Original Paper

E-cigarettes Perceptions and Use among Jordanian Medical Students

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Abstract

Purpose: *Medical students are the cornerstone for future public health awareness; this study aimed to assess e-cigarettes perceptions and use among medical students.*

Methods: *This is a cross-sectional, questionnaire-based national study. The study included all five medical schools in the country and addressed students in their clinical years. Data were collected through a self-administered and structured paper-based questionnaire between Dec 1, 2018, and Mar 30, 2019. Data obtained were analyzed using IBM SPSS Statistics for Windows and univariate inferential tests were employed to examine differences between groups.*

Results: *A total sample of 1819 (97.4%) students returned their questionnaires; with a declaration of their smoking habits from the five medical schools, 47% are males, and 53% are females. Only 13 students 0.7% of all students or 2.1% of all smokers used e-cigarettes solely, but 177 students 9.5% of all students or 29% of all smokers used e-cigarettes combined with other types of smoking. Most medical students (86%) were aware of e-cigarettes. The main motive behind using e-cigarettes was the rare and different flavors provided by these cigarettes. The general perception among smokers and non-smokers is that e-cigarettes are less harmful and helpful in quitting smoking.*

Conclusion: *Most medical students are aware of e-cigarettes. While their use as the only form of smoking is rare, e-cigarettes are frequently used in combination with other types of smoking.*

Keywords

Electronic cigarettes, smoking, medical students, perception

1. Introduction

Electronic cigarettes, electronic nicotine delivery systems (ENDS), or "e-cigarettes" generally consist of a power source (usually a battery) and a heating element (commonly referred to as an atomizer) that vaporizes a solution (e-liquid). Manufacturing companies now advertise these devices as a pleasant method to quit smoking (Brown & Cheng, 2014). However, there is uncertainty about the safety of this tool for nicotine replacement therapy (Malas et al., 2016). The use of e-cigarettes has increased significantly worldwide, at least doubling from 2008 to 2014 in North America and Europe among both adolescents and adults (WHO, 2014). However, there is very little or no data regarding the use of e-cigarettes in the developing countries, Jordan as an example. There is also a gap in our knowledge concerning the effect of second-hand smoking on e-cigarettes (Czogala et al., 2014; Schober et al., 2014).

The use of e-cigarettes is a controversial issue even among medical personnel, with some doctors advocating their use as a way of helping smokers quit regular smoking because their long-term effect is still unknown. Available data on the knowledge and use of e-cigarettes in developing countries are scarce. In general, medical students in their clinical years interact with patients and are considered the cornerstone of future medical practice. Therefore, it is crucial to gain information about the prevalence, knowledge, and attitude towards this new epidemic, which is already spreading to developing countries. Only a few studies were done on the use of e-cigarettes among medical students. One study in Poland showed that 1.3% of medical students were e-cigarette users, whereas 2.2% were dual smokers (Brożek et al., 2017). An investigation of Pakistani medical students found a higher percentage of e-cigarette users (6.2%) (Nousheen et al., 2018). This study aimed firstly to assess the smoking habits and preferences among medical students, including the frequency, perceptions, and knowledge about the harmfulness of e-cigarettes. Secondly, to find out the patterns and intentions to use e-cigarettes among those students, and finally to assess the awareness and motive of medical students to use e-cigarettes.

2. Method

2.1 Study Design

This is a cross-sectional study, and the study employed a self-reported survey questionnaire between Dec. 1, 2018, and Mar. 30, 2019.

2.2 Setting and Participants

The study sample was selected by random sampling from all five Jordanian medical schools in the country, including both national and international students, in their clinical years (i.e., 4th, fifth and sixth years).

A computer-generated random number list of all medical students at their clinical year in Jordanian

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universities was prepared. Eligibility criteria were all male and female, Jordanian, and non-Jordanian medical students at clinical year (4th, 5th, and 6th year of study). A simple random sampling method was employed to select even-numbered students to recruit a representative and adequate sample for this study. Randomization involved participants had a potential similar chance to be selected in the study sample at a higher than zero probability (Salkind et al., 2010; Polit & Beck, 2012). Thus, any observed differences in outcome may result from differences between the groups' characteristics (Vickers et al., 2008). Analysis using g* power showed that the required sample size is 1647 for the chi-squared test (Faul et al., 2009). This figure was associated with a power of 0.90, α of 0.05 (2-tailed), and an effect size of 0.1 (small effect). A sample of 1868 students was achieved.

2.3 Measures

A self-reported questionnaire was developed to assess the frequency, perceptions, and harmfulness of e-cigarettes, patterns, and intentions to use e-cigarettes, and awareness and motives of medical students to use e-cigarettes. The study questionnaire was self-administered, developed in English since it is the language of medical student's study. The Questionnaire is divided into four main parts, the first part asked about the Medical students' characteristics, which included sex, age in years, nationality (Jordanian, non-Jordanian), clinical study year (4th., 5th., 6th.), university, living status (with a family member, with a friend, hostel, alone), and monthly allowance in Jordanian Dinars.

The second part of the Questionnaire addressed medical students' awareness, ever use, and intention to use e-cigarettes were participants were asked to indicate if they were aware of e-cigarettes, had ever used them. Intention to use e-cigarettes, all questions mentioned above were mainly yes-no questions.

The third part asked the participant about the frequency of e-cigarettes smoking and other types of smoking or dual smoking (yes=1/no=0). Hence, the frequency of e-cigarettes smoking, cigarette smoking, water pipe, cigarette and water pipe, water pipe and e-cigarettes, cigarettes, and e-cigarettes, and all types of smoking were reported. The Questionnaire asked participants about the frequency of smoking and the duration of smoking. The questions divided the frequency of e-cigarettes smoking into three categories: daily bases, occasionally (not daily bases), and social (primarily in social contexts). Also, e-cigarettes smoking duration was divided into the following categories: less than one year, 1-2 years, 3-5 years, 6-10 years, and more than ten years. Additionally, all previous data were reported on cigarette smoking to reveal comparative data between cigarette and e-cigarettes smokers to the pattern of smoking.

The fourth part of the Questionnaire consisted of A Likert type scale collected data on perceptions and perceived harmfulness of e-cigarettes among medical students. Six paragraphs include the items of the medical student's perception, and five include the items of perceived harmfulness that were developed by researchers and based on literature. These 11 items were subjected to validation by researchers and experts, assessing comprehensiveness, clarity, avoidance of ambiguity, and content validity. We also validated these items and the whole survey in a pilot study that involved 30 medical students who completed the survey. Depending on the items of the scales, the internal validity (Cronbach's alpha)

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ranged between 0.72-0.84.

For each item in the perception scale, participants were asked to indicate their degree of appropriateness according to their knowledge (yes, no, neutral). For each item in the perceived harmfulness scale, participants were asked to choose the only item they perceive e-cigarettes are harmful in relation to cigarettes and waterpipe smoking.

At the end of this part we added a question about motives drive the participant to use e-cigarettes.

2.4 Ethical Considerations

The study was approved by the institutional review board (IRB) of Jordan University Hospital and conducted according to the declaration of Helsinki's latest update (2013). Participation was voluntary. The anonymity and confidentiality of medical students' participants were ensured by assigning identification numbers to participants, restricted to the research team. The Questionnaire contained detailed information about the study's objectives and returned questionnaires implied consent. Written consent was obtained from participants, and they could choose to leave the study at any time.

2.5 Data Collection

A detailed explanation of the study was presented to medical students at participating universities. A list of selected medical students was prepared by selected universities one day before data collection. Questionnaires were distributed to medical students by the researchers via student coordinators. Each Questionnaire had a cover letter explaining the study, its aims, and how to complete and return the form. Self-completed questionnaires were returned in a sealed envelope to the researchers.

2.6 Statistical Analysis

Data obtained were analyzed using IBM SPSS, Statistics for Windows (Version 24.0. Armonk, NY: IBM Corp). Descriptive statistics were used to describe students' characteristics using frequencies and percentages. Univariate inferential tests were employed to examine differences between groups. The frequency of smoking by type and sex, as well as the pattern of traditional cigarette and e-cigarette smokers among medical students, were examined using the chi-squared test for contingency tables. Significant results were examined at $\alpha=0.05$ (2-tailed) probability.

3. Result

3.1 Response Rate

Of the sample of 1868 medical students from five Jordanian medical schools who participated in the study, 1819 (97.4%) returned their questionnaires with a declaration of their smoking habits, and more than 90% of questions were answered, which are eligible for analysis.

3.2 Sample Characteristics

Of the1819 returned questionnaires, 849 (47%) were males, and 967 (53%) were females, with the majority (80%, n=1440/1806) being Jordanians. Fifty-four percent of students were aged 20 to 22 years (n=977/1815), and about 44% were 23 to 25 years old (n=789/1815). Additional characteristics of the participants were presented in Table 1. Among the 1819 students who returned their questionnaires with

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information about their smoking habits, the prevalence rates were 34% (n=616) smokers (including cigarettes, waterpipe, and e-cigarettes, dual or triple smoking), and 66% (n=1203) non-smokers.

Table 1. Description of Medical Students' Characteristics

Sample characteristics	Total, %*	Smokers (Cigarette, waterpipe, or e-cigarette) n, %	Nonusers n, %
Sex (n=1816)			
Male	849 (47%)	392 (22%)	457 (25%)
Female	967 (53%)	156 (9%)	811 (44%)
Age (years) (n=1815)			
< 20	10 (0.5%)	4 (0.2%)	6 (0.3%)
20-22	977 (54%)	287 (16%)	690 (38%)
23-25	789 (43.5%)	301 (16.5%)	488 (27%)
>25	39 (2%)	19 (1%)	20 (1%)
Nationality (n=1806)			
Jordanian	1440 (80%)	494 (27%)	946 (52%)
Non-Jordanian	366 (20%)	111 (7%)	255 (14%)
Clinical year (n=1819)			
4th year	690 (38%)	227 (12%)	463 (26%)
5th year	689 (38%)	230 (13%)	459 (25%)
6th year	440 (24%)	159 (9%)	281 (15%)
University(n=1819)			
UJ	501 (28%)	160 (9%)	341 (19%)
JUST	531 (29%)	148 (8%)	383 (21%)
HASH	292 (16%)	93 (5%)	199 (11%)
MUTAH	325 (18%)	172 (10%)	153 (8%)
YARMOUK	170 (9%)	42 (2%)	128 (7%)
Living status (n=1794)			
With family members	1159 (64%)	333 (19%)	826 (46%)
With friends	294 (16%)	116 (6%)	178 (10%)
Hostel near the university	98 (5%)	40 (2%)	58 (3%)
Alone	243 (13%)	117 (7%)	126 (7%)
Monthly allowance (JOD) (1 JOD= 1.4 USD) (n=1785)			
< 70	199 (11%)	31 (2%)	168 (9%)
70-140	496 (27%)	95 (5%)	401 (22%)
141-210	317 (18%)	127 (7%)	190 (11%)
211-280	191 (11%)	84 (5%)	107 (6%)

381-350	174 (10%)	87 (5%)	87 (5%)
351-420	170 (10%)	85 (5%)	85 (5%)
> 420	238 (13%)	102 (6%)	136 (7%)

*Numbers presented according to number of participants who respond to that item and percentages are calculated to the nearest digit.

Results revealed that there was statistically significant smoking behavior in males compared with females (p < 0.001) and in students aged 20-22 and 23-25 years compared to other age groups (p < 0.001). Interestingly, students who had good or very good academic performance lived with their original families and enjoyed a moderate allowance tended to have more frequent smoking behavior (p < 0.001).

Eighty-five percent (n=1555/1819) of medical students were aware of the use of e-cigarettes, 23% (n=413/1819) ever used e-cigarettes through their life span and 13% (n=233/1819) intended to use and recommend the use of e-cigarettes in their future life.

Results show that the total number of students who used e-cigarettes either alone or in combination with other types of smoking was 177 (9.5%) or 29% of all smokers (n=177/616). Only 13 students (0.7%) or 2.1% (n=13/616) of all smokers used e-cigarettes solely (Table 2). Table 3 also shows smoking habits by sex. There were statistically significant differences (p < 0.001) between male and female medical students who declared traditional smoking of cigarettes, waterpipe, combined types of cigarettes and waterpipe, cigarettes and e-cigarettes, and smoking habits of all types. It was evident that male medical students preferred cigarette smoking, and female medical students preferred waterpipe smoking.

Table 2. Frequency of Smoking by Type and Sex (N= 616)

Type of Smoking	Total smokers**	Females***(n=160)	Males***(n=456)	P-value*
Cigarette	135	13 (8%)	122 (27%)	0.001 *
Water pipe	183	97(61%)	86 (19%)	0.001 *
e-Cigarette	13	4 (2%)	9 (2%)	0.41
Cigarette and Waterpipe	121	17 (11%)	104 (22%)	0.001 *
Waterpipe and e-Cigarettes	52	15 (9%)	37 (8%)	0.30
Cigarette+ e-cigarettes	26	0 (0%)	26 (6%)	0.004 *
Cigarette, water pipe, and e-Cigarettes	86	14(9%)	72 (16%)	0.004 *

* significant at α=0.05 (2-tailed test) using X2 test

** Number may indicate multiple responses

*** Numbers presented according to number of participants who respond to that item and percentages are calculated to the nearest digit

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3.3 Patterns of E-cigarettes Use

A statistically significant difference in the patterns of e-cigarette and cigarette use was found among medical students, both concerning the frequency and duration of smoking (Table 3). Fifty percent (n=6/12) of e-cigarette smokers compared with 70% (n=94/134) of cigarette smokers habituate smoking daily, and 42% (n=5/12) of medical students declared e-smoking primarily in social contexts compared to only13% (n=17/134) who declared cigarette smoking in social contexts. These findings confirmed a higher frequency of cigarette smoking compared with e-cigarette smoking daily. Regarding the duration of smoking, medical students habituate e-cigarettes for a shorter duration compared with traditional cigarettes, where 90% of e-cigarette smokers declared smoking for1year or less, whereas approximately 78% of traditional cigarette smokers declared smoking for 3-5 and 6 -10 years.

Table 3. Patterns of E-cigarettes Smokers Compared with Cigarette Smokers among Medical Students

Pattern of smoking	**Cigarette smoking n=134	**e-cigarette n=12	P value*
Frequency of smoking			0.001
Daily	94 (70%)	6 (50%)	
Occasionally (not on daily bases)	23 (17%)	1 (8%)	
Social (primarily in social contexts)	17 (13%)	5 (42%)	
	n=127	n=10	
Duration of smoking			0.01
< 1 year	11(9%)	6 (60%)	
1-2 years	22(17%)	3 (30%)	
3-5 years	50 (39%)	1 (10%)	
6-10 years	36 (29%)	0 (0.0%)	
> 10 years	8 (6%)	0 (0.0%)	

* significant at α=0.05 (2-tailed test) using X2 test

** Numbers may vary according to number of responses in each category (cell)

3.4 Perceptions of E-cigarettes among Medical Students in Jordan

Table 4 shows the perceptions of e-smoking among Jordanian medical students. Approximately 50% of smokers and 35% of non-smokers agree that e-cigarettes help people cut down on traditional cigarettes, and 42% of smokers and 35% of non-smokers believe that e-cigarettes help people quit smoking. On the other hand, 42% of smokers and 50% of non-smokers believe that e-cigarettes can cause addiction. Moreover, 42% of smokers and 58% of non-smokers believe that e-cigarettes should be banned in public spaces. There is a relative agreement between smokers and nonusers regarding the belief that

more research is needed to study the effects of e-cigarettes on health and that e-cigarettes have become popular, especially in younger age groups.

Table 4. Perceptions of E-cigarettes Smoking among Medical Students

To which extent medical students agree/disagree with the following statements	Smokers*			Nonusers		
	Yes	No	Neutral	Yes	No	Neutral
E-cigarettes help people cut down on traditional cigarettes	298 (50%)	113 (19%)	185 (31%)	412 (35%)	329 (28%)	441 (37%)
E-cigarettes have shown to help smokers quit smoking	249 (42%)	122 (20%)	223 (38%)	412 (35%)	329 (28%)	441 (37%)
E-cigarettes can cause addiction	246 (42%)	90 (15%)	250 (43%)	581 (50%)	109 (10%)	465 (40%)
E-cigarettes should be banned in public spaces	247 (42%)	129 (22%)	216 (36%)	683 (58%)	161 (14%)	325 (28%)
More research is needed to study the effect of E-cigarettes on health	457 (77%)	31 (5%)	109 (18%)	1000 (85%)	36 (3%)	137 (12%)
E-cigarettes became more popular especially in younger age groups	415 (70%)	49 (8%)	129 (22%)	756 (64%)	106 (9%)	313 (27%)

* Numbers are variable in each statement based on number of responses

3.5 Perceived Harmfulness of E-cigarettes to Cigarettes and Waterpipe Smoking among Medical Students

Table 5 describes the perception of e-smoking in comparison to traditional smoking in terms of cigarette and waterpipe smoking. Forty-six percent of e-cigarettes smokers, 26% of cigarette smokers, 32% of the waterpipe smoker, and 31% of non-smokers perceive that e-cigarettes as less harmful compared with other types of smoking. On the other hand, 23% of e-cigarettes smokers, 53% of cigarette smokers, 44% of waterpipe smokers, and 40% of non-smokers do not know whether e-cigarettes are more, less or equally harmful compared to other types of smoking.

Table 5. Perceived Harmfulness of E-cigarettes to Cigarettes and Waterpipe Smoking among Medical Students

To which extent medical students agree/disagree with the following statements	Smokers			Nonusers (n=1167)
	e-cigarette (n=13)	Cigarette (n=135)	Water-Pipe (n=183)	
e-cigarettes are less harmful than cigarette smoking	6 (46%)	35 (26%)	59 (32%)	356 (31%)
e-cigarettes are more harmful than cigarette smoking	2 (15.5%)	7 (5%)	12 (7%)	95 (8%)
e-cigarettes are equally harmful to other types of smoking	0 (0.0%)	20 (15%)	28 (15%)	226 (19%)
e-cigarettes do not have any harmful effect on the human body	2 (15.5%)	2 (1%)	4 (2%)	22 (2%)
Have no idea about smoking harmfulness	3 (23%)	71 (53%)	80 (44%)	468 (40%)

* Number may indicate multiple responses

** Numbers presented according to number of participants who respond to that item and percentages are calculated to the nearest digit

3.6 Motives to Smoke E-cigarettes

The most frequently reported motive (n=72) declared by medical students was that "e-cigarettes have rare and different flavors", followed by "e-cigarettes have a less harmful effect on health" (n=63), and "desire to quit traditional cigarettes" and "desire to try something new" (n= 56 and 55, respectively), and" it is stylish and modern design" (n=35). Other motives with a relative degree of the agreement include the following: harmful to beauty (n=29); a gift (n=26); financial reasons (n=24); family/friends convinced me to buy e-cigarettes (n=18); and the least declared motive was "makes me more popular" (n=13).

4. Discussion

To our knowledge, the current study is one of a few worlds wide reporting e-cigarettes perceptions and use among medical students who are the future doctors who will be advising patients and looked upon as health experts by the general public. With a prevalence of about 34%, smoking, mostly in the form of cigarettes by males and waterpipe by females, is quite common among medical students despite their presumed knowledge of its risks and harmful effects. However, a surprising finding of our study is that almost one-third of smoking or 9.7% of all Jordanian medical students use e-cigarettes either alone or in combination with other types of smoking. An even higher percentage (23%) of these students ever used e-cigarettes, a percentage very similar to that found in medical students from the University of Arkansas for Medical Sciences, where 22.7% ever used e-cigarettes (Amy et al., 2017). On the other hand, a study from Pakistan showed that 6.2% of medical students were current e-cigarettes smokers, while a Polish study of medical students reported a rate of current e-cigarette smokers of only 2.2% (Brożek et al., 2017; Nousheen et al., 2018). These rates are lower than the 9.5% rate of current

e-cigarettes smokers found in our study and suggest that e-cigarettes smoking may be a particularly relevant issue in Jordanian medical students worthy of further investigation.

The relatively high percentage of combined e-cigarette smokers in our study (93%, n=164/177) (combined smokers with e-cigarettes –e-cigarettes alone) might be explained by the belief among smoking medical students that e-cigarettes help cut down on traditional cigarettes, a belief expressed by 50% of these students despite lack of conclusive evidence supporting this belief (Malas et al., 2016). The literature on the effectiveness of e-cigarettes in smoking cessation is contradictory. At the same time, a recent study found that the use of e-cigarettes is a risk factor for later cigarette initiation (Loukas et al., 2018), another study found that e-cigarettes were more effective in smoking cessation than nicotine replacement therapy (Hajek et al., 2019). The inconclusive evidence regarding the usefulness of e-cigarettes in reducing the need for traditional cigarettes is likely the main reason why the FDA has not yet approved e-cigarettes as smoking cessation tools, the other reason being the lack of robust data on the long-term safety of e-cigarettes (Belinda et al., 2019). However, it is essential to emphasize that our study found that the main motive behind the use of e-cigarettes was the perceived rare and different flavors that these e-cigarettes offer rather than the desire to cut down on traditional cigarettes. These flavors enhance the appeal for first-time users attracting more teenagers and younger age groups to smoking behavior (Jeffrey et al., 2019). A recent study found that e-cigarettes present a risk of unintentional nicotine exposure to children and young age groups (Cahn & Siegel, 2011), even though bystanders usually wrongly perceive only limited nicotine exposure from e-cigarettes (Tam & Warner, 2018).

Our findings regarding the uniqueness of the e-cigarettes experience agree with those of a United States of America study from Montana where "trying something new" was reported as one of the main reasons behind trying e-cigarettes (Schmidt et al., 2014). However, other studies found that the main reason for e-cigarette use was to reduce the harm of traditional cigarettes or to help them quit smoking traditional cigarettes (Tam & Warner, 2018; Adkison et al., 2013; Brown et al., 2014). One example is an Egyptian study reporting that 41.6% of participants believe that e-cigarettes help smoking cessation (Abo-Elkheir & Sobh, 2016).

The findings of the current study agree with other investigations that e-cigarettes are perceived as less harmful than traditional ones (Sutfin et al., 2013; Goniewicz et al., 2012; Abo-Elkheir & Sobh, 2016). In the study from Egypt just mentioned, 31.9% believe that e-cigarettes are less harmful than traditional cigarettes, and 5.6% believe it is not harmful at all (Abo-Elkheir & Sobh, 2016).

Finally, it is notable that our study found a relative agreement among smokers and non-smokers on the importance of banning e-cigarettes in public. This suggests relative awareness of the potentially severe adverse effects of e-cigarettes both for the smokers themselves and the bystanders, including pulmonary-related illnesses and non-pulmonary related disease like seizure caused by the content of e-cigarettes (Layden et al., 2019; Faulcon et al., 2020) and events specific to e-cigarettes, such as the potential for exploding causing facial burns (Malas et al., 2016). Steps toward banning e-cigarettes in

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public areas depend on how these products are marketed. They will unlikely be banned if marketed as a therapeutic product but should be banned if marketed as a tobacco product (Durmowicz, 2014).

5. Conclusions

The use of e-cigarettes alone and in combination with other types of smoking is relatively high among medical students. While their primary motive for smoking e-cigarettes appears to be the unique experience of different flavors, e-cigarettes are perceived by many smoking and nonsmoking medical students as suitable tools for quitting or cutting down on smoking and as less harmful than traditional cigarettes. These perceptions are not based on conclusive evidence and are likely to promote this type of smoking, which could potentially prove as harmful as traditional smoking. The general perception of a less harmful effect of e-cigarettes and that these can, therefore, be safely tried is especially worrisome in light of studies showing that e-cigarettes are a risk factor for later cigarette initiation. Our findings and those of others mandate the need for educational programs for medical students who are considered future advocates for the public are emphasizing the inconclusive evidence of the role of e-cigarettes in quitting smoking and that e-cigarettes are not an FDA-approved method for smoking cessation. Future studies should also include students from other academic disciplines, including those unrelated to the health profession, to have a more representative sample of university students.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of Jordan University Hospital. Information about the study was posted in the hospital, and students were given an opportunity to opt-out of participation.

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