

Knowledge and Attitudes Toward Electronic Cigarettes and Prevalence of Electronic Cigarette Use Among Medical Students in Casablanca, Morocco: A Cross-Sectional Study

Connaissances, attitudes à l'égard de la cigarette électronique et prévalence de son utilisation chez les étudiants en médecine à Casablanca, au Maroc: Etude transversale

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ABSTRACT

Introduction: The use of electronic cigarettes is increasing worldwide, especially among adolescents and young adults. Medical students attitudes are likely unique and may be important to explore.

Aim : The objectives of this study were to describe Moroccan medical students knowledge and attitudes toward electronic cigarettes, to estimate the prevalence of electronic cigarettes use among them, and to identify factors associated with this practice.

Methods: A cross-sectional study was conducted during the academic year 2020-2021, including all medical students enrolled at the Faculty of Medicine and Pharmacy of Casablanca.

Results: Among the 491 participants, the mean age was 21.0 ± 2.3 years and the female/male ratio was 1.94. The prevalence of lifetime electronic cigarettes use was 20.2% [16.6%; 23.7%]. Being a male ($p < 0.001$), smoking tobacco ($p < 0.001$), having a family member or close friend who uses e-cigarettes ($p < 0.001$), and having a family member or close friend who uses traditional cigarettes ($p < 0.001$) were significantly associated with electronic cigarettes use. Electronic cigarettes use was significantly associated with beliefs that they are an effective way to quit smoking ($p = 0.025$), that they are more effective than nicotine replacement therapy ($p = 0.009$), that they do not contain carcinogens ($p = 0.025$), that vaping is less harmful than smoking tobacco ($p = 0.009$), and that the consequences of vaping are less serious than smoking tobacco ($p = 0.033$).

Conclusion : Incorporating courses on the dangers of e-cigarettes into the medical curriculum may improve students cessation outcomes and their competencies in tobacco and e-cigarette cessation counseling.

Keywords : Electronic Nicotine Delivery Systems ; vaping ; medical students ; Health Knowledge, Attitudes, Practice

RÉSUMÉ

Introduction : L'utilisation des cigarettes électroniques augmente dans le monde, surtout chez les adolescents et jeunes adultes. Les attitudes des étudiants en médecine sont particulières et méritent d'être étudiées.

Objectifs : Décrire les connaissances et attitudes des étudiants en médecine marocains vis-à-vis des cigarettes électroniques, estimer leur prévalence et identifier les facteurs associés.

Méthodes : Étude transversale menée en 2020-2021 auprès de l'ensemble des étudiants de la Faculté de Médecine et de Pharmacie de Casablanca.

Résultats : Sur 491 participants, l'âge moyen était de $21,0 \pm 2,3$ ans, avec un ratio femmes/hommes de 1,94. La prévalence de l'usage de la cigarette électronique était de 20,2 % [16,6–23,7 %]. Les facteurs associés étaient le sexe masculin ($p < 0,001$), le tabagisme ($p < 0,001$), avoir un proche utilisateur de cigarettes électroniques ($p < 0,001$) ou de tabac ($p < 0,001$). L'usage était lié à la perception qu'elles aident au sevrage ($p = 0,025$), sont plus efficaces que les substituts nicotiniques ($p = 0,009$), contiennent moins de substances cancérigènes ($p = 0,025$), sont moins nocives que le tabac ($p = 0,009$) et ont des conséquences moins graves ($p = 0,033$).

Conclusion : L'intégration de cours sur les dangers des cigarettes électroniques dans le cursus médical pourrait améliorer les résultats du sevrage chez les étudiants et leurs compétences en conseil tabagique.

Mots-clés : Systèmes électroniques de délivrance de nicotine ; vapotage ; étudiants en médecine ; connaissances, attitudes et pratiques en santé.

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What is known ?

- Electronic cigarette use is increasing worldwide, including in Morocco, particularly among adolescents and young adults
- Data on the prevalence of electronic cigarette use among Moroccan medical students remain limited

What this article adds ?

- Electronic cigarette use was common among medical students in Casablanca
- Electronic cigarette use was significantly associated with male sex, tobacco smoking, social exposure to electronic cigarette or tobacco, and favorable beliefs regarding their safety and effectiveness for smoking cessation

INTRODUCTION

Electronic cigarettes (ECIG) use prevalence has been increasing rapidly worldwide in recent years, particularly among adolescents and young adults(1). In fact, according to the United States' (US) Centers for Disease Control and Prevention (CDC), 4.5% of adults aged 18 and over were current ECIG users in 2021, with e-cigarette use being the highest among adults aged 18–24 (11.0%)(2). In the U.S., ECIG sales increased from 15.7 million units to 22.9 million units between February 2020 and September 2023, representing an increase of 46.1%(3). In Morocco, according to the results of the Mediterranean School Survey Project on Alcohol and other Drugs (MEDSPAD) in 2021, the lifetime prevalence of e-cigarette use was 12.5% among high-school students aged 15-17 years, with a prevalence of 21.1% among boys and 5.2% among girls. Data from this survey showed a higher prevalence of e-cigarette use than tobacco use among Moroccan high school students(4). On the other hand, the 2017 Stepwise National Survey on Common Risk Factors for Noncommunicable Diseases reported a low prevalence of e-cigarette use of 0.6% in the Moroccan population, and of 1.12% among young adults aged 18 to 29(5).

ECIGs consist of a battery, an electric heater, and a liquid that is heated to produce an aerosol that is inhaled by the user. These liquids may contain nicotine, as well as at least one solvent (usually propylene glycol and/or vegetable glycerin) and flavorings(1). ECIGs can differ based on a variety of features. There are electronic nicotine delivery systems (ENDS) and electronic non-nicotine delivery systems (ENNDS)(6). ECIGs appears to be harmful, in short term, to multiple organ systems, including the cardiovascular, pulmonary, neurological, and immune systems. ECIGs use was reported to be associated with increased heart rate and diastolic blood pressure, increased asthma exacerbation, and chronic bronchitis in short term (7–9). Moreover, there is substantial evidence that ENDS can cause dependence or addiction in non-smokers, and strong evidence that young non-smokers who use ENDS are more likely than ENDS non-users to initiate tobacco smoking and to become regular smokers(10). Conversely, a recent systematic review

(2024) found that there is high-certainty evidence that ENDS increase tobacco quit rates compared to nicotine replacement therapy and there is moderate-certainty evidence that ENDS increase tobacco quit rates compared to ENNDS(11). A growing body of evidence suggests that higher vaping frequency, longer duration of ECIG use, use of nicotine-containing products, and higher e-liquid nicotine concentrations are associated with greater dependence levels(12,13). However, the current body of evidence is limited, in terms of long-term effects on organ systems(10,14). Similarly, there are no studies available on the mid- and long-term carcinogenic effects(15).

Medical students' attitude toward e-cigarettes is likely unique and may be important to explore, as they will be involved in smoking and vaping cessation promotion as part of the preventive healthcare program in the future. Therefore, due to their young age, medical students may have had close contact with vaping friends but also with friends who smoked tobacco. In fact, having three or more close friends who smoked any tobacco product was reported to be a reinforcing factor for e-cigarette initiation(16). However, due to their health education, they may be less likely to be e-cigarette users than their non-medical peers. As in a Chinese study conducted in 2021, the prevalence of e-cigarettes use was significantly higher among non-medical students than medical students(17). To our knowledge, no Moroccan study exploring vaping among medical students has been published. Therefore, the objectives of this study were to describe Moroccan medical students' knowledge of and attitudes toward electronic cigarettes, to estimate the prevalence of e-cigarette use among them, and to identify factors associated with this practice.

METHODS

Study design and setting

A cross-sectional study was carried out at the Faculty of Medicine and Pharmacy of Casablanca (FMPC)

Study population and sampling

All medical students enrolled at the FMPC from the first to the sixth year during the 2020-2021 academic year were included. A non-probability convenience sampling method was used. The sample size was calculated assuming an expected prevalence of lifetime e-cigarette use of 50%, a 5% alpha risk, and a 5% precision, based on a finite population of 2,811 medical students enrolled during the 2019–2020 academic year. The minimum required sample size was therefore 338 students. Sample size estimation was performed using EpiInfo software (version 7.2.4.0).

Data collection

Data were collected using a pre-tested, self-administered questionnaire. The pre-test was conducted on 20 students of the Faculty of Dentistry to check the understanding of the questions and to estimate the response time. Given

the epidemic context related to COVID-19, the link of the Google Forms questionnaire was shared online on the social platforms of FMPC medical students (WhatsApp groups). Data collection was conducted from August 2020 to April 2021.

The first section of the questionnaire collected sociodemographic information, including sex, year of study, and whether participants had a family member or close friend who smoked tobacco or used e-cigarettes. The second section assessed participants' knowledge of e-cigarettes, including their recognition as rechargeable battery-powered devices, their perceived cost and addictive potential compared with conventional cigarettes, and awareness of regulations governing e-cigarette use. The third section explored attitudes toward e-cigarettes, including perceptions of their role as a smoking cessation aid, their health effects, and opinions regarding the regulation of e-cigarette use. The final section assessed lifetime e-cigarette use, tobacco smoking, and characteristics of e-cigarette use. Lifetime e-cigarette use was defined as having used an e-cigarette at least once and included current users, former users, and individuals who had only experimented with vaping once or twice.

Data analysis

SPSS IBM Version 16 software was used for data analysis. Categorical variables were described using frequencies and percentages, and quantitative variables using means and standard deviations. The chi-square test of independence was used to study associations between categorical variables. The significance level was set at 0.05.

Ethical considerations

Participants were informed of the purpose of the survey through an introductory section at the beginning of the questionnaire. Informed consent for participation and publication of data was obtained through a mandatory question in Google Forms prior to participation. Anonymity and confidentiality of the collected data were ensured.

Use of generative AI

ChatGPT (OpenAI) was used solely to assist with language editing, grammar correction, and improvement of the manuscript's readability. It was not used for the study design, data analysis, interpretation of findings, or any other scientific aspect of the research. The authors reviewed and edited the output as necessary and take full responsibility for the final content of the manuscript.

RESULTS

Sociodemographic characteristics of participants

Of the 491 medical students who participated in our study, the mean age was 21.0 ± 2.3 years, with extremes

ranging from 17 to 30 years. The female/male ratio was 1.94. First and sixth year students were the most represented.

Of the students surveyed, 69.7% reported having a family member or close friend who smoked conventional cigarettes and 66.8% had a family member or close friend who used e-cigarettes (Table 1).

Table 1. Sociodemographic and personal characteristics of medical students (n= 491)

Characteristics		Total n (%)	Electronic cigarette use n (%)	p-value
Sex	Male	167 (34.0)	68 (40.7)	<0.001
	Female	324 (66.0)	31 (9.6)	
Year of study	First	101 (20.6)	20 (19.8)	<0.001
	Second	87 (17.7)	11 (12.6)	
	Third	68 (13.8)	8 (11.8)	
	Fourth	77 (15.7)	8 (10.4)	
	Fifth	64 (13.0)	30 (46.9)	
	Sixth	94 (19.1)	22 (23.4)	
Tobacco smoking	Yes	100 (20.4)	74 (74.0)	<0.001
	No	391 (79.6)	25 (6.4)	
Family member/ close friend smoking conventional cigarettes	Yes	342 (69.7)	87 (25.4)	<0.001
	No	149 (30.3)	12 (8.1)	
Family member/ close friend a user of e-cigarettes	Yes	328 (66.8)	90 (27.4)	<0.001
	No	163 (33.2)	9 (5.6)	

Medical students' knowledge about e-cigarette

Almost all participants (96.3%) had heard of e-cigarettes. The majority of students knew that e-cigarette is a reusable device (83.9%) and that it is the secondary source of nicotine exposure (73.9%). More than two-thirds of students (70.5%) were unaware of the existence of a system to regulate the use of e-cigarettes (Table 2).

Table 2. Medical students' knowledge about electronic cigarettes (n=491)

	True (%)	False (%)	Don't know (%)
E-cigarettes are the secondary source of nicotine exposure	363 (73.9)*	38 (7.7)	90 (18.4)
E-cigarettes are more addictive than tobacco products (cigarettes, pipes, cigars, chicha/ hookah, etc. ...)	114 (23.2)	208 (42.4)*	169 (34.4)
In general, the overall cost of e-cigarettes is lower than that of tobacco cigarettes	258 (52.5)*	148 (30.1)	85 (17.4)
E-cigarettes are battery-powered devices that do not burn tobacco	297 (60.5)*	59 (12.0)	135 (27.5)
All Moroccan consumers must provide proof of age to purchase e-cigarettes	124 (25.3)*	179 (36.5)	188 (38.2)
Regulatory systems have been put in place to restrict the use of e-cigarettes	145 (29.5)*	83 (16.9)	263 (53.6)
E-cigarettes are reusable	412 (83.9)*	2 (0.4)	77 (15.7)

*Correct response

Medical students' attitudes toward electronic cigarettes

On medical students' attitudes toward e-cigarettes as a smoking cessation aid, more than half of them (55.7%) agreed that e-cigarettes are an effective way to quit smoking, and 29.4% agreed that e-cigarettes are more effective at quitting smoking than nicotine replacement therapy products. Regarding the health risks of e-cigarette use, almost all participants (92.3%) disagreed

that e-cigarettes contain no carcinogens. The majority of students agreed that vaping is less harmful than tobacco smoking (73.5%), and that the health consequences of vaping were less severe than those of tobacco smoking (70.0%). On the subject of regulating e-cigarette consumption, almost all medical students agreed that e-cigarettes should not be sold to minors (95.3%), and that e-cigarette advertising should be banned from radio and television (92.1%) (Table 3).

Table 3. Medical students' attitudes toward electronic cigarettes

		Total n (%)	Electronic cigarette use n (%)	p-value
E-cigarettes are an effective way to quit smoking (n=483)	Agree	269 (55.7)	65 (24.2)	0.025*
	Disagree	214 (44.3)	34 (15.9)	
E-cigarettes are more effective at quitting smoking than nicotine replacement therapy products (489)	Agree	144 (29.4)	39 (27.1)	0.009**
	Disagree	345 (70.6)	58 (16.8)	
Vaping is less harmful than smoking tobacco (n=491)	Agree	361 (73.5)	83 (23.0)	0.009**
	Disagree	130 (26.5)	16 (12.3)	
The consequences of vaping are less serious than those of tobacco smoking (n=490)	Agree	343 (70.0)	78 (22.7)	0.033*
	Disagree	147 (30.0)	21 (14.3)	
Passive vaping can damage people's health (n=476)	Agree	427 (89.7)	68 (15.9)	0.001***
	Disagree	49 (10.3)	17 (34.7)	
E-cigarettes contain no cancer-causing agents (n=491)	Agree	38 (7.7)	13 (34.2)	0.025*
	Disagree	453 (92.3)	86 (19.0)	
E-cigarette advertising should be banned from radio and television (n=491)	Agree	452 (92.1)	88 (19.5)	0.192
	Disagree	39 (7.9)	11 (28.2)	
E-cigarettes should be taxed in the same way as tobacco products (n=491)	Agree	349 (71.1)	76 (21.8)	0.162
	Disagree	142 (28.9)	23 (16.2)	
E-cigarettes should be subject to the same national regulations as tobacco products (n=490)	Agree	404 (82.4)	84 (20.8)	0.482

*p ≤ 0,05 ; **p ≤ 0,01 ; ***p ≤ 0,001

Prevalence of tobacco smoking and smoking cessation using electronic cigarette

Among our participants, 100 medical students (20.4%) had smoked tobacco in at least one form (cigarette, cigar, shisha or hookah, etc.). Of the latter, 27 students (27.0%) reported using e-cigarettes as a smoking cessation aid. The results of this quitting attempt were mainly a complete cessation of smoking for 63.5% of them, while 25.0% did not change their smoking habits.

Prevalence and characteristics of electronic cigarette use

Ninety-nine medical students had used e-cigarette at least once, corresponding to a prevalence of 20.2% with a 95% confidence interval of [16.6% ; 23.7%]. Of the latter, 75.8% (n=75) had used them in the past 12 months. More than half of e-cigarette users (55.6%) reported using them rarely, and almost a quarter (21.2%) said they used them daily. Among e-cigarette users, 74 students out of 99 (74.7%) had also been a tobacco smoker and 25.3% had never smoked tobacco products. The majority of e-cigarette users (85.9%) preferred to use it alone and not in combination with other products, and

(36.4%) were using it in combination with conventional cigarettes. Among e-cigarette users, 85.9% said they started using e-cigarettes out of curiosity. Other reported reasons included boredom (34.3%), and imitation of others (21.2%) (Table 4). A quarter (26.3%) of e-cigarette users affirmed started vaping in order to quit smoking. Half of e-cigarette users (49.5%) said they have tried to quit. Of these, 67.3% were able to do so successfully. Difficulty in quitting e-cigarettes was reported by 46 of them. This difficulty was mainly linked to dependence or addiction for 50.0% of the students, and to a lack of determination for 17.4% of them.

Electronic cigarettes use associated factors

Being a male (p<0.001), smoking tobacco (p<0.001), having a family member or close friend who uses e-cigarettes (p<0.001), and having a family member or close friend a user of traditional cigarettes (p<0.001) were significantly associated with e-cigarette use among medical students (Table 1).

The proportion of e-cigarette users was significantly higher among medical students who believed that e-cigarettes are an effective way to quit smoking ($p=0.025$) and that e-cigarettes are more effective at quitting smoking than nicotine replacement therapy products ($p=0.009$). E-cigarette use was significantly associated with beliefs that vaping is less harmful than smoking tobacco ($p=0.009$), that the consequences of vaping are less serious than those of smoking tobacco ($p=0.033$), and that e-cigarettes do not contain carcinogens ($p=0.025$). The proportion of e-cigarette users was significantly higher among medical students who disagreed that passive vaping can harm people's health ($p=0.001$) (Table 3).

Table 4. Characteristics of electronic cigarette use among medical students (n=99)

Characteristics of e-cigarette use	n (%)
Frequency of electronic cigarette use	Rarely
	55 (55.6)
	Once in a while
	10 (10.1)
Previously smoked tobacco products	Several times a week
	10 (10.1)
	Every day
	21 (21.2)
Usage of e-cigarettes	Yes
	74 (74.7)
Reasons for starting e-cigarette use	Never
	25 (25.3)
	Used alone
	85 (85.9)
Usage of e-cigarettes	Combined with traditional cigarettes
	36 (36.4)
	Combined with chicha/ hookah
	16 (16.2)
Reasons for starting e-cigarette use	Combined with another product
	11 (11.1)
	Curiosity
	85 (85.9)
Reasons for starting e-cigarette use	Imitation of others
	21 (21.2)
	Feeling grown-up
	14 (14.1)
Reasons for starting e-cigarette use	Boredom
	34 (34.3)
	For no apparent reason
	48 (48.5)
Reasons for starting e-cigarette use	To defy a prohibition
	16 (16.2)
Reasons for starting e-cigarette use	Other
	18 (18.2)

Discussion

To our knowledge, this study is the first Moroccan study to examine the perception of e-cigarette and e-cigarette use prevalence among medical students. Electronic cigarette use was common among our participants and was significantly associated with male gender, tobacco smoking, social exposure to smokers or vapers, and favorable beliefs regarding their safety and effectiveness for smoking cessation. Our study has therefore some limitations. First, we adopted a convenience sampling approach, which may have introduced selection bias and limits the generalizability of the findings to all Moroccan medical students. The exceptional constraints imposed by the COVID-19 pandemic prevented the use of probability-based sampling methods. Secondly, the reliance on self-reported data may have led to social desirability bias and potential misclassification of students regarding their vaping behavior.

The prevalence of lifetime e-cigarette use found among medical students in our study was 20.2%, with a prevalence of daily use of 4.3%. Similar results were reported by an Italian study (2017-2018) with 24.6% of healthcare students had already tried e-cigarettes(18). Similarly, the prevalence of e-cigarette use among medical students in Saudi Arabia ranged from 10.6% to 27.7%, according to a systematic review of articles published in Saudi Arabia between 2010 and 2020(19). However, a higher prevalence of 32.4% was reported in a study of Saudi and Bahraini (2022)(20). While a Brazilian study (2016-2018) reported a lower prevalence of experimentation with and current use of e-cigarettes of 13.1% and 2.3% respectively(21). Much lower prevalences were reported by two studies; a Pakistani study (2016), with 6.2% of medical students reporting having used e-cigarettes, of whom 1.2% reporting daily use, and a Malaysian study (2021) reporting a prevalence of lifetime use of 6.4% among a private medical university students (22,23). These differences may be due to differences relating to e-cigarette advertising, sales, accessibility, importation taxes but also socioeconomic level of countries. In addition, a higher prevalence of vaping among adolescents has been reported to be associated with higher tobacco taxes in some countries(24). Observed differences could also be explained by differences in study methodology and study period. Various regulatory approaches to the use of e-cigarettes have been implemented in different countries in recent years. In Morocco, the Finance law project for 2024 called for an increase in the importation duty rate applicable to disposable electronic cigarettes from 2.5% to 40%(25).

Regarding their attitude toward ECIG as a smoking cessation aid, 55.7% of our participants agreed that ECIG are an effective way to quit smoking. A lower proportion was reported by a multinational study among medical students and physicians-in-training, with 32.4% of them endorsing e-cigarettes to quit smoking(26). A much lower proportion was reported in the Saudi-Bahraini study, with 23.9% of medical students believing that ECIG are a helpful tool for smoking cessation(20). A Chinese systematic review (2024) reported that ECIG were more effective than no treatment in encouraging tobacco smoking abstinence(27). Other recent systematic reviews concluded that there is a high certainty that nicotine ECIG are more effective than conventional nicotine replacement or behavioral smoking cessation therapies (11,28). However, other systematic reviews reported inconclusive results or low to moderate certainty evidence regarding their effectiveness(29,30). Therefore, ECIGs are not currently approved as a smoking cessation aid. A Tunisian study conducted among physicians reported that the recommendation of ECIGs as a smoking cessation tool was negatively associated with training in addictology ($p = 0.027$)(31), highlighting the importance of adequate training in shaping appropriate attitudes toward smoking cessation counselling. In our study, 73.5% of students agreed that vaping is less harmful than tobacco smoking, a proportion substantially higher than those reported in Poland (38%), Saudi Arabia (30.8%), and a multinational study (27.4%) (26,32,33). Current evidence suggests that

ECIG may be a healthier alternative to cigarette smoking for periodontal health(34). However their effects on many important health outcomes compared to traditional cigarettes are uncertain(10). In our study, only a small proportion of medical students (10.3%) disagreed that passive vaping can damage people's health. In contrast, more than a third of trainees in the multinational study did not acknowledge the risks of passive exposure to e-cigarette (42.9%)(26). Therefore, it was reported that with prolonged exposure and close proximity to active vapers, passive vapers may be at risk for potential health effects of harmful e-cigarette chemicals(35). In our study, the majority of ECIG users (85.9%) said they started using it out of curiosity. Similarly, curiosity was the major reason for e-cigarette experimentation reported by the Brazilian study(21). Whereas the Saudi-Bahraini study reported that 41.1% of students smoked e-cigarettes because they thought they were less harmful and 24.3% smoked e-cigarettes to try something new(20).

In our study, ECIG use was significantly higher among male compared to female medical students. Similar findings were reported in the literature (16,19,20,22). In fact, Stanton et al. recently suggested that male gender is a significant predictor of e-cigarette prior initiation and initiation with progression(36). Tobacco smoking was significantly associated with ECIG use in our study. Comparable results were reported by the Saudi-Bahraini study and the Pakistani study(20,22). Having a family member or a close friend who uses e-cigarettes or traditional cigarettes was significantly associated with ECIG use in our study, consistent with findings in the literature (16,21). The influence of social networks on substance use behaviors has been consistently reported in the literature. A recent meta-analysis showed that peer influence is a significant predictor of substance use initiation and maintenance, highlighting the role of social environments in shaping risky health behaviors(37).

CONCLUSION

Electronic cigarette use was common among our participants and was significantly associated with male gender, tobacco smoking, social exposure to smokers or vapers, and favorable beliefs regarding their safety and effectiveness for smoking cessation. In the light of this findings we suggest introducing a specific course in the medical school curriculum on dangers of vaping and vaping cessation techniques. This could have multiple benefits ; helping vaping students to quit, preventing non-users from vaping initiation, but also properly preparing them for their future task of providing tobacco and electronic cigarette cessation counseling.

REFERENCES

- Breland A, Soule E, Lopez A, Ramôa C, El-Hellani A, Eissenberg T. Electronic cigarettes: what are they and what do they do? *Ann N Y Acad Sci.* 2017;1394(1):5-30. doi:10.1111/nyas.12977
- Kramarow EA, Elgaddal N. Current electronic cigarette use among adults aged 18 and over: United States, 2021. *NCHS Data Brief*, no 475. Hyattsville, MD: National Center for Health Statistics. 2023. 10.15620/cdc.129966
- US Centers for Disease Control and Prevention. About E-Cigarettes (Vapes). Accessed : June 15, 2026: <https://www.cdc.gov/tobacco/e-cigarettes/about.html>
- El Omari F, Toufiq J, Sabir M et al. Evaluation de l'usage de substances psychoactives et du comportement addictif auprès des élèves scolarisés au Maroc : l'enquête nationale MedSPAD-IV Maroc 2021 n.d. Accessed: June 15, 2026: <http://www.abhatoo.net.ma/maalama-textuelle/developpement-economique-et-social/developpement-social/sante-publique/evaluation-de-l-usage-de-substances-psychoactives-et-du-comportement-addictif-aupres-des-eleves-scolarises-au-maroc-l-enquete-nationale-medspad-iv-maroc-2021>
- Ministry of Health (Morocco). Rapport de l'enquête nationale sur les facteurs de risque communs des maladies non transmissible, STEPS, 2017-2018. Accessed : June 15, 2026: <https://www.sante.gov.ma/Documents/2019/05/Rapport%20de%20l%20enqu%C3%AAt%20stepwise.pdf>
- World Health Organization. Tobacco: E-cigarettes.2024. Accessed : June 15, 2026: <https://www.who.int/news-room/questions-and-answers/item/tobacco-e-cigarettes>
- Cao DJ, Aldy K, Hsu S, McGettrick M, Verbeck G, De Silva I, et al. Review of Health Consequences of Electronic Cigarettes and the Outbreak of Electronic Cigarette, or Vaping, Product Use-Associated Lung Injury. *J Med Toxicol Off J Am Coll Med Toxicol.* juill 2020;16(3):295-310. doi:10.1007/s13181-020-00772-w PubMed PMID: 32301069; PubMed Central PMCID: PMC7320089.
- Li X, Zhang Y, Zhang R, Chen F, Shao L, Zhang L. Association Between E-Cigarettes and Asthma in Adolescents: A Systematic Review and Meta-Analysis. *Am J Prev Med.* juin 2022;62(6):953-60. doi:10.1016/j.amepre.2022.01.015 PubMed PMID: 35337694.
- Eltorai AE, Choi AR, Eltorai AS. Impact of Electronic Cigarettes on Various Organ Systems. *Respir Care.* 2019 Mar;64(3):328-336. doi: 10.4187/respcare.06300.
- Banks E, Yazidjoglou A, Brown S, Nguyen M, Martin M, Beckwith K, et al. Electronic cigarettes and health outcomes: umbrella and systematic review of the global evidence. *Med J Aust.* 3 avr 2023;218(6):267-75. doi:10.5694/mja2.51890 PubMed PMID: 36939271; PubMed Central PMCID: PMC10952413.
- Lindson N, Butler AR, McRobbie H, Bullen C, Hajek P, Begh R, et al. Electronic cigarettes for smoking cessation. *Cochrane Database Syst Rev.* 8 janv 2024;1(1):CD010216. doi:10.1002/14651858.CD010216.pub8 PubMed PMID: 38189560; PubMed Central PMCID: PMC10772980.
- Moussa C, Mahmoud N, Rouis H, Khattab A, Zendah I, Maâlej S. [Not Available]. *Tunis Med.* 5 juin 2023;101(6):580-4. PubMed PMID: 38372554; PubMed Central PMCID: PMC11388089.
- Kundu A, Sanchez S, Seth S, Feore A, Sutton M, Sachdeva K, et al. Evidence update on e-cigarette dependence: A systematic review and meta-analysis. *Addict Behav.* avr 2025;163:108243. doi:10.1016/j.addbeh.2024.108243 PubMed PMID: 39826373.
- Wasfi RA, Bang F, de Groh M, Champagne A, Han A, Lang JJ, et al. Chronic health effects associated with electronic cigarette use: A systematic review. *Front Public Health.* 2022;10:959622. doi:10.3389/fpubh.2022.959622 PubMed PMID: 36276349; PubMed Central PMCID: PMC9584749.
- Travis N, Knoll M, Cadham CJ, Cook S, Warner KE, Fleischer NL, et al. Health Effects of Electronic Cigarettes: An Umbrella Review and Methodological Considerations. *Int J Environ Res Public Health.* 25 juill 2022;19(15):9054. doi:10.3390/ijerph19159054 PubMed PMID: 35897421; PubMed Central PMCID: PMC9330875.
- Benjakul S, Nakju S, Termsirikulchai L. Use of e-cigarettes among public health students in Thailand: Embedded mixed-methods design. *Tob Induc Dis.* 2022;20:78. doi:10.18332/tid/152256 PubMed PMID: 36128402; PubMed Central PMCID: PMC9449824.
- Song H, Yang X, Yang W, Dai Y, Duan K, Jiang X, et al. Cigarettes smoking and e-cigarettes using among university students: a cross-section survey in Guangzhou, China, 2021. *BMC Public Health.* 7 mars 2023;23(1):438. doi:10.1186/s12889-023-15350-2
- Prigitano A, Binda S, Pariani E, Destrebecq A, Castaldi S, Cogliati M, et

- al. Tobacco and e-cigarette smoking habits among Italian healthcare students. *Ann Ig Med Prev E Comunita*. 2020;32(6):608-14. doi:10.7416/ai.2020.2382 PubMed PMID: 33175072.
19. Patil S, Fageeh HN, Mushtaq S, Ajmal M, Chalikkandy SN, Ashi H, et al. Prevalence of electronic cigarette usage among medical students in Saudi Arabia - A systematic review. *Niger J Clin Pract*. juin 2022;25(6):765-72. doi:10.4103/njcp.njcp_2006_21 PubMed PMID: 35708416.
 20. Turkistani YA, Dahlawi M, Bukhari RI, Aldabbagh M, Turkistani YA, Malosh A. Electronic Cigarette Prevalence and Knowledge Among Medical Students in Saudi Arabia and Bahrain: A Cross-National Study. *Cureus*. sept 2023;15(9):e45583. doi:10.7759/cureus.45583 PubMed PMID: 37868497; PubMed Central PMCID: PMC10587730.
 21. Martins SR, Araújo AJ de, Wehrmeister FC, Freitas BM, Basso RG, Santana ANC, et al. 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 Publicacao Of Soc Bras Pneumol E Tisiologia*. 2023;49(1):e20210467. doi:10.36416/1806-3756/e20210467 PubMed PMID: 36700569; PubMed Central PMCID: PMC9970372.
 22. Iqbal N, Khan ZA, Anwar SMH, Irfan O, Irfan B, Mushtaq A, et al. Electronic cigarettes use and perception amongst medical students: a cross sectional survey from Sindh, Pakistan. *BMC Res Notes*. 22 mars 2018;11(1):188. doi:10.1186/s13104-018-3303-z PubMed PMID: 29566743; PubMed Central PMCID: PMC5863800.
 23. Yew Shen Y, Ramzi NH, Gopinath D. Personality Traits and Sociodemographic Factors Associated with the Use of E-Cigarettes, Waterpipe and Conventional Cigarettes among Medical University Students. *Int J Environ Res Public Health*. 8 juin 2022;19(12):7000. doi:10.3390/ijerph19127000 PubMed PMID: 35742249; PubMed Central PMCID: PMC9222766.
 24. Chan GCK, Gartner C, Lim C, Sun T, Hall W, Connor J, et al. Association between the implementation of tobacco control policies and adolescent vaping in 44 lower-middle, upper-middle, and high-income countries. *Addiction*. 2022;117(8):2296-305. doi:10.1111/add.15892
 25. Ministry of Economy and Finance, Kingdom of Morocco. *Loi de Finances 2024*. Accessed : June 15, 2026: <https://www.finances.gov.ma/Maliya%20tawassol/SLF-22-2024.pdf>
 26. Bruno FP, Degani-Costa LH, Kandipudi KLP, Gushken F, Szleif C, Tokeshi AB, et al. Medical Trainees' Knowledge and Attitudes Towards Electronic Cigarettes and Hookah: A Multinational Survey Study. *Respir Care*. 28 févr 2024;69(3):306-16. doi:10.4187/respcare.11042 PubMed PMID: 38416660; PubMed Central PMCID: PMC10984587.
 27. Meng Y, Xiang S, Qu L, Li Y. The efficacy and acceptability of pharmacological monotherapies and e-cigarette on smoking cessation: a systemic review and network meta-analysis. *Front Public Health*. 2024;12:1361186. doi:10.3389/fpubh.2024.1361186 PubMed PMID: 38841681; PubMed Central PMCID: PMC11150810.
 28. Levett JY, Filion KB, Reynier P, Prell C, Eisenberg MJ. Efficacy and Safety of E-Cigarette Use for Smoking Cessation: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Am J Med*. août 2023;136(8):804-813.e4. doi:10.1016/j.amjmed.2023.04.014 PubMed PMID: 37148992.
 29. Liber AC, Knoll M, Cadham CJ, Issabakhsh M, Oh H, Cook S, et al. The role of flavored electronic nicotine delivery systems in smoking cessation: A systematic review. *Drug Alcohol Depend Rep*. juin 2023;7:100143. doi:10.1016/j.dadr.2023.100143 PubMed PMID: 37012981; PubMed Central PMCID: PMC10066538.
 30. Vyas N, Bennett A, Hamel C, Beck A, Thuku M, Hersi M, et al. Effectiveness of e-cigarettes as a stop smoking intervention in adults: a systematic review. *Syst Rev*. 29 juin 2024;13(1):168. doi:10.1186/s13643-024-02572-7 PubMed PMID: 38951828; PubMed Central PMCID: PMC11218295.
 31. Kammoun I, Hajri A, Driss F, Zalila H, Maamri A. [Not Available]. *Tunis Med*. 5 juin 2024;102(6):366-71. doi:10.62438/tunismed.v102i6.4726 PubMed PMID: 38864201; PubMed Central PMCID: PMC11358830.
 32. Mroczek PJ, Tyrpień-Golder KM, Janoszka BM, Szumska M. Medical students' awareness of e-cigarette use addiction. *Environ Med*. 16 janv 2024;26(3-4):60-6. doi:10.26444/ms/174281
 33. Alshanberi AM, Baljoon T, Bokhari A, Alarif S, Madani A, Hafiz H, et al. The prevalence of E-cigarette uses among medical students at Umm Al-Qura University; a cross-sectional study 2020. *J Fam Med Prim Care*. sept 2021;10(9):3429-35. doi:10.4103/jfmpc.jfmpc_1496_20 PubMed PMID: 34760769; PubMed Central PMCID: PMC8565129.
 34. Thiem DGE, Donkiewicz P, Rejaey R, Wiesmann-Imilowski N, Deschner J, Al-Nawas B, et al. The impact of electronic and conventional cigarettes on periodontal health-a systematic review and meta-analysis. *Clin Oral Investig*. sept 2023;27(9):4911-28. doi:10.1007/s00784-023-05162-4 PubMed PMID: 37526741; PubMed Central PMCID: PMC10492702.
 35. Su WC, Lin YH, Wong SW, Chen JY, Lee J, Buu A. Estimation of the dose of electronic cigarette chemicals deposited in human airways through passive vaping. *J Expo Sci Environ Epidemiol*. nov 2021;31(6):1008-16. doi:10.1038/s41370-021-00362-0
 36. Stanton CA, Tang Z, Sharma E, Seaman E, Gardner LD, Silveira ML, et al. Predictors of E-cigarette and Cigarette Use Trajectory Classes from Early Adolescence to Emerging Adulthood Across Four Years (2013–2017) of the PATH Study. *Nicotine Tob Res*. 11 mai 2022;25(3):421-9. doi:10.1093/ntr/ntac119 PubMed PMID: 35554569; PubMed Central PMCID: PMC9910140.
 37. Awua J, Tuliao AP, Gabben-Mensah D, Kanjor F, Botor NJB, Ohene L, et al. Interpersonal communication and perceived norms as social influence mechanisms of e-cigarette use among adults: a systematic review. *Am J Drug Alcohol Abuse*. 3 mai 2024;50(3):291-304. doi:10.1080/00952990.2024.2346928 PubMed PMID: 38832973; PubMed Central PMCID: PMC12035739.