronic cigarette use and stage of medical training. Although no clear linear trend was identified across the different stages of the curriculum, adjusted residual analysis showed that this association was primarily driven by a higher-than-expected frequency of current regular users among students in the preclinical stage and a higher-than-expected frequency of never-users among students in the internship. The absence of significant differences among clinical-stage students indicates a heterogeneous pattern, and these findings should not be interpreted as a progressive decline or increase in use over the course. Because of the cross-sectional design, they reflect comparisons between different groups of students at a single point in time, rather than changes in individual behavior. Greater clinical exposure to tobacco-related diseases among interns is a possible hypothesis, but it was not evaluated in this study. The differences may also reflect characteristics of specific class cohorts, since current regular use was concentrated in the second and third semesters (14/22). Longitudinal studies following the same students throughout medical training are needed to distinguish between these explanations.

A high level of awareness regarding the health risks of electronic cigarettes was also observed among the participants. While a previous study conducted among Saudi university students reported that more than 90% had heard of electronic cigarettes, only approximately 70% considered them harmful to health [12], nearly all medical students in the present study recognized both the harmful effects of electronic cigarettes and their nicotine content. This finding may be explained by the greater exposure of medical students to health promotion, disease prevention, and tobacco-related education during undergraduate training. Nevertheless, comparisons between studies should be interpreted cautiously because of differences in study populations and sociocultural contexts, which may influence knowledge and perceptions regarding electronic cigarette use.

Despite the high level of awareness regarding the health risks of electronic cigarettes, nearly one-third of the medical students reported having used these devices. This finding suggests that knowledge alone may not be sufficient to modify behaviors related to electronic cigarette use. The apparent disconnect between awareness and behavior may reflect the influence of social, behavioral, and environmental factors that extend beyond health education. These findings reinforce the need for comprehensive prevention strategies that combine educational interventions with approaches targeting the broader determinants of electronic cigarette use among young adults.

Previous studies have consistently identified curiosity, peer influence, social acceptance, and stress relief as the main factors motivating experimentation with electronic cigarettes, although cultural and population differences may influence their relative importance [7,13,14]. In the present study, peer influence was the most frequently reported motivation, followed by the need for social acceptance and stress relief. In addition, electronic cigarette use occurred predominantly in social settings, such as parties, concerts, and gatherings with friends, and was characterized mainly by occasional use and shared devices rather than ownership. Together, these findings suggest that electronic cigarette use among medical students may be related to the social environment, and it is possible that it serves as a means of social integration and group belonging [4]. However, nicotine dependence was not assessed in this study, and occasional use does not exclude dependence. In addition, these data were self-reported by users and do not establish a causal role of social influences.

Previous studies have also highlighted coping with mental health-related issues as an important motivation for electronic cigarette use among adolescents and young adults [15]. In the present study, although 11.2% (16/143) of participants reported initiating electronic cigarette use to relieve stress, no significant association was observed between electronic cigarette use and self-reported mental disorders. This apparent discrepancy may be explained by methodological differences between the studies. While the North American study investigated subjective motivations for electronic cigarette use, our study evaluated associations with physician-diagnosed mental disorders, which represent distinct constructs. Nevertheless, the identification of stress as a relevant motivation for initiating electronic cigarette use underscores the importance of addressing psychological well-being within medical education.

The demanding nature of medical training, characterized by a heavy academic workload, frequent examinations, and substantial psychological pressure, has been suggested as a context that may favor this behavior. In our study, many users reported increased electronic cigarette use during periods of greater academic stress, particularly at the end of academic semesters and before examinations. However, this information was self-reported by users and could not be compared with non-users; therefore, it does not establish that academic stress leads to electronic cigarette use, and the use of electronic cigarettes as a coping strategy should be considered a hypothesis. Previous studies suggest that nicotine exposure may alter nicotinic acetylcholine receptor function and disrupt physiological stress-response pathways, potentially increasing stress levels over time and reinforcing continued nicotine use [16]. However, nicotine dependence was not assessed in the present study, and this mechanism cannot be inferred from our findings.

The concomitant use of electronic cigarettes and alcohol has been consistently reported in the literature. In the present study, 95.1% (136/143) of electronic cigarette users reported alcohol consumption, and 86% (123/143) reported an increased desire to use electronic cigarettes after drinking alcohol. Although this association could not be formally tested because alcohol consumption was not assessed among non-users, the high prevalence observed is consistent with previous studies demonstrating a close relationship between these behaviors [17,18]. Together, these findings suggest that electronic cigarette use should not be viewed as an isolated behavior but rather as part of a broader pattern of health-risk behaviors commonly observed among university students. This highlights the importance of developing prevention and cessation strategies that address multiple behavioral risk factors rather than focusing exclusively on electronic cigarette use.

These findings have practical implications for medical training. Since knowledge of the risks was almost universal but did not prevent use, educational content could be complemented by prevention actions in the social settings where use begins, particularly among students in the early semesters; by institutional support for cessation, given that 83.2% of users expressed interest in quitting; and by strategies for managing academic stress and promoting mental health, as 60.8% of users reported increased use during periods of greater academic workload. Addressing this behavior during undergraduate training is also relevant because these students will be responsible for counseling patients on tobacco and nicotine use.

This study has several limitations. First, its cross-sectional design precludes causal inference, allowing only the identification of associations between the variables investigated. Second, the inclusion of students from a single medical school and the use of convenience sampling may limit the generalizability of the findings to other academic settings. Although the response rate was 62% and students from all semesters participated, the characteristics of nonrespondents could not be compared with those of respondents, and nonresponse bias cannot be excluded, since participation may have differed between users and non-users. Third, the analyses were limited to unadjusted bivariate associations, and no multivariable analysis was performed; therefore, independent associated factors could not be identified, and residual confounding may have influenced the results; in particular, age and stage of medical training are closely related, and their associations with electronic cigarette use may not be independent. Fourth, data were obtained through a self-administered questionnaire, making the study susceptible to social desirability and recall biases. These biases may be particularly relevant among medical students, who are likely to be aware of the health risks associated with tobacco use and may therefore underreport electronic cigarette use or mental health conditions. Finally, the questionnaire was not formally validated, and its reliability was not evaluated; in addition, nicotine dependence was not assessed, and alcohol consumption was evaluated only among users. Despite these limitations, this study provides important evidence regarding the prevalence, patterns of use, and factors associated with electronic cigarette use among Brazilian medical students, contributing to the growing body of evidence needed to support targeted prevention and cessation initiatives in this population.

Conclusions

This study identified a high lifetime prevalence of electronic cigarette use among medical students, despite the high level of awareness regarding the health risks associated with these products. In bivariate analyses, electronic cigarette use was associated with male sex, household exposure to tobacco use, and stage of medical training, although without a linear trend across training stages; patterns of use were related to peer relationships, social settings, alcohol consumption, and periods of increased academic stress. These associations are exploratory, were not adjusted for potential confounders, and do not establish causality, and the use of a convenience sample from a single institution limits the generalizability of the findings. These findings suggest that knowledge alone may not be sufficient to prevent electronic cigarette use in this population. Instead, comprehensive institutional strategies integrating health education, mental health support, stress management, and smoking prevention and cessation initiatives may help address this behavior among medical students. Given the future role of medical students as healthcare professionals, promoting healthy behaviors during undergraduate training may have implications not only for their own well-being but also for future tobacco control efforts and patient counseling. Further multicenter longitudinal studies with multivariable analyses are warranted to clarify the determinants of e-cigarette use and to support the development of evidence-based prevention strategies.

Appendices

Appendix 1: Questionnaire

Gender:

☒ Male

☒ Female

☒ Other

Current year of medical school:

☒ 1st

☒ 2nd

☒ 3rd

☒ 4th

☒ 5th

☒ 6th

☒ 7th

☒ 8th

☒ 9th

☒ 10th

☒ 11th

☒ 12th

Age:

☒ Under 18 years

☒ 18-19

☒ 20-23

☒ 24 or older

Living arrangements:

☒ With family

☒ With friends

☒ Alone

Do you experience financial difficulties?

☒ Yes

☒ No

☒ Severe financial difficulties

Do you engage in physical activity?

☒ Yes, 1-3 times per week

☒ Yes, 4-6 times per week

☒ Yes, every day

☒ No

Have you been medically diagnosed with any of the following conditions?

☒ Depression

☒ Anxiety

☒ ADHD

☒ ASD

☒ Bipolar disorder

☒ None

☒ Other

Are you currently receiving care from a psychiatrist and/or psychologist/therapist/psychoanalyst?

☒ Psychiatrist

☒ Psychologist/therapist/psychoanalyst

☒ No

Does anyone in your family or household currently smoke or have a history of smoking any type of cigarette?

☒ Yes, and still smokes

☒ Yes, but does not currently smoke

☒ No

Do you consider electronic cigarette use harmful to health?

☒ Yes

☒ No

Have you received information about the risks of nicotine use during medical school classes, symposia, or lectures?

☒ Yes

☒ No

Have you received information about the risks of smoke inhalation during medical school classes, symposia, or lectures?

☒ Yes

☒ No

Are you aware that electronic cigarettes are nicotine-containing devices?

☒ Yes

☒ No

Do you consider yourself well-informed about the risks of electronic cigarette use?

☒ Yes

☒ No

Have you ever used electronic cigarettes regularly, or do you currently use them regularly?

☒ Yes, I currently use them regularly

☒ Yes, I used them regularly in the past

☒ Yes, but my use is not considered regular

☒ No, I have never used them

How long ago did you first try electronic cigarettes?

☒ 1 month ago

☒ 3 months ago

☒ 1 year ago

☒ 3 years ago

☒ More than 3 years ago

For how long have you been using or did you use electronic cigarettes?

☒ 1 month

☒ 1-6 months

☒ 6-12 months

☒ 1-3 years

☒ More than 3 years

Do you purchase your own electronic cigarette device?

☒ Yes

☒ No

During the past 30 days, on how many days did you use electronic cigarettes?

☒ 0-5 days

☒ 5-15 days

☒ 15-25 days

☒ 25-30 days

Frequency of use:

☒ Daily

☒ At least once a week

☒ Less than once a week, but at least once during the past month

Why do you use electronic cigarettes?

☒ Friends use them

☒ Family members use them

☒ Social acceptance

☒ Personal image

☒ Stress relief

☒ Flavors

☒ To quit conventional cigarettes

☒ Other

Do your friends use electronic cigarettes?

☒ Yes, 1-5 friends

☒ Yes, 5-10 friends

☒ Yes, more than 10 friends

☒ No

Did you use a friend's device before purchasing your first one?

☒ Yes

☒ No

Do you usually share your electronic cigarette devices with friends?

☒ Yes

☒ No

Where do you most commonly use electronic cigarettes?

☒ At home

☒ At college/university

☒ At the gym

☒ On the street

☒ Parties

☒ Concerts

☒ Gatherings with friends

☒ Other: _____

Do you notice an increase in your electronic cigarette use in certain situations perceived as stressful?

☒ Yes

☒ No

In which situations do you notice an increase in electronic cigarette use?

☒ Before taking an exam

☒ Before receiving an exam grade

☒ Before giving presentations

☒ At the end of the academic semester

☒ Before outpatient clinic sessions/practical classes

☒ Other: _____

Do you consume alcoholic beverages?

☒ Yes

☒ No

Do you associate alcohol consumption with electronic cigarette use?

☒ Yes

☒ No

Do you notice an increase in electronic cigarette use or craving after consuming alcoholic beverages?

☒ Yes

☒ No

Do you notice an increase in electronic cigarette use or craving at parties, concerts, events, etc.?

☒ Yes

☒ No

Have you ever tried to quit using electronic cigarettes?

☒ Yes

☒ No

Are you interested in quitting electronic cigarette use?

☒ Yes

☒ No

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Caio B. Prando, Victor M. Bianchini, Marcos S. Meireles

Acquisition, analysis, or interpretation of data: Caio B. Prando, Victor M. Bianchini

Drafting of the manuscript: Caio B. Prando, Victor M. Bianchini

Critical review of the manuscript for important intellectual content: Marcos S. Meireles

Supervision: Marcos S. Meireles

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Ethical Committee of Escola Superior de Ciências da Santa Casa de Misericórdia de Vitória issued approval 7.461.352. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **AI use statement:** The authors have declared that no AI tools were used during the work or in the drafting of this article. The authors take full responsibility for the work. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any

organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Bhave SY, Chadi N: E-cigarettes and vaping: a global risk for adolescents . Indian Pediatr. 2021, 58:315-9. 10.1007/s13312-021-2188-4
2. Barufaldi LA, Guerra RL, Albuquerque RC, Nascimento AD, Chança RD, Souza MC, Almeida LM: Risk of initiation to smoking with the use of electronic cigarettes: systematic review and meta-analysis (in Portuguese). Cien Saude Colet. 2021, 26:6089-103. 10.1590/1413-812320212612.35032020
3. Dinardo P, Rome ES: Vaping: the new wave of nicotine addiction . Cleve Clin J Med. 2019, 86:789-98. 10.3949/ccjm.86a.19118
4. Carrillo G, Mendez-Dominguez NI, Acosta Enriquez ME, Morán-Martínez J: Attitudes, behaviors, and perceptions of students vaping in three Mexican universities. Int J Environ Res Public Health. 2024, 21:464. 10.3390/ijerph21040464
5. Bertoni N, Szklo AS: Electronic nicotine delivery systems in Brazilian state capitals: prevalence, profile of use, and implications for the National Tobacco Control Policy. Cad Saude Publica. 2021, 37:e00261920. 10.1590/0102-311X00261920
6. Clendennen SL, Smith J, Sumbe A, Chen B, Wilkinson AV, Harrell MB: Symptoms of depression and anxiety and subsequent use of nicotine and THC in electronic cigarettes. Subst Use Misuse. 2023, 58:591-600. 10.1080/10826084.2023.2177110
7. Lucinda LMF, Mattos GA, Paticcié GF, et al.: Prevalence and factors associated with e-cigarette use among undergraduate students: a cross-sectional study (in Portuguese). Rev Med Minas Gerais. 2024, 34:e-34108. 10.5935/2238-3182.2024e34108
8. Kundu S, Shaw S, Khan J, Chattopadhyay A, Baptista EA, Paswan B: Age, gender and socioeconomic patterns of awareness and usage of e-cigarettes across selected WHO region countries: evidence from the Global Adult Tobacco Survey. BMJ Open. 2023, 13:e070419. 10.1136/bmjopen-2022-070419
9. Irvine DS, Lee EY, Janssen I, Leatherdale ST: Gendered associations between e-cigarette use, cigarette smoking, physical activity, and sedentary behaviour in a sample of Canadian adolescents. Dialogues Health. 2022, 1:100029. 10.1016/j.dialog.2022.100029
10. Kalousova L: Parental smoking in childhood as a smoking risk factor throughout middle age . Am J Prev Med. 2023, 65:261-9. 10.1016/j.amepre.2023.02.023
11. Yang X, Yan Z, Xu G, Tan Y, Zhu J: How secondhand smoke exposure affects tobacco use and smoking susceptibility of adolescents: sex and school differences. Tob Induc Dis. 2021, 19:68. 10.18332/tid/140094
12. Aqeeli AA, Makeen AM, Al Bahhawi T, Ryani MA, Bahri AA, Alqassim AY, El-Setouhy M: Awareness, knowledge and perception of electronic cigarettes among undergraduate students in Jazan Region, Saudi Arabia. Health Soc Care Community. 2022, 30:706-13. 10.1111/hsc.13184
13. Guan T, Yu Z, Bhosle P, Li C, Sun K, Rao MB: Why our youth vape? A trend analysis based on cross-sectional annual surveys of middle and high school students in the U.S. Medicina. 2026, 62:223. 10.3390/medicina62010223
14. Lindpere V, Winickoff JP, Khan AS, Dong J, Michaud TL, Liu J, Dai HD: Reasons for e-cigarette use, vaping patterns, and cessation behaviors among US adolescents. Nicotine Tob Res. 2023, 25:975-82. 10.1093/ntr/ntac278
15. Do EK, Koris K, Minter T, Esayed S, Hair EC: Reasons for e-cigarette use and their associations with frequency, dependence, and quit intentions: findings from a youth and young adult sample. Am J Prev Med. 2025, 69:107629. 10.1016/j.amepre.2025.03.009
16. Jha V, Kraguljac A: Assessing the social influences, self-esteem, and stress of high school students who vape. Yale J Biol Med. 2021, 94:95-106.
17. Roberts W, Verplaetse T, Peltier MK, Moore KE, Gueorguieva R, McKee SA: Prospective association of e-cigarette and cigarette use with alcohol use in two waves of the Population Assessment of Tobacco and Health. Addiction. 2020, 115:1571-9. 10.1111/add.14980
18. Ou TS, Buu A, Yang JJ, Lin HC: A longitudinal study of the association between e-cigarette use contexts and alcohol use problems among college students. J Am Coll Health. 2025, 73:3507-11. 10.1080/07448481.2024.2422327