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Research Article

Electronic Cigarettes among Healthcare Students at an Urban Southeastern University in US: Prevalence, Awareness and Beliefs

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Abstract

Purpose: The use of electronic cigarettes is rising among young individuals, especially former and current tobacco cigarette smokers. The purpose in this study was to identify the prevalence of electronic cigarette use, awareness status of electronic cigarette components and delivery methods, and explore the beliefs concerning e-cigarette use among health care students.

Methods: This was a cross-sectional study with 217 healthcare students representing undergraduate programs of nursing, nutrition and respiratory therapy professions. A 16-item survey assessed student perception of electronic cigarette prevalence, awareness, and beliefs regarding use.

Results: The response rate was 98.1%, females were 87% of the respondents and the ages of 19-25 years made up 70% of the respondents. The majority of respondents had heard of electronic cigarettes (99.5%), and 21.2% had used electronic cigarettes at least once in their lifetime. The mean awareness score was $4.8 \pm 1.51(1-7?)$; and smokers revealed the greatest mean awareness score of 5.5 ± 1.97 . The status of awareness was significantly different among individuals who have friends who used electronic cigarettes (5.25 ± 1.23) than who do not have friends used it (4.10 ± 1.66) $p < .001$; as well as the individuals who have parents who used electronic cigarettes (5.50 ± 0.93) than who do not have parents who used it (4.70 ± 1.97) $p = 0.02$. Most of the respondents disagreed that electronic cigarettes are less dangerous than traditional cigarettes or can help smokers to quit.

Conclusion: The findings of this study revealed that most of the health care students did not use electronic cigarettes. Individuals who have used electronic cigarettes have friends who have used electronic cigarettes as well. We have found general disagreements on electronic cigarettes use as a less harmful alternative to combustible tobacco cigarettes to help smokers quit.

Keywords: E-cigarette; Education; ENDS; Perception; Smoker; Undergraduate

Introduction

Several modified tobacco cigarettes have been sold in recent years that are claimed to reduce harm and toxicity of cigarette

constituents [1,2]. Electronic Nicotine Delivery System (ENDS) that is known as electronic cigarettes (e-cigarette) is one of the most recent devices that is introduced from the tobacco industry [3]. It is vaporizing nicotine with different flavours to be inhaled without the addition of tobacco smoke [4]. The shape and appearance are similar to the traditional tobacco cigarettes, but no combustion or

smoke is included in it [5]. Since the introduction and regulation of e-cigarettes in the US market [6], the use of e-cigarettes was quickly rising, particularly among youth and smokers [7,8]. It is debatable whether the use of e-cigarettes helps smokers to quit or leads non-smokers to initiate smoking. Soneji, et al. [9] reported e-cigarette use was associated with greater risk for subsequent tobacco smoking initiation among adolescents and adults [9]. This finding supports the continuous rise of public health concerns in regard to the safety and awareness of health impact of e-cigarette use [10,11]. Indeed, the contents of e-cigarette devices make them unique in their delivery and use than any other smoke or smokeless tobacco products because of the lack of combustion and carbon monoxide production, and the addition of different flavours [12,13]. This triggers most current cigarette smokers and e-cigarette users to believe that e-cigarettes are safer than tobacco combustible cigarettes [14-16].

The beliefs, awareness, and use of e-cigarettes vary based on smoking behaviours, education level, age and other different determinants that increase the intention to use or use of e-cigarettes [8,17,18]. Therefore, there is need to assess and track changes of the awareness and use of e-cigarettes among the adults and youth especially among college students because they are in a vulnerable period of their life and the tobacco industry targets this age group [19,20]. Certainly, the college-based healthcare students are a unique cluster of college students because they have direct and indirect knowledge in interest of and clinical training with smokers and e-cigarette users [21]. The purpose of this study was to determine the awareness, beliefs and prevalence of e-cigarette use among undergraduate college-based health care students. The outcomes of this study will be in interest of health care clinicians and educators to understand the current knowledge of health care students about e-cigarettes and its contents. This study will also reveal the current beliefs of health care students about the harms and benefits of e-cigarette use.

Material and Methods

A cross-sectional study was conducted among on-campus undergraduate bachelor's degree students of all third- and fourth-year respiratory therapy, nursing and nutrition programs in Georgia State University - a south eastern university in the United States. Other health care professions were graduate degrees where our purpose was to capture undergraduate students who have no prior clinical experience. A convenient sample of the participants was chosen during the period of the spring semester of 2016. After IRB approval and informed consent, the participants in the study were asked voluntarily to answer an anonymous self-reporting questionnaire delivered by the primary researcher in their classroom without the attendance of the classes' instructors. No incentives or disincentives for participation were offered to fill the questionnaire on papers. The questionnaire that was used in this

study assesses the socio-demographic characteristics (gender and age), students' awareness, beliefs, prevalence of use and exposure to e-cigarettes by their friends, parents, and siblings. Additionally, smoking behaviour was analysed and the respondents who reported smoking traditional cigarettes in the last month were defined as smokers, those who reported smoking in the past but not in the last month were defined as former smokers and those who have never smoked tobacco cigarettes were non-smokers.

The 16-item questionnaire used in this research that measures participant' beliefs, prevalence of use and exposure questions were created and adopted from Lotrean [22]. The awareness questions were developed by a panel of public health, respiratory therapy, and education faculty members. The awareness construct aimed to explore the awareness of e-cigarette properties and method of delivery. The Cronbach's alpha for internal reliability test was computed on all awareness questions ($\alpha = 0.62$).

Statistical Analysis

Data were analysed by using the statistical program SPSS version 22. The descriptive analysis was performed to find the prevalence of use, awareness and beliefs about electronic cigarettes. The t-test significance of the awareness mean was based on two-tailed $p < 0.05$. The awareness scores were evaluated from 0 (lowest score) to 7 (highest score). The awareness questions were coded as "Yes" or "No" with total score added together. The belief questions were consolidated to agree, neutral (I do not know) and disagree to earn comprehensive conclusions about the health care students' beliefs about electronic cigarettes.

Results

The overall number of students from the third year (junior) and fourth year (senior) respiratory therapy, nursing and nutrition programs was 221, whereby 217 students voluntarily enrolled in this study (response rate 98.1%). Most of the students were from nursing ($n = 103$, 47.5%); followed by nutrition ($n = 64$, 29.5%); and respiratory therapy ($n = 50$, 23%). Female students composed of 189 (87.1%) and male students were 28 (12.9%). Most of the students self-reported as non-smokers ($n = 181$, 83.4%); followed by former traditional cigarette smokers ($n = 30$, 13.8%); and current cigarette smokers ($n = 6$, 2.8%) (Table 1).

Characteristics	n (%)
Gender	
Male	28 (12.9%)
Female	189 (87.1%)
Year of study	
Third-year (Junior)	129 (59.4%)
Fourth-year (Senior)	88 (40.6%)
Education program	
Nursing	103 (47.5%)

Nutrition	64 (29.5%)
Respiratory therapy	50 (23%)
Age	
19-25	152 (70%)
26-30	33 (15.2%)
31-35	16 (7.4%)
36-40	5 (2.3%)
40+	11 (5.1%)
Smoking behavior	
Smoker	6 (2.8%)
Former smoker	30 (13.8%)
Never smoked	181 (83.4%)
n= 217	

Table 1: Demographic and traditional cigarettes smoking status data of participants.

The Prevalence of Electronic Cigarette Exposure

Most of the students (78.8%) have never used electronic cigarettes before. The individuals who used electronic cigarettes indicated that curiosity was the main reason for trying electronic cigarettes. The vast majority of the students reported no intention to use electronic cigarettes in the next year (94.5%). The students reported that most of them have friends who have used electronic cigarettes (58.5%) (Table 2). Also, most of the students who have used electronic cigarettes in lifetime before have friends who also have used electronic cigarettes (95.7%). Parents and siblings of the students were not electronic cigarette users or ever tried electronic cigarettes. Never smokers were 47.8% of the students who have used electronic cigarettes before, whereas former smokers were 43.5% and smokers were 8.7%.

Category	n (%)
I have used e-cigarettes at least once during my lifetime	
Yes	46 (21.2%)
Neutral	0 (0%)
No	171 (78.8%)
I have used e-cigarettes in the last month	
Yes	8 (3.7%)
Neutral	1 (0.5%)
No	208 (95.9%)
I intend to use e-cigarettes in the next year	
Yes	5 (2.3%)
Neutral	7 (3.2%)

NO	205 (94.5%)
I have friends who have tried e-cigarettes	
Yes	127 (58.5%)
Neutral	7 (3.2%)
NO	83 (38.2%)
I have parents who have tried e-cigarettes	
Yes	24 (11.1%)
Neutral	1 (0.5%)
NO	192 (88.5%)
I have siblings who have tried e-cigarettes	
Yes	28 (12.9)
Neutral	9 (4.1%)
NO	180 (82.9%)
n= 217	

Table 2: Prevalence of electronic cigarettes exposure.

The Awareness of Electronic Cigarettes

Almost all the students have heard of electronic cigarettes (99.5%) and that electronic cigarettes are nicotine delivery devices which vaporize nicotine. Most of the students reported that they are aware that electronic cigarettes can be inhaled with different additives and flavours. However, the health care students were not aware that there are no combustion and carbon monoxide resulted with the use of electronic cigarettes (Table 3).

Category	n (%)
Have you heard of electronic cigarettes (E-cigarette)?	
Yes	216 (99.5%)
NO	1 (0.5%)
Are you aware that an e-cigarette is nicotine delivery system?	
Yes	178 (82%)
No	39 (18%)
Are you aware that an e-cigarette is an appliance vaporizes nicotine?	
Yes	165 (76%)
No	52 (24%)

Are you aware that an e-cigarette can be inhaled with different additives (i.e. Nicotine)?	
Yes	151 (69.6%)
No	66 (30.4%)
Are you aware that an e-cigarette can be inhaled with different flavors (i.e. Peach)?	
Yes	193 (88.9%)
No	24 (11.1%)
Are you aware that there is no combustion in an e-cigarette?	
Yes	86 (39.6%)
No	131 (60.4%)
Are you aware that there is no carbon monoxide in an e-cigarette?	
Yes	53 (24.4%)
No	164 (75.6%)
Mean±SD	4.8±1.51
n= 217	

Table 3: Awareness of electronic cigarettes' properties.

The mean awareness score was 4.8±1.51. The awareness status was significantly different among male students (5.42±1.31) and female students (4.70±1.52) with $p = 0.02$. The awareness status was significantly different among students who have friends that have used electronic cigarettes (5.25±1.23) than students who do not have friends who used electronic cigarettes (4.10±1.66) with $p < .001$. The students who have parents who have used electronic cigarettes have a significantly different awareness score (5.50±0.93) than students whose parents have not used electronic cigarettes (4.70±1.55) with $p = 0.02$. The awareness score was significantly different among students who are smokers (5.5±1.97), former smokers (5.43±1.04), and never smokers (4.67±1.54), $p = 0.02$. We were not able to capture any significant differences among different age groups, educational years and educational professions of the health care students in regard to the awareness status of electronic cigarettes.

The Beliefs about the Use of Electronic Cigarettes

Half of the students disagreed that electronic cigarettes are less harmful than traditional tobacco cigarettes (54.1%) and some agreed (35.9%) on this statement. Contrariwise, greater than half of the students who smoke and have tried electronic cigarettes agreed that electronic cigarettes are less harmful than traditional tobacco cigarettes. There was no clear agreement of belief from the students when asked if electronic cigarettes can help smokers to quit. However, more than half of the students who have used

electronic cigarettes agreed that electronic cigarettes can help smokers to quit (56.5%) and half of the smokers agreed on that as well (50%). Most of the students disagreed that only smokers (63.5%) and students who agreed make up of 19.3% of the sample use electronic cigarettes. In addition, the majority of the students who have tried electronic cigarettes (78.3%), as well as the smokers (83.3%) disagreed on that belief too.

The students who reported intentions to use electronic cigarettes in the next year showed significant differences in the beliefs of electronic cigarette use than students who reported no intention to use electronic cigarettes in the next year. These beliefs are as follows: electronic cigarettes are less harmful than traditional cigarettes (1.00±0.00 vs. 3.28±1.77, $p = 0.005$) and electronic cigarettes can help smokers to quit (1.00±0.00 vs. 3.21±1.73, $p = 0.005$). The students who have friends who have used electronic cigarettes revealed significant differences when compared to students who do not have friends who have used electronic cigarettes regarding the belief that electronic cigarettes are used only by smokers (4.05±1.50 vs. 3.53±1.71, $p = 0.02$). There were no other significant differences among age groups, smoking behaviours, educational years and educational professions of the health care students in comparing the beliefs of electronic cigarette use.

Discussion

This study is among few studies that addressed the prevalence of use, awareness of and beliefs about electronic cigarettes among college-based health care students. The prevalence of self-reported e-cigarette use in this study ($n=46$, 21.2%), compares similarly with Franks, et al. [21] that reported electronic cigarette use of 20% among health care students in Arkansas. We found that almost 50% of students who used electronic cigarettes were non-smokers which was not consistent with other studies of Cataldo, et al. [23] and Lotrean [22] that reported the electronic cigarette users were mostly tobacco smokers as well. The prevalence of tobacco cigarette smoking among health care providers in the United States in less than that of the general population [24]. This is a possible explanation of why the health care students reported low rates of traditional tobacco and electronic cigarette consumption. In our study, we found the age of more than 75% of students who used electronic cigarettes were between 19-25 years, likely since college-aged students. This is consistent with another study of Sutfin, et al. [25] that reported electronic cigarette consumption is more common among US young adults, ages 18 to 24 years.

Almost all the students in our study had heard about electronic cigarettes. This corroborates with other studies that the college students were aware of electronic cigarettes as well [21,22,26]. We have reported unique findings of this research that assess the electronic cigarette awareness status from different components

(device, content, delivery); in fact, most of the students revealed that they are aware of electronic cigarettes as nicotine delivery systems vaporize nicotine. Moreover, the students were aware that electronic cigarettes can be inhaled with different additives and flavours. However, most of the students were not aware that there are no carbon monoxide and combustion in it. These findings are important for the next generation of health care clinicians who provide care and promote health education to different people including tobacco smokers and electronic cigarette users. The contents of electronic cigarettes shape the behaviours of use and beliefs of harm and safety of people who use and intend to use electronic cigarettes [14-16].

Our findings reveal that health care students have different beliefs about electronic cigarettes than other college students (health care and non-health care). In our study, the majority of the health care students believe that electronic cigarettes are not less dangerous than traditional cigarettes, that electronic cigarettes cannot help smokers to quit, and their use is not exclusive to smokers only. This is in contrast to other studies of Choi, et al. [27] and Lotrean [22] who reported that young adults perceived electronic cigarettes as safer products than combustible cigarettes and more effective in helping smokers to quit tobacco cigarettes [22,27]. Inversely, the electronic cigarette users among health care students believe that electronic cigarettes are less dangerous than traditional cigarettes; that electronic cigarettes can help smokers to quit tobacco cigarettes; and that electronic cigarettes are not used by smokers only. This was similar to what Czoli, et al. [28] also reported that electronic cigarette consumers believe that electronic cigarettes are an effective smoking cessation tool and can help smokers quit tobacco cigarettes. Thus, we can infer that people who use electronic cigarettes are driven by their beliefs of "Harm reduction" that influence their electronic cigarette use. While we did not assess differences between genders in this study, this may vary based on gender.

The findings in our study draw a picture on the prevalence of use, awareness of and beliefs about electronic cigarettes among college-based health care students. This study expands the beliefs about and awareness of electronic cigarette use along with the prevalence of electronic cigarette exposure in a period where electronic cigarettes are increasing in popularity despite rising debates about its use. Health care students are to become the clinicians in the future, and that urges the needs of addressing electronic cigarette products in health care education programs. This can clarify misconceptions and equip students with the knowledge that can influence their nicotine-dependent patients about hazards of alternative tobacco products such as electronic cigarettes. In addition, this can increase the confidence of students to support and participate in public health campaigns and smoking cessation programs.

This finding from this study were limited by several factors. First, all data were collected via self-report and truthfulness of student impacts outcomes of the study. Additionally, the sample size is small and not representative of all student populations. The sample was from one academic institution (Georgia State University) with limited to undergraduate educational degrees and professions. The total participants are 217 which is considered a small sample size. An uneven ratio of gender with higher percentage of females to males affects generalizing these findings. The make-up of the students in this academic institution does not permit for the analysis of data separately for educational programs because the undergraduate nursing program is the largest program offered, and for gender because females account for 80% of the student population in these programs. It can be a reason why we have a small number of smokers considering prevalence of smoking is higher among males. Therefore, this study cannot be generalized to all health care students. The assessment instrument of the awareness construct that was developed from the investigator showed Cronbach's alpha for internal reliability test ($\alpha=0.62$) which is in the borderline scale of acceptable reliability.

More evaluation is required to test electronic cigarette use and perceptions. The purpose of this study was to determine the prevalence, awareness and beliefs of e-cigarettes and we used descriptive and t-tests to capture the differences among different professions, gender, age, educations. There was no correlation analysis performed to these results. The p-values for the primary and secondary results were narratively reported in the result section. We are calling for more research among different professions to examine prevalence of use, awareness of and beliefs about electronic cigarette use with a larger sample size. The replications of this study among different health care professions, health care providers and educators are encouraged to have a clearer perception about of electronic cigarette use among the health care personnel. Academic and public campaigns about electronic cigarette hazards, misconceptions and misinformation should be offered to combat and control electronic cigarette use. Also, refining the questionnaire instrument of this study is recommended to have a more reliable conclusion on the prevalence of use, awareness of and beliefs about electronic cigarettes. In future studies, we will validate the modified questionnaire and will test before adopting. Therefore, further validity and reliability assessments are recommended for this instrument.

Conclusion

Our study revealed the prevalence of use, awareness of and beliefs about e-cigarettes among health care students. Most of the students have never tried e-cigarettes but have friends who have tried it. The awareness score was high among students who use e-cigarettes. There was limited knowledge about the components

of e-cigarettes, such as the fact that e-cigarettes have no carbon monoxide or combustion production. The majority of students do not believe that electronic cigarettes are less harmful than traditional tobacco cigarettes, that electronic cigarettes can help smokers to quit and that electronic cigarettes are used only by smokers. Awareness and beliefs about the hazards of e-cigarette use among students can be changed with comprehensive education and effective correction about misconceptions and misinformation. Thus, more informed decisions about e-cigarette products can be perceived without unguided beliefs and awareness among health care students.

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