

Original Article

Attitudes and perceptions toward electronic cigarettes among undergraduate health science students, Rangsit University, Thailand

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Abstract

Objective: This study aimed to explore the attitudes and perceptions toward electronic cigarette (e-cigarette) use among undergraduate health science students.

Methods: A survey was performed in January to May 2019. The data collection was conducted through self-administered questionnaires, which probed demographic data, attitudes, and perceptions toward e-cigarette use. Descriptive statistics were used to present the demographic data and misperception prevalence. The data on e-cigarette users and non-users were compared using Chi-square test or Fisher's exact test. Multivariable logistic regression was performed to determine predictive factors of e-cigarette use.

Results: The in total of 415 students by quota sampling were mostly female. Approximately 20% of the students were e-cigarette users whereas 10% were tobacco users. The major source of knowledge about e-cigarettes was friends or close friends, while only 14% was from curriculum. The predictive factors of e-cigarette use were tobacco use, being around smokers, and alcohol consumption. E-cigarette users were found to have more misperceptions than those not using e-cigarettes in several dimensions: health impacts, addiction, appearance, smoking cessation, and legal exception.

Conclusions: Undergraduate health science students had misperceptions about e-cigarettes in several aspects. The information about e-cigarettes in the curriculum was insufficient and posters or boards in the university were not effective. Consequently, supplementary knowledge should be provided and attractive smoking cessation campaigns should be created.

Keywords: e-cigarettes, attitude, perception, health science students, misperception

1. Introduction

Electronic cigarettes (e-cigarettes) are an electronic product that mimics the nicotine delivery of conventional cigarettes into the body. They are also called electronic nicotine delivery systems (ENDS). E-cigarettes were first produced in 2003 by a Chinese pharmacologist, aimed at helping smokers to quit smoking (Nayir, Karacabey, Kirca, & Ozdogan, 2016). E-cigarettes mostly consist of three main components: a rechargeable lithium battery, a vaporizing chamber and a cartridge that contains electronic liquid (e-liquid) or "smoke juice". E-cigarettes use energy from batteries to activate a reaction in the electronic liquid. The

smoke juice is converted to nicotine containing vapor and inhaled by the smoker (Grana, Benowitz, & Glantz, 2013; Sasin Management Consulting [SMC], 2014). E-cigarette vapor has been found to contain propylene glycol, vegetable glycerin, nicotine, and flavors (Grana, Benowitz, & Glantz, 2014). Moreover, it also contains many toxicants, carcinogens and heavy metals (Hajek, Etter, Benowitz, Eissenberg, & McRobbie, 2014).

The National Youth Tobacco Survey and the Center of Disease Control and Prevention (2018) reported that in the United States during 2011-2018, the use of e-cigarettes increased from 0.6% to 4.9% in middle school students and from 1.5% to 20.8% in high school students (Gentzke *et al.*, 2019). Major reasons were imitating friends or family members (39.0%), availability of flavors (31.0%), and a false belief that e-cigarette is less harmful than other tobacco products (17.1%) (Tsai *et al.*, 2018). In Thailand, no studies

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about the prevalence of e-cigarette users have been conducted. However, a survey by SMC (2014) among fifty e-cigarette users found that most users were male and aged 19-24. Major reasons for their e-cigarette use were curiosity (52.0%), lower consumption of tobacco (42.0%), smoking cessation (38.0%), and the false belief that e-cigarette is less harmful than other tobacco products (34.0%). However, those reasons seem to not be supported by several research papers revealing that e-cigarettes appear to significantly increase risk of cardiovascular diseases, respiratory diseases, mental illness as well as lead to addiction with other tobacco products (Autoniewicz *et al.*, 2016; Beard, Brown, Bold *et al.*, 2018; Garcia-Arcos *et al.*, 2016; Michie, & West, 2018; Qasim, Karim, Rivera, Khasawnwh, & Alshbool, 2017). Moreover, there is no conclusive evidence that e-cigarette use could be effectively used to support smoking cessation.

E-cigarette use has become problematic and expanded among Thai graduate students in the last few years, even though both importation and distribution are illegal. In addition, SMC study in 2014 found that many undergraduate students had misperceptions about e-cigarettes, especially regarding the health impacts. However, no study about attitudes and perceptions has been conducted in Thailand. Consequently, we were interested in exploring knowledge, attitudes, and perceptions toward e-cigarette use, particularly in health science students, because they should take a responsibility in passing on their knowledge to other people in health care services. The results of this research will be utilized in analyzing and improving the curriculum to promote the right perceptions about e-cigarettes.

2. Materials and Methods

A survey study was conducted between January and May 2019 among undergraduate health science students at Rangsit University, who voluntarily participated in the study. A sample size of 415 participants was recruited by the quota sampling method from the following faculties or colleges: dental medicine, medicine, pharmacy, medical technology, nursing, oriental medicine, physical therapy and sport medicine, optometry, and radiological technology.

The instrument was a set of self-administered questionnaires that a participant could complete in 10-15 minutes. The questionnaire was divided into two parts: 1) demographic data, such as age, gender, faculty or college, year of study; and 2) attitudes and perceptions toward e-cigarettes, such as health impacts, addiction, appearance, use for smoking cessation, and law. The process in developing the questionnaire was composed of three steps. First, we explored interesting topics by reviewing the literature as well as by focus group discussion. Second, we created the closed-ended questions and then determined the content validity by five expert judgements. Finally, the understanding of content was validated using a pilot test.

As this research was conducted among students, the questionnaires were de-identified to maintain confidentiality, and informed consent was used to confirm willingness to participate. The applied research methodology was approved by the Ethics Committee of Research Institute (DPE. No. RSUERB2019-012).

The data were processed using IBM SPSS statistics 22.0. Descriptive statistics were used to present the demo-

graphic data and misperception prevalences in health science students. Inferential statistics were used where appropriate, namely Chi-square test or Fisher’s exact test for comparing the data between e-cigarette users and non-users in a contingency table, and multivariable logistic regression for providing the OR and 95% confidence intervals of predictive factors of e-cigarette use. All tests of significance were two-tailed with a p-value of 0.05 required for statistical significance.

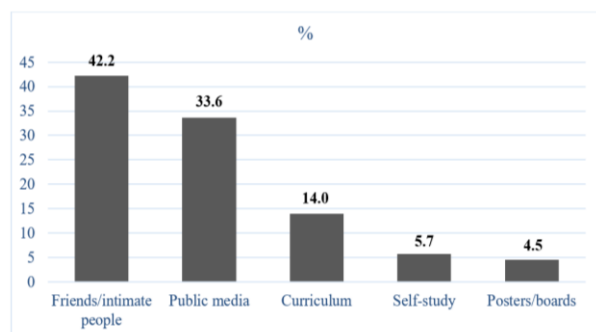
3. Results

A total of 415 health science students from nine faculties or colleges in equal proportions by quota sampling were the participants in this study. Most participants were female (70.4%). The majority were 3rd-year students (32.0%), followed by 4th-year students (26.3%), and 2nd-year students (24.6%). Approximately 20% of the students were e-cigarette users whereas less than 10% of them were tobacco users. Moreover, 18.6% of the participants consumed alcohol more than 2 times per month and 4.3% of them had some history of addictive substance use.

The demographic data revealed that gender, college/faculty, tobacco use, being around smokers, alcohol consumption, and substance use were significantly different between e-cigarette users and non-users. The e-cigarette users were more likely to be male (37.4% vs 15.1%, $p < 0.001$), tobacco users (92.3% vs 14.4%, $p < 0.001$), were surrounded by smokers (34.6% vs 5.4%, $p < 0.001$), consumed alcohol (50.6% vs 15.1%, $p < 0.001$) and had history of substance use (100.0% vs 18.1%, $p < 0.001$) (Table 1).

The main influencing source of students’ perceptions about e-cigarettes was friends (42.2), especially in e-cigarette users, followed by public media (33.6%). On the other hand, only 14.0% of students received relevant information from academic learning and only 4.5% of them gave attention to posters or boards within the university (Figure 1).

Logistic regression was performed to assess the influences of gender, academic year, monthly income, tobacco use, being around smokers, alcohol consumption and history of substance use. Exclusive e-cigarette use was significantly associated with gender (OR=0.30, 95%CI 0.18-0.48), tobacco use (OR=71.56, 95%CI 21.28-240.57), being around smokers (OR=9.22, 95%CI 4.61-18.43) and alcohol consumption (OR=5.78, 95%CI 3.38-9.88). However, the multivariable analysis showed that the strongest predictive factor of e-



*Note: Students could choose more than one source of knowledge

Figure 1. Sources of knowledge about e-cigarettes.

cigarette use was tobacco use (OR=37.83, 95%CI 10.38-137.85) followed by being around smokers (OR=6.72, 95%CI 3.04-14.85) and alcohol consumption (OR=2.74, 95%CI 1.39-5.38) (Table 2).

When comparing factors that contribute to e-cigarette use among tobacco users and non-tobacco users, the result showed that gender, alcohol consumption and history of substance use were significantly different between these groups, as shown in Table 3. Most students using dual

forms of cigarettes were likely to be male (58.7% vs 20.5, p <0.001) consume alcohol (53.8% vs 29.4%, p=0.019), and be students with a history of substance use (83.3% vs 29.2%, p <0.001) (Table 3).

According to attitudes and perceptions toward e-cigarette use in Table 3, it was found that e-cigarette users seem to have more misperceptions than non-users regarding health impacts, addiction, appearance, and effectiveness of e-cigarettes as a smoking cessation tool (Table 4).

Table 1. Demographic data of health science students regarding use of e-cigarettes.

Variable	Total	Non e-cigarette user	e-cigarette user	P-value
	n, (%)	n, (%)	n, (%)	
No. of participants	415 (100.0)	325 (78.3)	90 (21.7)	
Gender				
• Male	123	77 (62.6)	46 (37.4)	<0.001
• Female	292	248 (84.9)	44 (15.1)	
College/Faculty				
• Dental Medicine	96	77 (80.2)	19 (19.8)	0.005
• Medicine	70	54 (77.1)	16 (22.9)	
• Pharmacy	69	57 (82.6)	12 (17.4)	
• Medical Technology	49	44 (89.8)	5 (10.2)	
• Nursing	41	27 (65.9)	14 (34.1)	
• Oriental Medicine	30	26 (86.7)	4 (13.3)	
• Physical Therapy and Sport Medicine	23	16 (69.6)	7 (30.4)	
• Optometry	21	17 (81.0)	4 (19.0)	
• Radiological Technology	16	7 (43.7)	9 (56.3)	
Academic year				
• 1 st	31	25 (80.6)	6 (19.4)	0.626
• 2 nd	102	74 (42.5)	28 (27.5)	
• 3 rd	133	109 (82.0)	24 (18.0)	
• 4 th	109	86 (78.9)	23 (21.1)	
• 5 th	21	17 (81.0)	4 (19.0)	
• 6 th	19	14 (73.7)	5 (26.3)	
Monthly income (baht)				
• <5,000	25	19 (76.0)	6 (24.0)	0.102
• 5,000-10,000	105	91 (86.7)	14 (13.3)	
• 10,001-15,000	131	103 (78.6)	28 (21.4)	
• 15,001-20,000	98	73 (74.5)	25 (25.5)	
• >20,000	56	39 (69.6)	17 (30.4)	
Tobacco use				
• No	376	322 (85.6)	54 (14.4)	<0.001
• Yes	39	3 (7.7)	36 (92.3)	
Being around smokers				
• No	184	174 (94.6)	10 (5.4)	<0.001
• Yes	231	151 (65.4)	80 (34.6)	
Alcohol consumption (>2 times/month)				
• No	338	287 (84.9)	51 (15.1)	<0.001
• Yes	77	38 (49.4)	39 (50.6)	
History of substance use (except tobacco production and alcohol)				
• No	397	325 (81.9)	72 (18.1)	<0.001
• Yes	18	0 (0)	18 (100.0)	

Table 2. Factors associated with e-cigarette use by multivariable regression.

Variables	Crude OR (95%CI)	Adjusted OR (95%CI)	p-value
Female gender	0.30 (0.18-0.48)	0.58 (0.31-1.09)	0.091
Tobacco use	71.56 (21.28-240.57)	37.83 (10.38-137.85)	<0.001
Being around smokers	9.22 (4.61-18.43)	6.72 (3.04-14.85)	<0.001
Alcohol consumption	5.78 (3.38-9.88)	2.74 (1.39-5.38)	0.003

Table 3. Factors associated with e-cigarette use among tobacco users and non-users.

Variables	Total	E-cigarette users (without tobacco)	E-cigarette + tobacco users	p-value
	n, (%)	n, (%)	n, (%)	
No. of participants	90	54 (60.0)	36 (40.0)	
Gender				
• Male	46	19 (41.3)	27 (58.7)	<0.001
• Female	44	35 (79.5)	9 (20.5)	
Alcohol consumption (>2 times/month)				
• No	51	36 (70.6)	15 (29.4)	0.019
• Yes	39	18 (46.2)	21 (53.8)	
History of substance use (except tobacco production and alcohol)				
• No	72	51 (70.8)	21 (29.2)	<0.001
• Yes	18	3 (16.7)	15 (83.3)	

Table 4. The attitudes and perceptions toward e-cigarette use among students.

The attitudes	Misperceptions prevalence (%)		P-value
	Non-user (n=325)	User (n=90)	
Health impact			
E-cigarette is harmful to overall health.	16.0	25.6	0.037
E-cigarette can cause respiratory diseases, such as lung cancer, emphysema, asthma and COPD.	11.7	25.6	0.001
E-cigarette can cause cardiovascular diseases.	12.9	26.7	0.002
E-cigarette is harmful to surrounding people.	14.20	26.7	0.005
Addiction			
E-cigarette are not associated with addiction like conventional cigarette.	16.9	27.8	0.021
E-cigarette can lead to other substance abuse.	15.4	38.9	<0.001
Appearance			
E-cigarette user is more good-looking than conventional cigarette.	31.4	42.2	0.054
Smoking cessation			
E-cigarette is helpful in smoking cessation.	18.2	33.3	0.002
Have ever suggested for smoking cessation.	12.3	26.7	0.001
Law			
The importation and distribution of e-cigarette is illegal.	10.5	7.8	0.450
The use of e-cigarette in public area is prohibited.	15.4	13.3	0.629

4. Discussion

The majority of participants in our study were female (70.4%). This finding was different from the gender ratio in adolescence aged 19-21 in Thailand (Office of the Permanent Secretary, 2006). Otherwise, it was consistent with the principal gender of medical students in universities from several countries (Association of American Medical Colleges [AAMC], 2017; Moberly, 2018). Approximately 20% of the students consumed alcohol more than 2 times per month, conforming to the proportion of drinkers aged 15-24 in Thailand (Social Statistics Bureau, 2004). Less than 10% of students were tobacco users, whereas approximately 20% of students were e-cigarette users. Regarding gender, 37.4% of male students and 15.1% of female students used e-cigarettes; however, we found that gender was not a predictive factor of e-cigarette use by use of multivariable analysis. In this study, the prevalence of e-cigarette use in males was similar to the prevalence in university students in Malaysia, but our study had a larger proportion of e-cigarette use in females (Wan Puteh *et al.*, 2018). Therefore, academic administrators should be concerned about smoking among female students and

smoking cessation campaigns should target this group. Nevertheless, the prevalence in male university students seems to be higher than in Spain and Canada (Reid *et al.*, 2019; Rodriguez, Parrón & Alarcón, 2017). This study revealed that even though the importation and distribution of e-cigarettes are illegal in Thailand, e-cigarettes are still widely used among students in higher education. This problem seems to be growing over time in several countries or regions, such as United States, Britain, European Union, and Asian countries; especially South Korea and China, where e-cigarette distribution is still legal (SMC, 2004).

The main influencing sources of students' perceptions about e-cigarettes were friends, especially in e-cigarette users, followed by public media; those findings were different from a study conducted among medical students in Pakistan (Iqbal *et al.*, 2018). Moreover, learning about e-cigarettes in the curriculum was insufficient and only 5% of students paid attention to posters or boards in the university; therefore, they entertained wrong information. Consequently, e-cigarette campaigns focusing on knowledge, attitudes and social values should be established among undergraduate students as well as incorporated into all faculties' curricula.

The strongest predictive factor of e-cigarette use was tobacco use, followed by being around smokers, and by alcohol consumption. Tobacco users in this study were more likely to use e-cigarettes concurrently, almost 40 times more likely than non-users. When comparing the factors related to e-cigarette use among tobacco users and non-tobacco users, this study found that female e-cigarette users tend to use only e-cigarettes whereas the males were significantly dual users. This might be because e-cigarettes have availability of flavors attractive to women. In contrast, most conventional cigarettes can be perceived bad smell. In addition, alcohol consumption could significantly contribute to the dual use of cigarettes. These findings are consistent with other studies which found that e-cigarette users tend to have tobacco dependence (Amrock, Lee, & Weitzman, 2016; Bold, 2018; Klein, 2018). Especially the flavored e-cigarettes can easily cause nicotine dependence (Chen-Sankey, Kong, & Choi, 2019). The second strongest predictive factor was being around smokers. Therefore, smoking cessation is supposed to be processed based on smokers' family history as well as society to persuade those surrounding people to participate in the cessation process. The weakest predictive factor was alcohol consumption. Alcohol could increase the amount of cigarette use relatively, since both act with similar mechanisms in the brain (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2013). In addition, because tobacco is a mild stimulant while alcohol is a depressant, a person smoking while drinking alcohol tends not to feel happy enough from smoking in the same amount and could drink more alcohol than he should. Those mixing alcohol and tobacco could run a risk of throat and esophageal cancer in the long term (American Addiction Centers [AAC], 2018). Moreover, drinking alcohol can be an obstacle to smoking cessation because drinkers are more likely to have reckless behaviors (National Cancer Institute [NCI], 2019). Despite the discovery of no significant association between substance use and e-cigarette use, those using addictive substances and e-cigarettes should not be overlooked, because cigarette smoking could increase the likelihood of substance use relapse (Weinberger, Platt, Esan, Galea, & Goodwin, 2017). Regarding the predictive factors of e-cigarette use, policymakers and health educators should be interested in these aspects. Firstly, the correct understanding of e-cigarette use should be promoted among undergraduate students by focusing on health impacts, addiction, as well as lack of evidence in smoking cessation, to prevent the emergence of new e-cigarette users. Secondly, there should be campaigns for reminding smokers to have social responsibility in smoking at smoking areas, because being around smokers or secondhand smoke can lead to nicotine dependency. Finally, all smoking cessation campaigns must be aimed to promote alcohol cessation and substance abuse avoidance as well.

E-cigarette users seem to have more misperceptions than non-users in terms of health impacts, addiction, appearance, and effectiveness as a smoking cessation tool. Conversely, e-cigarette users had less legal misperceptions. Those results were similar to the study by Iqbal *et al.* (2018). However, in this study, misunderstandings of e-cigarette users were in a larger proportion, possibly caused by higher variability of our subjects. Interestingly, in spite of the fact that most students smoking e-cigarettes were found to have

knowledge of drug laws, realizing that importation and distribution of e-cigarettes is legally prohibited, they still smoked e-cigarettes. When focusing on attitudes and perceptions of e-cigarette users regarding gender differences, it appeared that the top three misperception prevalence topics among male students were appearance, addiction and effectiveness as a smoking cessation tool, respectively. For the females, the misperceptions with highest prevalences were addiction and impact on heart diseases. As a result, health science students should be provided correct information about health impacts, addiction, and effectiveness as a smoking cessation tool. In addition, we should adjust the perspective that the use of e-cigarettes cannot improve the image of the smoker especially in male students. Having sufficient information and realizing the negative impacts of e-cigarettes, they could pass on their knowledge to other people in health care services.

Some limitations of our study were noted. First, the sample size of some faculties seems to be too small; consequently, some results might not be representative. Second, most participants were female, unlike the proportion of smokers in Thailand, or in e-cigarette use worldwide; therefore, our results may be misleading and could not be generalized to other populations. Finally, because of our close-ended questionnaire, some topics about attitude or perception of e-cigarette use might have been overlooked or not clarified. The information gained can be in this respect incomplete. Further studies are recommended to study among students from a variety of fields or faculties, to assess differences as well as to investigate attitudes by open-ended questions.

5. Conclusions

According to our study, the undergraduate health science students had misperceptions about e-cigarettes in several aspects. The information about e-cigarettes provided by the university curriculum was insufficient, and posters or boards around the university encouraging to quit smoking did not appeal to most students. Consequently, knowledge about health impacts, addiction, appearance, and effectiveness as a smoking cessation tool should be provided in the health science students' curriculum, especially regarding the unique dangers for female students. Attractive smoking cessation campaigns should be created using stage performances, spot clips, digital signages and university's television programs.

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