Article

Prevalence and usage profile of electronic cigarettes in medical students from a capital in southern Brazil

*Prevalência e perfil de uso de cigarros eletrônicos em estudantes de medicina de uma capital do sul do Brasil**

Pedro Luiz Belei Garcia [1], Jorge Daher Scander Sielski[2], Luiz Victor Padoan de Oliveira[3], Marcos Eduardo Dos Santos Duarte[4], Iago Garcia Miranda[5], Pietro Ragi Garofani Ramos[6], Fabiana Antunes Andrade[7]

ABSTRACT: INTRODUCTION: Electronic cigarettes have gained prominence in the Brazilian social scene in recent years, especially among university students. This rise raises questions about the incidence and potential effects of their use among medical students. **OBJECTIVE**: To investigate the prevalence and characterize the socioeconomic profile of medical students who use electronic smoking devices (ESDs), as well as to investigate the degree of dependence on electronic cigarettes, duration of use, and associated symptoms. **METHODOLOGY**: This is a cross-sectional observational study conducted with medical students in the city of Curitiba-PR, through the application of a self-administered questionnaire via the Google Forms platform. The questionnaire included questions about socioeconomic data, electronic cigarette use and frequency, occurrence of symptoms, presence of anxiety, and nicotine dependence scale. The study was approved by the Ethics and Research Committee of the Positivo University. **RESULTS**: A total of 562 participants were included, mostly women, with an average age of 22 years. The prevalence of electronic cigarette users was 39.7%. Regarding the users profile, proportionally, the majority are men with incomes higher than 10 minimum wages. Cough and odynophagia were the main symptoms reported. 72.5% of ESD users reported feeling anxious, and additionally, 22.4% of users exhibited a high or very high degree of dependence, which was associated with the presence of symptoms when smoking (p=0.021) and a tendency towards anxiety (p=0.056). **CONCLUSION**: We observed a high prevalence of electronic cigarette use among medical students. Considering the dependency rate and the observed relationship between ESD use and anxiety, it becomes imperative to implement awareness campaigns, as well as to improve regulatory practices regarding their commercialization and use.

KEY WORDS: Electronic cigarette; Nicotine addiction; Anxiety; Medical students.

RESUMO: INTRODUÇÃO: Os cigarros eletrônicos têm ganhado destaque no cenário social brasileiro nos últimos anos, especialmente entre os universitários. Esta ascensão suscita indagações acerca da incidência e dos potenciais efeitos do seu consumo entre estudantes de medicina. **OBJETIVO**: investigar a prevalência e caracterizar o perfil socioeconômico de estudantes de medicina que utilizam os dispositivos eletrônicos para fumar (DEFs), além de investigar o grau de dependência de cigarros eletrônicos, tempo de uso e os sintomas associados. **METODOLOGIA**: Trata-se de um estudo observacional transversal realizado com estudantes de medicina da cidade de Curitiba-PR, através da aplicação de um questionário autoaplicável via plataforma *Google Forms*. O questionário possuía perguntas sobre dados socioeconômicos, uso de cigarro eletrônico e frequência, aparecimento de sintomas, presença de ansiedade e escala de dependência de nicotina. O estudo foi aprovado pelo Comitê de ética e pesquisa da Universidade Positivo. **RESULTADOS**: Foram incluídos 562 participantes, em sua maioria mulheres, com média de idade de 22 anos. A prevalência de usuários de cigarros eletrônicos foi de 39,7%. Quanto ao perfil dos usuários, proporcionalmente, a maioria é de homens com renda superior a 10 salários-mínimos. Tosse e odinofagia foram os principais sintomas apresentados. 72,5% dos que utilizam DEFs se declararam ansiosos, além disso, 22,4% dos usuários apresentaram grau elevado ou muito elevado de dependência, o qual foi associado à presença de sintomas ao fumar (p=0,021) e a uma tendência a presença de ansiedade (p=0,056). **CONCLUSÃO**: Observamos uma elevada prevalência de uso de cigarros eletrônicos entre estudantes de medicina. Considerando taxa de dependência e a observada relação do uso de DEFs com a ansiedade, torna-se imperativo a implementação de campanhas de conscientização, além do aprimoramento das práticas regulatórias referentes à sua comercialização e uso.

PALAVRAS-CHAVE: Cigarro eletrônico; Dependência de nicotina; Ansiedade; Estudantes de medicina.

* O presente trabalho foi apresentado de forma oral no 17° Congresso Brasileiro de Clínica Médica e 7° Congresso Internacional de Medicina de Urgência e Emergência, realizado em Balneário Camburiú no ano de 2023 com o título "Repercussões do consumo de cigarros eletrônicos em estudantes de medicina na cidade de Curitiba". O presente trabalho teve resultados parciais apresentados de forma oral no III Congresso Acadêmico de Medicina da Universidade Positivo, em Curitiba no ano de 2023 com o título "Prevalência e perfil de uso de cigarros eletrônicos em estudantes de medicina de Curitiba".

1. Universidade Positivo, Faculdade de Medicina, Curitiba, Paraná. ORCID: 0009-0001-5776-0807. E-mail: pedrobelei@hotmail.com
2. Universidade Positivo, Faculdade de Medicina, Curitiba, Paraná. ORCID: 0009-0003-7787-1859. E-mail: jorgedss@outlook.com
3. Universidade Positivo, Faculdade de Medicina, Curitiba, Paraná. ORCID: 0000-0002-9150-2908. E-mail: luizvpadoan@gmail.com
4. Universidade Positivo, Faculdade de Medicina, Curitiba, Paraná. ORCID: 0000-0002-6473-2281. E-mail: m.eduarduarte@gmail.com
5. Universidade Positivo, Faculdade de Medicina, Curitiba, Paraná. ORCID: 0009-0004-1396-7090. E-mail: Iagogmiranda@gmail.com
6. Universidade Positivo, Faculdade de Medicina, Curitiba, Paraná. ORCID: 0009-0008-2775-4095. E-mail: Pietroramos33@gmail.com
7. Universidade Positivo, Faculdade de Medicina, Curitiba, Paraná. ORCID: 0000-0003-4116-2324. E-mail: fabiana.andrade@up.edu.br
Correspondence: Pedro Luiz Belei Garcia. Universidade Positivo, R. Professor Pedro Viriato Parigot de Souza, 5300, Curitiba, Paraná, CEP 81280-330. E-mail: pedrobelei@hotmail.com.

INTRODUCTION

Smoking is a chronic disease related to nicotine dependence and tobacco-based products[1]. According to the World Health Organization (WHO), this condition falls within the category of "mental, behavioral, or neurodevelopmental disorders" due to the use of psychoactive substances[2]. It is also considered the leading preventable cause of both individual illness and premature deaths worldwide[3].

Tobacco is a plant (Nicotiana tabacum) whose leaves are used in the production of various products containing nicotine as the active ingredient, leading to addiction[4]. There are several tobacco-derived products, including cigarettes, cigars, pipes, hookahs, electronic smoking devices, and others. In Brazil, Resolution of the Collegiate Board No. 46 of 2009 by the National Health Surveillance Agency (Anvisa) prohibits the commercialization, importation, and advertisement for any electronic smoking devices[5].

Electronic cigarettes were introduced to the global market in 2006 as a non-pharmacological aid for smoking cessation. Despite being initially targeted at nicotine users, a product named JUUL was launched in 2015, featuring a more modern aesthetic compared to other electronic cigarettes, which encouraged non-smokers to try and frequently use the novelty. The increasing use of JUUL-like electronic cigarettes led to the development of other types, such as "pods" or "vapes," sold in a wide range of sizes and flavors, facilitating acceptance and normalization of use among young people in school or university[6]. The issue, although not yet extensively described in literature, is the impact that the use of these products will have on individuals' health and on the public health system in the medium and long term.

According to the National Cancer Institute (INCA), various types of cancer are linked to smoking, including lung, liver, and kidney cancer, among others. The platform further associates the number of deaths in cancer patients who smoked, which was around 33% in 2015[7]. According to the WHO, diseases caused by all forms of tobacco include strokes, acute myocardial infarction, oral cancer, and other oral diseases, throat cancer, fetal death, reduced fetal growth, low birth weight, and premature birth. Diseases caused or exacerbated by tobacco smoking include asthma, Chronic Obstructive Pulmonary Disease (COPD), tuberculosis, other respiratory diseases, reduced lung function, type II diabetes, dementia, reduced fertility in both men and women, erectile dysfunction, sudden infant death syndrome, painful menstruation, and accelerated menopause, congenital defects, vision and hearing loss, gastrointestinal diseases, weakened immune system, weak bones, and skin lesions[8].

Despite electronic cigarettes being considered illegal products, there has been no tracking or registration of how many of these products have entered the country in recent years, according to ANVISA's email report. However, a technical note from the institution presented possibilities for regulating and monitoring the sale of these products and their effects, acknowledging the importance of the issue currently[9].

Due to the aforementioned issue, it is necessary to gather data that can indicate that the measure taken to address one problem has become the cause of another equally significant problem, negatively impacting individuals' health.

METHODOLOGY

This study was conducted as a cross-sectional observational study targeting students enrolled in the Medicine program in the city of Curitiba. Approval for this study was obtained from the Ethics Committee of Research at Universidade Positivo (approval number 5,749,226).

Students were invited to participate in the study through invitations sent via social media platforms such as WhatsApp, Instagram, and direct contact. An online questionnaire was shared using the Google Forms platform to collect responses from students enrolled in Medicine faculties in Curitiba. Inclusion criteria comprised students enrolled in Medicine programs in Curitiba, while exclusion criteria included incomplete questionnaire responses, students from other academic fields, or those outside Curitiba.

The questionnaire consisted of six sections. Initially, an Informed Consent Form (ICF) was presented for participants to agree to the continuation of the research. Subsequently, sociodemographic data such as age, gender, academic year, and socioeconomic profile were collected in the second section. The third section addressed the use of electronic cigarettes, including whether students use them, frequency of use, and any symptoms or discomforts experienced due to their use, selecting from options such as fatigue, coughing, and irritability. In the fourth section, questions were directed towards the presence and frequency of anxiety episodes. Following that, the fifth section involved the application of the *Fagerstrom*[12] test or scale to quantify nicotine dependence. This self-administered test consists of six questions, including the time of day the individual first smokes after waking up, difficulty in refraining from smoking in prohibited areas, amount smoked per day, time of day smoking is most satisfying and hardest to eliminate from routine, whether more cigarettes are smoked in the first hours after waking up, and whether smoking occurs even when ill. Scores from this test allow evaluation of the degree of nicotine dependence, categorized as very low (0-2 points), low (3-4 points), moderate (5 points), high (6-7 points), and very high (8-9 points). Finally, the sixth and last section addressed the use of other sources of nicotine, if any, and their frequency.

Data were collected and digitized into Excel™ tables. Analysis was conducted using the Statistical Package for the Social Sciences (SPSS™) software (Version 22.0, IBM). Initially, a descriptive analysis of the dataset was performed: qualitative variables were expressed as frequencies and percentages, while quantitative variables expressed as means and standard deviations (SD). Qualitative data compared using the Chi-square test and Fisher's exact test, as appropriate. P-values less than 0.05 were considered significant.

RESULTS

In the present study, a total of 562 students were included, with 67.3% being women and 32.7% men, with a mean age of

22 years. The majority of participants self-identified as white (90%) and had a family income above 10 minimum wages (61.9%) (Table 1). When asked if they used electronic cigarettes, 39.7% answered yes, with 14.1% using other sources of nicotine besides e-cigarettes (Table 2).

Among users of electronic smoking devices, 37.2% use them 6 to 7 times a week, and 30.5% use them only once a week. Regarding symptoms related to electronic cigarette use, cough (67.1%) and sore throat (55.7%) were the main systemic manifestations; however, fatigue (42.5%), shortness of breath (40.7%), irritability (24.6%), and headache (2.4%) were also reported (Table 2).

Table 1 - Sociodemographic data of research participants.

		N	%
Sex	Female	378	(67,3)
	Male	184	(32,7)
Age, mean (SD)		22,0	(3,1)
Race	Yellow or Indígenous	18	(3,2)
	White	506	(90,0)
	Black	4	(,7)
	Brown	34	(6,0)
Income	Above 10 minimum wages	348	(61,9)
	Up to 2 minimum wages	23	(4,1)
	From 3 to 5 minimum wages	70	(12,5)
	From 6 to 10 minimum wages	121	(21,5)
Uses Electronic Cigarettes	No	339	(60,3)
	Yes	223	(39,7)

Table 2 - Frequency of use among participants, their symptoms, and their relationship with anxiety. Data from Electronic Cigarette Users.

Electronic cigarette user data		N	%
How many days a week	1 day	68	(30,5)
	2 to 3 days	46	(20,6)
	4 to 5 days	26	(11,7)
	6 to 7 days	83	(37,2)
Discomfort	No	56	(25,1)
	Yes	167	(74,9)
Coughing		112	(67,1)
Odynophagia		93	(55,7)
Fatigue		71	(42,5)
Shortness of breath		68	(40,7)
Irritability		41	(24,6)
Headache		4	(2,4)
How long after use did you experience symptoms	1 day	29	(17,4)
	1 week	17	(10,2)
	1 mounth	22	(13,2)
	2 to 3 mounths	26	(15,6)
	3 to 6 mounths	35	(21,0)
	1 year	38	(22,8)
Use another source of nicotine	No	483	(85,9)
	Yes	79	(14,1)
Do you have anxiety?	No	61	(27,5)
	Yes	161	(72,5)
Do you have anxiety attacks?	No	122	(55,0)
	Yes	100	(45,0)

continuation

Electronic cigarette user data		N	%
How frequent are the crises?	I don't have anxiety attacks	115	(51,8)
	At least once every 3 months	13	(5,9)
	At least once every 6 months	16	(7,2)
	At least once a week	16	(7,2)
	At least once a year	18	(8,1)
	At least once a month	44	(19,8)
Do you take medication for anxiety?	No	153	(68,9)
	Yes	69	(31,1)
Do you use electronic cigarettes to relieve anxiety?	No	139	(62,6)
	Yes	83	(37,4)
Fagerstrom	Very low	121	(54,3)
	Low	36	(16,1)
	Medium	16	(7,2)
	High	16	(7,2)
	Very high	34	(15,2)

Additionally, 72.5% of interviewed smokers reported having symptoms of anxiety, 31.1% take medication to control this condition, and 37.4% use the electronic smoking device as a way to alleviate the comorbidity (Table 2). When relating to the Fagerstrom Scale, which measures nicotine dependence, it was observed that 7.2% have a high level and 15.2% have a very high level of dependence, totaling 22.4% of students with a significant degree of nicotine dependence (Table 2).

When comparing users and non-users of electronic cigarettes, we observed a prevalence of male smokers (39% vs. 28.6%; p=0.010) and those with income above 10 minimum wages (71.7% vs. 55.5%; p<0.0001) (Table 3). Additionally, participants with a very high and high level of dependence more frequently present symptoms when smoking (27.5% vs. 7.1%; p=0.010) (Table 4).

Table 3 - Relationship between the use of electronic cigarettes and sociodemographic profile.

		Electronic Cigarette Use				
		No		Yes		p-value
		N	%	N	%	
Sex	Female	242	(71,4)	136	(61,0)	0,010
	Male	97	(28,6)	87	(39,0)	
Age, mean (SP)		22,2	3,5	21,8	2,3	0,163
Race	Yellow or Indigenous	8	(2,4)	10	(4,5)	0,469
	White	306	(90,3)	200	(89,7)	
	Black	3	(,9)	1	(,4)	
	Brown	22	(6,5)	12	(5,4)	
Income	Above 10 minimum wages	188	(55,5)	160	(71,7)	<0,0001
	Up to 2 minimum wages	21	(6,2)	2	(,9)	
	From 3 to 5 minimum wages	50	(14,7)	20	(9,0)	
	From 6 to 10 minimum wages	80	(23,6)	41	(18,4)	

In relation to the onset time of symptoms and frequency of use, the data indicate that the majority of participants who use electronic cigarettes only once a week reported symptoms already on the first day after use (p < 0.0001).

Furthermore, we observed that among electronic cigarette users, the levels of very high and high dependence were associated with the presence of anxiety, with a p-value on the borderline of significance (p = 0.056), however, they were not related to the frequency of crises (p = 0.190) (Table 5). When it comes to smoking frequency and its relationship with the level of nicotine dependence, the result found was that the more times one smokes in a week (6-7 times), the Fagerstrom score will be high or very high (92%; p < 0.0001) (Table 6). In other words, the more times a week the electronic cigarette is used, the greater the chance of the user being nicotine dependent.

Table 4 - Relationship between discomfort experienced and nicotine dependence level among participants.

		Discomfort				p-value
		No		Yes		
		N	%	N	%	
Frequency of use per week	1 day	18	(32,1)	50	(29,9)	0,205
	2-3 days	16	(28,6)	30	(18,0)	
	4-5 days	7	(12,5)	19	(11,4)	
	6-7 days	15	(26,8)	68	(40,7)	
Uses another source of nicotine	No	45	(80,4)	117	(70,1)	0,135
	Yes	11	(19,6)	50	(29,9)	
Fagerstrom	Low	12	(21,4)	24	(14,4)	0,010
	Medium	3	(5,4)	13	(7,8)	
	Very Low	37	(66,1)	84	(50,3)	
	High/ Very High	4	(7,1)	46	(27,5)	

Table 5 - Relationship between the presence of anxiety and the frequency of crises with the level of nicotine dependence.

	Do you have anxiety				p-value	Frequency of anxiety crises						p-value
Fagerstrom	No		Yes			1x a week-1month		6 months-1year		At least once		
	N	%	N	%		N	%	N	%	N	%	
Low	16	(26.2)	20	(12.4)	0,056	3	(5.0)	4	(11.8)	4	(30.8)	0,190
Medium	4	(6.6)	12	(7.5)		3	(5.0)	1	(2.9)	1	(7.7)	
Very Low	32	(52.5)	88	(54.7)		37	(61.7)	21	(61.8)	6	(46.2)	
High/ Very High	9	(14.8)	41	(25.5)		17	(28.3)	8	(23.5)	2	(15.4)	

Table 6 - Frequency of use by nicotine dependence level.

		Fagerstrom								p-value
		Low		Medium		Very Low		High/Very High		
		N	%	N	%	N	%	N	%	
Frequency of use per week	1 day	10	(27.8)	0	(.0)	58	(47.9)	0	(.0)	<0,0001
	2-3 days	10	(27.8)	1	(6.3)	32	(26.4)	3	(6.0)	
	4-5 days	5	(13.9)	3	(18.8)	17	(14.0)	1	(2.0)	
	6-7 days	11	(30.6)	12	(75.0)	14	(11.6)	46	(92.0)	

DISCUSSION

According to the World Health Organization (WHO), smoking is responsible for approximately 8 million deaths annually, with 1.2 million being passive smokers. Anti-smoking campaigns have been effective, but the world still has 1.1 billion smokers, raising questions about whether the number of users will increase or continue to decrease[10-13]. This study aimed to establish the prevalence and sociodemographic profile of electronic cigarette smokers in medical schools in Curitiba, as well as to understand and expose the health impacts on participants based on the main reported symptoms.

The frequency of electronic cigarette users among medical students in this study (39.7%) was very high compared to similar studies. Martins et al. 2023 revealed that only 2.1% of medical students from 11 Brazilian universities, unspecified, use these devices[14]. Another study with medical students showed that 20.1% of these academics are electronic cigarette smokers in their sample[15]. The COVITEL survey also obtained similar results on a national scale, indicating that up to 20% of young people between 18 and 24 years old use electronic cigarettes[10]. A hypothesis for the high rate of electronic cigarette users observed in this study would be the sample profile, which consists of medical students from the southern region of the country with high income, a factor associated with the use of these devices.

Maintaining nicotine addiction requires an investment, as

it is more expensive to be an electronic cigarette smoker than a conventional cigarette smoker[16]. A hypothesis mentioned in the literature is that initially only higher-income groups have access to new technologies, such as electronic cigarettes, and over time, this becomes more equitable across all income levels. Additionally, it is evident that users of electronic cigarettes and hookahs are younger and wealthier than conventional cigarette smokers[17]. Thus, a worrying trend of increasing electronic cigarette consumption can be inferred, as over time, the product may become more widespread, diversified, and cheaper.

Another important variable is gender. Currently, in the world, the number of male conventional cigarette smokers is considerably higher than females (36.7% vs. 7.7%)[13]. Regarding electronic cigarettes, there are discrepancies presented in studies congruent with this one that reinforce this same relationship. However, Martins et al. 2023 reported that the experimentation and use of electronic cigarettes do not show a significant disparity between genders[14,18].

Regarding the mode of use and possible complications, a relationship was evidenced between the time until the onset of symptoms and the frequency of electronic cigarette use, indicating that even lower frequency of use (once a week) is associated with the earlier onset of symptoms. Tsai et al.[19] indicated that the inhalation of aerosols, even for 5 minutes, can alter the flow resistance of the airways. Thus, even users who use in smaller quantities may have symptoms. However, the potential harms may be substantially greater since the use of electronic cigarettes affects the cardiovascular system – through nicotine – and the respiratory system, through the direct action of smoke and chemicals present in the essences[20]. Nicotine is a risk factor for conditions such as acute myocardial infarction, stroke, deep vein thrombosis, and acute aortic dissection. Smoke, heated and loaded with toxic substances, acts differently[21]. Composed of heavy metals (e.g., nickel and cadmium) and other harmful substances like propylene glycol, electronic cigarette essence disrupts the epithelial cells of the respiratory tract[19,20]. In the lungs, in addition to cough and dyspnea, these substances can decrease the forced expiratory volume in the first second (FEV1) to forced vital capacity (FVC) ratio, making breathing and oxygenation difficult, mimicking chronic obstructive pulmonary disease (COPD). In addition, aerosolized propylene glycol produces ultrafine particles that contribute to asthma attacks[21].

Regarding symptoms, it is important to mention a comorbidity exclusively caused by the use of electronic cigarettes, EVALI (E-cigarette or Vaping Product Use-Associated Lung Injury). This disease is associated with acute lung injuries with diffuse alveolar damage, various types of pneumonia, such as chemical pneumonia, and complications such as pneumothorax and pleural effusion. Although EVALI is characterized by a failure in the immune system that leads to an intense inflammatory process in the lungs and its clinic is more critical and evident than that of the participants in this study, research affirms that the vapors of electronic cigarettes can be stored in the lungs of smokers, causing chronic lung injuries, especially if the habit is not interrupted[22-24].

Regarding complications, in addition to possible symptoms, it is significant to emphasize nicotine dependence.

In this study, an association was observed between higher frequency of use (6 to 7 days a week) and high or very high nicotine dependence, with 22.4% of all study participants considered nicotine-dependent.

Johnson et al. also showed significant dependence associated with the use of electronic cigarettes, as well as demonstrating the possibility of these causing greater nicotine addiction when compared to traditional cigarettes[25]. In this study, using the Fagerstrom Test, a higher average dependence score was observed for electronic cigarette users (5.0) than for conventional cigarettes (4.3–4.6) in the main articles on the subject in the United States. This fact was explained by the composition of these new cigarettes since the nicotine salt used arises from the addition of benzoic acid to free-base nicotine, which allows for a much higher load of the active ingredient and, consequently, causes more dependence than that used in traditional cigarettes. This new formulation also reduces the harshness and unpleasant taste of tobacco, making it easier to use and allowing for greater and deeper drags, which ultimately result in greater absorption[14,25].

Moreover, high and very high levels of dependence were related to the occurrence of symptoms in this study. This relationship has already been documented in the literature in studies involving conventional cigarettes, where it was observed that in smokers with a higher degree of nicotine dependence, symptoms such as dyspnea, fatigue, and cough were more frequent. Concurrently, it was found that respiratory symptoms were directly related to the number of cigarettes smoked per day, which corroborates the findings in this study[26].

Regarding nicotine, the substance is responsible for stimulating the release of dopamine by the body, which generates a positive balance due to its action in the brain. In patients with depression, levels of this neurotransmitter are low, and they rely on nicotine dependence to increase their dopaminergic levels to feel mentally well. Additionally, another troubled relationship between smoking and mental illness is built by the fact that since nicotine increases the production of dopamine, by negative feedback, the body stops producing this substance on its own, increasing tobacco dependence. Thus, it is evident that depression, anxiety, and other emotional disorders increase the risk of smoking experiences, including nicotine dependence[27].

Overcoming nicotine dependence is a challenge for individuals with psychiatric disorders. This substance induces a feeling of relaxation and leads users to believe that smoking can reduce anxiety and stress. Thus, nicotine produces mood alterations that mask psychic symptoms[28]. This study reinforces this relationship, since about 75% of medical students who smoke electronic cigarettes declared themselves anxious, and 37.4% reported using electronic cigarettes to combat anxiety symptoms.

The high rate of users in the study sample corroborates the hypothesis that young people are at risk for smoking. A multicenter Brazilian study conducted at the University of São Paulo in 2021 showed that the age group with the highest prevalence of conventional cigarette, hookah, and electronic cigarette use among medical students in Brazil is between 20 and 24 years old. Furthermore, the experimentation of electronic

cigarettes was twice as high for young people who had siblings or friends who smoke, demonstrating the influence of close people. Moreover, the two main reasons for using or experimenting with hookah or electronic cigarettes among young students were curiosity and aroma/flavor, which make these tobacco products more attractive and also increase the risk of smoking initiation[14].

Martins et al. indicated that most medical students are aware of the harms of smoking in general; however, 72% of them believe that electronic cigarettes cause less dependence than conventional cigarettes[14]. Given the findings in this study and those found in the literature, it is possible to suggest that experimentation and use of harmful products occur due to a false sense of personal immunity, lack of knowledge about the potential harm of electronic cigarettes, and curiosity to try a drug disguised by various colors and flavors, made to break the stigma of toxic cigarette smoke, allowing, above all, its consumption in previously considered improper environments.

Finally, it is important to note that this study has some limitations, such as errors in filling out or understanding the questions, since the questionnaire was done online. On the other hand, the fact that the questionnaire was completely anonymous favors more reliable answers, as it generates less embarrassment for the respondent. Another relevant factor is the profile of the studied sample, since the participants are medical students from a capital city in the southern region of Brazil and have only one public university, while the other four are private. In this sense, the results may not be representative of other regions of the country.

CONCLUSION

In conclusion, the study revealed a high prevalence of electronic cigarette use among medical students in Curitiba, with a majority of male users and a family income of over 10 minimum wages. Regarding symptoms related to electronic cigarette use, cough and sore throat were the most prevalent. A significant portion of medical students (22.4%) showed high or very high levels of nicotine dependence, which was associated with the presence of symptoms while smoking and a tendency towards anxiety.

Our findings underscore the need for public policies to combat smoking, particularly targeting the young population, who despite being aware of its risks and harms, exhibit a high prevalence of use. It is essential to implement strategies to monitor the production and trade of these products.

REFERENCES

1. Instituto Nacional do Câncer, em tabagismo. https://www.inca.gov.br/tabagismo.

2. Drope J, Schluger NW. The Tobacco Atlas. Atlanta: American Cancer Society and Vital Strategies, 2018. https://tobaccoatlas.org/topic/deaths.

3. World Health Organization. Tobacco. https://www.who.int/news-room/fact-sheets/detail/tobacco.

4. Brasil. Ministério da Saúde. Secretaria-Executiva. Secretaria de Atenção à Saúde. Glossário temático: fatores de proteção e de risco de câncer. Brasília: Ministério da Saúde, 2016.

5. Agência Nacional de Vigilância Sanitária. Resolução da Diretoria Colegiada - RDC n.º 46, de 28 de agosto de 2009. Proíbe a comercialização, a importação e a propaganda de quaisquer dispositivos eletrônicos para fumar, conhecidos como cigarro eletrônico. http://portal.anvisa.gov.br/documents/10181/2718376/RDC_46_2009_COMP.pdf

6. Gülşen A, Uslu B. Health Hazards and Complications Associated with Electronic Cigarettes: A Review. Turk Thorac J. 2020;21(3):201-8. Doi: 10.5152/TurkThoracJ.2019.180203. PMID: 32584238; PMCID: PMC7311157.

7. Instituto Nacional do Câncer. https://www.inca.gov.br/observatorio-da-politica-nacional-de-controle-do-tabaco/doencas-relacionadas-ao-tabagismo.

8. World Health Organization. (2019). The tobacco body. World Health Organization. https://apps.who.int/iris/handle/10665/324846. Licença: CC BY-NC-SA 3.0 IGO.

9. Documento Técnico Risco e Impactos de uma eventual Autorização de Registro dos DEF no Brasil, ANVISA. https://www.gov.br/anvisa/pt-br/assuntos/regulamentacao/participacao-social/tomada-publica-de-subsidios/arquivos/tomada-publica-de-subsidios-no-6-de-11-04-2021/documento_tecnico___riscos_e_impactos_de_uma_eventual_autorizacao_de_registro_dos_def_no_brasil.pdf/view.

10. Inquérito telefônico de fatores de risco para doenças cardíacas não transmissíveis em tempos de pandemia – Covitel 2022, p.54-5.

11. Instituto Nacional do Câncer. https://www.inca.gov.br/imprensa/estudo-do-inca-alerta-sobre-risco-de-cigarros-eletronicos.

12. Fagerstrom KO, Schneider NG. Measuring nicotine dependence: A review of the Fagerstrom Tolerance Questionnaire. J Behav Med. 1989;12(2):159-82. Doi:10.1007/bf00846549.

13. Tobacco N. WHO global report on trends in prevalence of tobacco use 2000-2025, fourth edition. https://www.who.int/publications/i/item/9789240039322.

14. Martins RS, Araújo AJ (in memoriam), Wehrmeister FC, Freitas BM, Basso RG, Santana ANC, Santos UP. Prevalence and associated factors of experimentation with and current use of water pipes and electronic cigarettes among medical students: a multicentric study in Brazil. J Bras Pneumol. 2023:49(1):e20210467.

15. Lima PVM, Maia PB, Duarte JJL. Prevalência do uso de cigarros eletrônicos e suas complicações respiratórias entre estudantes de medicina em uma universidade privada de Teresina-PI. Res Soc Develop. 2023:12(4):e9212440977, 2023.

16. Barufaldi LA, Guerra RL, Albuquerque RCR, Nascimento A, Chança RD, Souza MC, Almeida LM. Risco de iniciação ao tabagismo com o uso de cigarros eletrônicos: revisão sistemática e meta-análise. Ciencia Saude Col. 2021:26(12):6089–103.

17. Bertoni N, Szklo A, De Boni RB, Coutinho C, Vasconcellos M, Silva PN, Almeida LMB, Monteiro FIP. Electronic cigarettes and narghile users in Brazil: Do they differ from cigarettes smokers? Addictive Behaviors. 2019;98:106007.

18. Filho SVFC. Conhecimento dos estudantes do curso de medicina de uma faculdade particular em Salvador sobre cigarros eletrônicos. 2022.

19. Tsai M, Byun MK, Shin J, Alexander LEC. Effects of e-cigarettes and vaping devices on cardiac and pulmonary physiology. J Physiol. 2020:598(22):5039-62.

20. Seiler-Ramadas R, Sandner I, Haider S, Grabovac I, Dorner TE. Health effects of electronic cigarette (e-cigarette) use on organ systems and its implications for public health. Wiener klinischeWochenschrift. 2021;133(19-20):1020-7.

21. Pereira D, Dos Santos Borrego, A, Garcia Alves Â. Consequências Fisiopatológicas e Abordagem Anestésica em Doentes Consumidores de Cigarros Eletrónicos e Produtos de Tabaco Aquecido: Revisão Narrativa. Acta Medic Portuguesa. 2022;35(9):663-8.

22. Chatham-Stephens K, Roguski K, Jang Y, Cho P, Jatlaoui TC, Kabbani S, et al. Lung Injury Response Epidemiology / Surveillance Task Force e Lung Injury Response Clinical Task Force (2019). Características de pacientes hospitalizados e não hospitalizados em um surto nacional de cigarro eletrônico, ou Vaping, lesão pulmonar associada ao uso do produto - Estados Unidos, novembro de 2019. MMWR. Relatório semanal de morbidade e mortalidade. 68(46):1076-80.

23. Casey AM, Muise ED, Crotty Alexander LE. Vaping and e-cigarette use. Mysterious lung manifestations and an epidemic. Cur Opin Immunol. 2020;66:143-50.

24. Alexander LEC, Ware LB, Calfee CS, Callahan SJ, Eissenberg T, Farver C, et al. Relatório do workshop do NIH: E-cigarro ou uso de produto vaporizador lesão pulmonar associada (EVALI): desenvolvendo uma agenda de pesquisa. Am J Respir Crit Care Med. 2020;202(6):795-802.

25. Johnson JM, Muilenburg JL, Rathbun SL, Yu X, Naeher LP, Wang JS. Elevated Nicotine Dependence Scores among Electronic Cigarette Users at an Electronic Cigarette Convention. J Community Health. 2018;1;43(1):164-74.

26. Manzano BM, Ramos EMC, Vanderei LCM, Ramos D. Tabagismo no ambiente universitário: grau de dependência, sintomas respiratórios e função pulmonar. Arq Ciênc Saúde UNIPAR. 2009;13(2):75-80.

27. El-Sherbiny NA, Elsary AY. Smoking and nicotine dependence in relation to depression, anxiety, and stress in Egyptian adults: A cross-sectional study. J Family Community Med. 2022;29(1):8-16. Doi: 10.4103/jfcm.jfcm_290_21

28. Leventhal AM, Ray LA, Rhee SH, Unger JB. Genetic and environmental influences on the association between depressive symptom dimensions and smoking initiation among Chinese adolescent twins. Nicotine & tobacco research: official journal of the Society for Res Nicotine Tobacco. 2012;14(5):559-68. Doi: https://doi.org/10.1093/ntr/ntr253.