ELECTRONIC CIGARETTES: KNOWLEDGE, ATTITUDES, AND PERCEPTIONS OF RISK

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I, THE UNDERSIGNED MEMBER OF THE COMMITTEE, HAVE APPROVED THIS THESIS

ELECTRONIC CIGARETTES: KNOWLEDGE, ATTITUDES, AND PERCEPTIONS OF RISK

BY

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Electronic Cigarettes: Knowledge, Attitudes, and Perceptions of Risk

Cigarette smoking is the leading cause of preventable death in the United States. Nearly a quarter of the population smokes, and approximately 438,000 deaths per year are related to smoking-related illnesses (Armour, Woollery, Malarcher, Pechacek, Husten, 2005). Tobacco control policies have been effective in reducing the prevalence of cigarette smoking and have contributed to the recent decline in cigarette sales (Connolly & Alpert, 2008). Due to the decline in use and increase in restrictive smoking laws, tobacco companies have introduced new smokeless tobacco products (Choi, Fabian, Mottey, Corbett, & Forster, 2012). Despite the fact that e-cigarettes are a worldwide phenomenon, little is known regarding knowledge, attitudes, and perceptions of use among youth populations. Thus, it is particularly important to examine emerging adults’ (e.g. college students) perceptions of these new products because they have been a target of tobacco company marketing, and this is a period of development when they are likely to engage in risk behavior (Arnett, 2000), such as using these nicotine products.

Electronic cigarettes, or e-cigarettes, were developed in China in 2004 and entered the U.S. market in 2007. They are battery powered devices that provide inhaled doses of nicotine and other additives to the user (Food and Drug Administration [FDA], 2009). Depending on the brand, e-cigarette cartridges typically contain nicotine, propylene glycol, and flavorings (e.g., tobacco, mint, fruit, chocolate; Etter, Bullen, Flouris, Laugesen, & Eissenberg, 2011). Since becoming available in the United States, e-cigarettes have been promoted as being cost-effective, permissible to use in smoking-restricted environments, and more socially acceptable than traditional cigarettes (Cobb, Byron, Abrams, & Shields, 2010; Henningfield & Zaatari, 2010). Proponents of e-cigarettes contend that the product is markedly less harmful to health than traditional cigarettes and may help some smokers quit (Cahn & Siegel, 2011).

Although e-cigarettes have also been marketed as smoking cessation aids, there is
currently no conclusive scientific evidence that e-cigarettes promote long-term cessation (Etter et al., 2011), and e-cigarettes are not included as a recommended smoking cessation method by the U.S. Public Health Service (PHS, 2008). Many public health professionals are concerned that e-cigarettes may have an adverse impact on users' health, encourage smoking initiation, perpetuate the use of nicotine and tobacco products among smokers who might otherwise quit, and counter the effectiveness of smoke-free policies (Etter et al., 2011; Henningfield & Zaatari, 2010). Potentially harmful ingredients have also been identified in some e-cigarette cartridges (Cobb et al., 2010; FDA, 2009). Further research on the rates and health effects of dual use is critical for assessing and considering total public health impact of these products (Grana, 2013).

Although e-cigarettes are becoming increasingly popular (Ayers, Ribisl, & Brownstein, 2011), data on awareness and use of the product are limited (McMillen, Maduka, & Winickoff, 2012; Pearson, Richardson, Niaura, Vallone, & Abrams, 2012). A recent study found that awareness of e-cigarettes doubled from 16.4% in 2009 to 32.2% in 2010, whereas ever use among those aware of the product quadrupled from 0.6% to 2.7% (Regan, Promoff, Dube, & Arrazola, 2013). The limited published research about the safety, efficacy, or public health impact of e-cigarettes raises concerns about the product’s lack of regulation, quality assurances, and its appeal to youth or nonsmokers (Grana, 2013). Because e-cigarettes resemble traditional cigarettes and their use could potentially result in increased nicotine addiction as well as the initiation of tobacco smoking, further surveillance of e-cigarette use is warranted. This may be particularly true among youth and young adults, who tend to be more susceptible to social and environmental influences to use tobacco (U.S. Department of Health and Human Services, 2012).

Young adults desire a wide range of novel and intense experiences, including tobacco use. Jeffrey Arnett (2000) proposes a period of development called emerging adulthood, which
ELECTRONIC CIGARETTES

encompasses ages 18 to 25 years old. Emerging adults pursue risky behaviors, such as substance use, more freely than adolescents because they are less likely to be monitored by parents and can pursue them more freely than adults because they are less constrained by responsibilities. As part of their identity exploration, they seek out novel and intense experiences (Arnett, 2000).

Not surprisingly, young adults, including college students, are heavily targeted by the tobacco industry (Rigotti, Moran, & Wechsler, 2004). This is one of many factors that likely contribute to the fact that 18-to-24 year olds have the highest cigarette smoking rates among all age groups (CDC, 2005). One study found the images of independence, peer acceptance, and sexuality portrayed in the ads may be attractive to adolescents in grades 6-12 because such images resonate with important developmental issues and with characteristics that they may wish to possess (Pollay, 1997). The ads exploit their developmental needs and make it easier for them to see smoking as potentially rewarding rather than as a deadly addiction (Arnett, 2001). These findings may also apply to emerging adults considering this sample included those transitioning into that life stage (i.e. high school seniors). For example, young adults may be attracted to the “high-tech” image and flavorings of e-cigarettes (Henningfield & Zaatari, 2010). Further supporting this idea, data from the Center for Disease Control and Prevention found that twice as many young people experimented with e-cigarettes in 2012 as in 2011, while use of tobacco cigarettes declined during those years (Fairchild, Bayer, & Colgrove, 2014). Thus, it is important to conduct studies among college students because they are in a transitional stage as they move from the adolescent stage of their lives to becoming adults, and experience new environments and influences (White, Labouvie, & Papadratsakis, 2005).

Young adults are more aware of e-cigarettes than older adults (Regan, Promoff, Dube, & Arrazola, 2013). King, Alam, Promoff, and Ar’s (2013) findings reveal that awareness and use of e-cigarettes are increasing. Approximately 6 in 10 adults were aware of e-cigarettes in 2011.
compared with 4 in 10 adults in 2010. Moreover, in 2011, 6.2% of all adults and 21.2% of current smokers had ever used e-cigarettes, representing an approximate doubling of 2010 estimates. More recently, Trumbo and Harper (2013) conducted a study on the use and perception of electronic cigarettes among college students. These researchers found 71% had heard of e-cigarettes and 13% had tried e-cigarettes. The high rate of awareness among youth is concerning, particularly because the literature raises concerns about e-cigarette products with regard to ingredients and device safety (Grana, 2013). This suggests that studies should consider monitoring awareness and use of this product among these populations. Due to the modes of advertising for this product, it is perhaps unsurprising that younger persons are more aware of these products. Regan and colleagues (2013) have reported that e-cigarettes are aggressively advertised on the internet through web pages on Facebook, YouTube.com promotional videos and search engine sites such as Google, Yahoo and MSN. Since they are currently available through the internet and shopping mall kiosks, these locations make them available to younger users (Regan et al., 2013).

Hedman, Gabre, and Riis (2008) found that attitudes toward tobacco use, although generally negative, vary among adolescents who use and reject tobacco use. Their arguments for not using tobacco were based on knowledge about harmful physiological influence and on emotional factors. This is further supported by the finding that a correlation exists between lower knowledge of smoking risk and higher use of tobacco (Finney Rutten, Auston, Moser, Beckjord, & Hesse, 2008). The participants in the Hedman et al. (2008) study also stress different circumstances in life as important for their attitudes towards tobacco use. Emerging adults emphasize the importance of their friends’ and parents’ attitude to tobacco use. Therefore, social pressure and parental influence play a significant role in determining attitudes (Hedman, Gabre, & Riis, 2008). Results from another study indicated that attitudes as well as alternate tobacco
product use is strongly correlated with e-cigarette use and acceptance. They concluded that “e-cigarettes provide current tobacco users an added option for continuing use” (Trumbo & Harper, 2013, p. 154). A study in North Carolina was conducted to “estimate the prevalence of e-cigarette use and identify correlates of use among a large, multi-institution, random sample of college students” (Suftin, McCoy, Hoeppner, & Wolfson, 2013, p. 214). According to that study, e-cigarette use was more common among traditional cigarette smokers but not exclusive to them and not associated with intentions to quit smoking (Suftin et al., 2013). The latter finding contradicts e-cigarette proponents’ claim to use the product to quit smoking and avoid relapse. While this may motivate older, more experienced smokers, the findings suggest quit intentions do not play a large role in e-cigarette use among college students. Another study has suggested that known predictors of initiation of cigarette smoking, such as sensation seeking and positive smoking expectancies (i.e., attitudes), may be relevant factors to examine in future research investigating e-cigarette use among adolescents (Grana, 2013). More research is necessary to understand the motivational factors underlying e-cigarette use in this population.

One study assessing the perceptions of 18-to-24 year olds about new and established tobacco products found that although they were familiar with a wide range of novel products, there was disagreement with regard to perceived risk (Wray, Jupka, Berman, Zellin, & Vijaykumar, 2012). Previous studies have found that young people like the flavors and the fact that they could use it in places where smoking is not allowed (Choi, Corbett, Fabian, Forster, & Mottey, 2012). Another study by Gerking and Khaddaria (2012) found that perceived health risk deters smoking among young people who think that they would find it difficult to quit smoking, and this relationship is especially strong for those who also believe that the onset of deleterious health effects occurs quickly. However, the authors also found that perceived health risk has no effect on the smoking status of young people who think that it would be less difficult to quit and
think that it takes a relatively long time for adverse health effects to develop. Young people in this study who viewed smoking as less habit-forming and health effects as less immediate may have more confidence in their ability to give up cigarettes altogether before they are harmed and, consequently, may have less incentive to consider long-term health effects of prolonged tobacco use (Gerking & Khaddaria, 2012).

As policies have restricted smoking, the tobacco industry has responded by developing new products designed to be more attractive and affordable for young people. However, research about new tobacco products is limited. Increasing rates of awareness and use of these new products underscores the need for rigorous surveillance of e-cigarettes and their impact on smoking initiation, smoking cessation, concurrent use with combustible products, users’ health, and smoke-free policy compliance. Since youth do not seem to believe that they are susceptible to the consequences or consider how the long-term consequences of their risky behavior will affect their future (Arnett, 1995), more investigation to fill the gaps in current scientific knowledge on the topic of e-cigarettes is particularly salient among college students. By understanding what emerging adults know and perceive, public policies can be made to combat the growing e-cigarette use trend and emphasize the need for continued research. Therefore, this study will assess the level of awareness, attitudes, and perceptions of risk among college students. The following hypotheses will be tested: college students will have high awareness and positive attitudes, but little to no perceived risks regarding the use of e-cigarettes.

Method

Sample

A survey was distributed via the internet, and was completed by 109 students. Participants needed to be at least 18 years old and an undergraduate student to take part in the study. Snowball sampling was utilized, where a link was emailed to undergraduate students who
were asked to send the survey to other undergraduates through email and social networking sites.

**Measures**

**Demographics.** Basic demographics included age, gender, ethnicity, employment, type of institution, whether smoke-free campus, and class standing. Ethnic groups were categorized based on largest groups and the remaining groups were put into “other.” Participants answered open-ended questions regarding which college/university they attend and area of study.

**Smoking Status.** Current cigarette smoking status was based on two items, and classified participants into one of three categories: current smoker, former smoker and never-smoker. Current smokers were defined as those who reported smoking at least 100 cigarettes in their lifetime and currently smoke everyday or some days; former smokers had smoked at least 100 cigarettes in their lifetime but currently do not smoke at all; never-smokers had not smoked 100 cigarettes in their lifetime (Regan et al., 2013).

**Use.** Tobacco use was assessed using nine items from the National Youth Tobacco Survey (Centers for Disease Control and Prevention, 2011a). These questions captured ever use as well as use in the past 30 days. Different types of tobacco use included: cigarettes; cigars, cigarillos or little cigars; snus; dissolvable tobacco products; flavored little cigars; water pipes or hookahs; clove cigarettes or clove cigars; roll your own cigarettes or flavored cigarettes. Two additional questions asked about use of chewing tobacco, snuff or dip (Centers for Disease Control and Prevention, 2011b).

Five questions asked about e-cigarette use (Pearson et al., 2012). Based on the item, “Have you ever tried or used electronic cigarettes?” respondents who selected “yes, in the past 30 days” or “yes, but not in the past 30 days” were considered e-cigarette users. Additional items assessed frequency of use, debut age, who introduced them, and previous smoking. Finally, two items inquired about effects of e-cigarettes.
**Awareness.** Awareness of e-cigarettes was assessed using the question, "Have you ever heard of a product called an electronic cigarette or e-cigarette, or brands such as Smoke Everywhere, NJOY, Blu or others?" Respondents who selected "yes" were considered aware of e-cigarettes (Pearson et al., 2012).

**Knowledge.** Given the limited data available on the health effects of e-cigarettes, e-cigarette knowledge was assessed using four questions asking about the kinds of e-cigarettes that exist and the regulations imposed on e-cigarettes (Phansopkar, 2012). Participants received one point for each correct answer and a sum of correct responses was calculated to create the continuous knowledge score.

**Attitudes.** Attitudes towards e-cigarettes were assessed using five scale items (Phansopkar, 2012). Participants rated the items from “strongly agree” to “strongly disagree.” For example, respondents were asked if e-cigarettes should be banned and whether e-cigarettes give them pleasure during its usage. The attitude score was created by calculating the mean of the values for each individual item. Because higher values were associated with more negative responses, the higher the score, the more negative the attitude.

**Perceptions of risk.** Perceptions of risk associated with e-cigarette use were assessed using the question, “Compared to regular-strength cigarettes, do you think that e-cigarettes are.” Respondents who selected “a little more harmful” and “a lot more harmful to health” were considered to perceive e-cigarettes as risky (Pearson et al., 2012).

**Research Design**

Cross-sectional, observational study

**Procedure**

Online surveys were used to collect data. Participants completed a short questionnaire in order to obtain data on the aforementioned measures. All the information obtained from the
surveys was completely anonymous. Participants consented to participate prior to completing the survey. The survey included a statement telling participants that completing the survey implied that they consented to participate. A description of the study was provided so that potential participants could make an informed decision to participate or not. Approval for all study procedures was obtained from the IRB of California State University, Long Beach.

Data Analysis

SPSS version 20 was used to conduct all statistical analysis. Descriptive statistics were reported to summarize characteristics of the sample. Simple inferential analyses explored associations among demographic factors and variables of interest. Specifically, correlations were used to assess the relationship between interval-level variables. Independent samples t-tests and one-way independent ANOVAs were used to assess differences in outcomes by categorical variables. Statistical significance was set at $p < .05$.

Results

Table 1 describes demographic characteristics of the study sample. Participant’s ages ranged from 18 to 34 years old. The majority of the sample was female, with most of the participants being of white ethnicity. Most of the sample was employed, and of those that work, most of the participants worked part-time. Over half of the sample consisted of senior undergraduates. Thirty-three (31.1%) participants reported having a major related to the science, technology, engineering, and math fields. When asked if their campus was smoke-free, the majority of the sample answered “No” and a small fraction did not know. A large majority of participants (86%) reported being never smokers.

Table 1. Characteristics of the Sample (N = 109)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>30</td>
<td>27.8</td>
</tr>
<tr>
<td>Female</td>
<td>78</td>
<td>72.2</td>
</tr>
</tbody>
</table>
### Electronic Cigarettes

**Age in Years***  
21.15 2.63

**Ethnicity**  
- White: 45 41.3
- Hispanic / Latino: 28 25.7
- Other: 36 33.0

**Employment**  
- Yes: 77 70.6
- No: 32 29.4

**Part-time**: 67 89.3  
**Full-time**: 8 10.7

**Type of Institution**  
- 2-year college/university: 6 6.0
- 4-year college/university: 100 94.0

**Class Standing**  
- Freshman: 10 9.5
- Sophomore: 15 14.3
- Junior: 23 21.9
- Senior: 57 54.3

**College of Study**  
- Health and Human Services: 23 21.7
- Liberal Arts: 28 26.4
- Science, Technology, Engineering, Math: 33 31.1
- Other: 22 20.8

**Smoke-free Campus**  
- Yes: 15 14.2
- No: 69 65.1
- I don’t know: 22 20.8

**Smoker Status**  
- Current smoker: 7 6.6
- Former smoker: 7 6.6
- Never smoker: 92 86.8

*Mean and Standard Deviation reported for continuous variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Table 2. Descriptives for Awareness, Attitudes, and Perceived Risk</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awareness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>13</td>
<td>12.3</td>
</tr>
<tr>
<td>Yes</td>
<td>93</td>
<td>87.7</td>
</tr>
<tr>
<td><strong>Attitudes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude Score*</td>
<td>3.06</td>
<td>0.65</td>
</tr>
<tr>
<td>Gain superiority</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly agree</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Agree</td>
<td>2</td>
<td>2.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>24</td>
<td>23.8</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>75</td>
<td>74.3</td>
</tr>
</tbody>
</table>
ELECTRONIC CIGARETTES

Should be banned

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>8</td>
<td>17</td>
<td>54</td>
<td>20</td>
</tr>
<tr>
<td>Agree</td>
<td>8.1</td>
<td>17.2</td>
<td>54.5</td>
<td>20.2</td>
</tr>
</tbody>
</table>

Pleasurable

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>3</td>
<td>15</td>
<td>20</td>
<td>53</td>
</tr>
<tr>
<td>Agree</td>
<td>3.3</td>
<td>16.5</td>
<td>22.0</td>
<td>58.2</td>
</tr>
</tbody>
</table>

Relieves stress

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>3</td>
<td>24</td>
<td>26</td>
<td>40</td>
</tr>
<tr>
<td>Agree</td>
<td>3.2</td>
<td>25.8</td>
<td>28.0</td>
<td>43.0</td>
</tr>
</tbody>
</table>

Help quit smoking

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>5</td>
<td>24</td>
<td>25</td>
<td>37</td>
</tr>
<tr>
<td>Agree</td>
<td>5.5</td>
<td>26.4</td>
<td>27.5</td>
<td>40.7</td>
</tr>
</tbody>
</table>

Perceived Risk

<table>
<thead>
<tr>
<th></th>
<th>A lot less harmful</th>
<th>A little less harmful</th>
<th>About the same</th>
<th>A little more harmful</th>
<th>A lot more harmful</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25</td>
<td>49</td>
<td>21</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>25.0</td>
<td>49.0</td>
<td>21.0</td>
<td>3.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

*Mean and Standard Deviation reported for continuous variables

Primary Outcomes

Results of analysis relevant to hypotheses are displayed in Table 2. Regarding awareness, 87.7% reported ever hearing of an electronic cigarette. Participants reported high scores on attitudes (possible range: 1 - 4), indicating negative attitudes towards e-cigarettes. For the individual attitude items, most students disagreed that they would “gain superiority among their friends if they use an e-cigarette.” Over half of participants disagreed that “e-cigarettes should be banned” and that e-cigarettes “give them pleasure during its usage.” Interestingly, 40.7% strongly disagreed that e-cigarettes “will help them quit smoking.” In regards to perceived risk, the majority of students perceived e-cigarettes as less harmful than traditional cigarettes.

Additional Outcomes
In addition to testing hypotheses, e-cigarette use and knowledge were assessed. Seventy participants (65.4%) had not ever tried or used electronic cigarettes. Of the remaining participants who had tried or used electronic cigarettes, 97% reported averaging less than two cartridges per day while one participant reported averaging 6-8 cartridges per day. Participants reported they started smoking e-cigarettes during emerging adulthood, with the largest proportion (39.3%) of participants starting at age 21. The participants scored low (M= 1.99, SD= 0.87, range= 0.00-4.00) on e-cigarette knowledge even though a large majority of the sample were aware of e-cigarettes. Of the 102 participants that answered the e-cigarette knowledge questions, only three participants got all four questions right, which indicates that accurate knowledge regarding e-cigarettes is not widespread among college students.

Further analyses were performed to identify demographic variables that were associated with e-cigarette knowledge, attitudes, and perceived risk. Correlations indicate that age was not related to knowledge (r = -0.064, p = .565), attitude (r = -0.142, p = .207), or perceived risk (r = -0.032, p = .781). Table 3 shows results of independent samples t-tests conducted to compare e-cigarette knowledge and e-cigarette attitudes between males and females. There was a statistically significant difference in the e-cigarette attitude scores for males vs. females.

Table 3. Gender differences in e-cigarette knowledge and attitude

<table>
<thead>
<tr>
<th></th>
<th>Males Mean (SE)</th>
<th>Females Mean (SE)</th>
<th>t (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-cigarette Knowledge</td>
<td>2.07 (0.18)</td>
<td>1.95 (0.10)</td>
<td>0.65 (.517)</td>
</tr>
<tr>
<td>E-cigarette Attitude</td>
<td>2.76 (0.14)</td>
<td>3.18 (0.07)</td>
<td>-3.00 (.003)</td>
</tr>
</tbody>
</table>

A one-way, between subjects ANOVA was conducted to test for differences in e-cigarette knowledge, attitudes, and perceived risk by ethnicity. There were no statistically significant ethnic differences in e-cigarette knowledge, F(2, 99) = 0.55, p = 0.581, attitudes, F(2, 98) = 1.04, p = 0.358, or perceived risk, F(2, 97) = 0.41, p = .664. Of note, results showed a significant correlation between e-cigarette attitude and perceived risk (r = .372, p < .001).
Tobacco Products and E-cigarette Knowledge and Attitudes

Table 4. Differences in e-cigarette knowledge and attitudes by tobacco product use

<table>
<thead>
<tr>
<th>E-cigarette Knowledge</th>
<th>Never Used</th>
<th>Ever Used</th>
<th>t (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarettes</td>
<td>3.32 (0.07)</td>
<td>2.71 (0.10)</td>
<td>0.09 (.926)</td>
</tr>
<tr>
<td>Cigar</td>
<td>1.90 (0.10)</td>
<td>2.20 (0.16)</td>
<td>-1.58 (.118)</td>
</tr>
<tr>
<td>Water pipe</td>
<td>2.02 (0.12)</td>
<td>1.96 (0.12)</td>
<td>0.33 (.740)</td>
</tr>
<tr>
<td>Chew</td>
<td>1.94 (0.09)</td>
<td>2.63 (0.32)</td>
<td>2.18 (.031)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E-cigarette Attitude</th>
<th>Never Used</th>
<th>Ever Used</th>
<th>t (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarettes</td>
<td>3.32 (0.07)</td>
<td>2.71 (0.10)</td>
<td>5.29 (.001)</td>
</tr>
<tr>
<td>Cigar</td>
<td>3.17 (0.07)</td>
<td>2.81 (0.13)</td>
<td>2.60 (.011)</td>
</tr>
<tr>
<td>Water pipe</td>
<td>3.20 (0.08)</td>
<td>2.94 (0.09)</td>
<td>2.05 (.043)</td>
</tr>
<tr>
<td>Chew</td>
<td>3.15 (0.06)</td>
<td>2.10 (0.28)</td>
<td>4.85 (.000)</td>
</tr>
</tbody>
</table>

Tables 4 and 5 provide results of analyses between use of tobacco products and e-cigarette outcomes. There was a statistically significant difference in the e-cigarette attitude scores for never cigarette smokers and ever cigarette smokers (p = .001). There was a statistically significant negative correlation between cigarette use in the past 30 days and e-cigarette attitudes (p = .002). There was a statistically significant difference in the e-cigarette attitude scores for never cigar smokers and ever cigar smokers (p = .011). There was a statistically significant difference in the e-cigarette attitude scores for never water pipe smokers and ever water pipe smokers (p = .043). There was a statistically significant difference in the e-cigarette attitude scores for never and ever tobacco chewers (p < .001). There was a statistically significant negative correlation between chewing tobacco in the past 30 days and e-cigarette attitudes (p = .001).

Table 5. Relationship between past 30-day use of tobacco products with e-cigarette knowledge and attitudes

<table>
<thead>
<tr>
<th></th>
<th>Knowledge</th>
<th>Attitude</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r (p-value)</td>
<td></td>
</tr>
<tr>
<td>Cigarette</td>
<td>.056 (.575)</td>
<td>-.298 (.002)</td>
</tr>
<tr>
<td>Cigar</td>
<td>.104 (.297)</td>
<td>-.069 (.492)</td>
</tr>
<tr>
<td>Water pipe</td>
<td>.043 (.669)</td>
<td>-.170 (.089)</td>
</tr>
<tr>
<td>Chew</td>
<td>.004 (.970)</td>
<td>-.331 (.001)</td>
</tr>
</tbody>
</table>
Discussion

The original hypotheses were partially supported. The sample of college students had high awareness, negative attitudes, and low perceived risk regarding the use of e-cigarettes. The results did not support the original hypotheses that college students would have positive attitudes toward e-cigarettes.

Marketing campaigns for e-cigarettes have successfully reached emerging adults, evident in the fact that the present study found high awareness levels among the sample. E-cigarette advertisements challenge a barrier to television promotion. For this reason, current nonsmoking policies should be expanded to include e-cigarettes. Tobacco education materials should cover e-cigarettes to combat current marketing strategies targeted towards the youngest legal consumers of tobacco products. College students’ low knowledge and little perceived risk may result in their experimentation with e-cigarettes. Previous studies have found that a correlation exists between lower knowledge of smoking risk and higher use of tobacco (Finney Rutten, Auston, Moser, Beckjord, & Hesse, 2008). While this may not automatically translate to e-cigarettes, being aware of the product and lacking adequate knowledge may affect college students’ decision to try or use e-cigarettes.

Despite the fact that participants do not agree that e-cigarettes will help them gain superiority among their friends, are pleasurable, relieve stress, or will help them quit smoking, they also do not agree that e-cigarettes should be banned. Participants may not associate any positive benefits with e-cigarettes but want to keep the product available. The participants’ opposition to ban e-cigarettes could suggest that this product may increase re-acceptance of smoking as a societal norm, which threatens to reverse the successful, decades-long public health campaigns to prevent smoking. E-cigarettes may seem attractive to young cigarette smokers due to the ability “to enjoy various flavors without having to deal with the smell of tobacco smoke”
or negative social norms (Pokhrel, Little, Fagan, Muranaka, & Herzog, 2014, p. 1065).

According to Trumbo and Harper (2013), there is potential for higher levels of acceptance of e-cigarette use in social situations given the reduced impact on nonusers. It is imperative more research is conducted to understand how to prevent this possible phenomenon.

In addition to participants holding negative attitudes, they also perceive e-cigarettes as less harmful compared to traditional cigarettes. Low perceived risk may encourage young adults to use e-cigarettes even though there is little to no scientific evidence of the risks associated with e-cigarette use. There are not yet sufficient data on health risks to determine the safety and efficacy of e-cigarettes. While ingredients in e-cigarettes may not be as harmful as those in tobacco products, they are still a concern because they contain various levels of nicotine. The National Institutes of Health claim “users could expose themselves to toxic levels of nicotine while refilling the devices or even use them to smoke other substances” (Sisak, 2014, para. 12). Nicotine is highly addictive and causes negative health effects on the human body (Mooney, Leventhal, & Hatsukami, 2006). Perceived health risk deters young people from smoking if the onset of deleterious health effects occurs quickly (Gerking & Khaddaria, 2012). The lack of knowledge about health effects associated with short-and long-term e-cigarette use demonstrates the need for further scientific research. Once health effects of prolonged e-cigarette use are known, then public health officials can educate youth and adult populations. Until then, countermarketing awareness campaigns should emphasize the fact that lack of knowledge about the health risks does not correspond with lack of health risks.

The literature raises concern of e-cigarettes being used as a gateway to cancer-causing tobacco products. It is for this reason that the present study examined the relationship between tobacco product use and e-cigarette outcomes. All tobacco product use was consistently associated with attitudes towards e-cigarettes, indicating that positive e-cigarette attitudes are
more likely among tobacco users than never users. This may be because the former might believe e-cigarettes to be more advantageous than traditional tobacco products. Considering the significant correlation found between attitude and perceived risk, it seems that individuals who perceive little to no risks with e-cigarette use will have more favorable or positive attitudes towards the product. Thus, it may be concluded that tobacco users have positive attitudes towards nicotine products, which translates to perceiving e-cigarettes as less harmful—it seems the marketing by tobacco companies is being successful in this regard. The impact electronic cigarettes have made on college students and campuses should be a concern to public health officials and smoke-free proponents alike.

Further, it has been argued that “the goal of e-cigarette makers is not cessation of tobacco use but ‘dual use’ where e-cigarettes simply ‘capitalize on harm-reduction sentiment’ to sustain what has become a private habit by reopening public spaces” (Fairchild, Bayer, & Colgrove, 2014, p. 294). Dual use of e-cigarettes and tobacco products has the potential to increase users’ nicotine levels and increase risk of health consequences. Trumbo & Harper (2013) suggest e-cigarette use by college students is most likely to be reserved to those who have a history of tobacco use. The researchers argue that e-cigarettes not only expand the use of alternate tobacco products, but also may join the plethora of substances already accepted by college students. The findings from the current study showing positive attitudes towards e-cigarettes among those using tobacco products indicate that public health officials may indeed need to be concerned with dual use.

The current study should be interpreted in light of several limitations. Although the sample size for the study was sufficiently powered to conduct analyses, it likely was not large enough to be representative of all college students. The sample had higher proportions of female students, and more senior students; thus, the current results may not represent the views and
behaviors of male and younger college students. Additionally, the majority of students were attending one particular public state university in southern California (and all students were from California institutions). California has been a world leader in tobacco control since 1990 when the California Tobacco Control Program was established “to keep tobacco out of the hands of youth, to help tobacco users quit, and to ensure that all Californians can live, work, play, and learn in tobacco-free environments….as the world’s first and longest-running comprehensive tobacco control program, California has defined best practices for comprehensive tobacco control efforts that have been modeled throughout the nation and the world” (California Tobacco Control Program, n.d.). This has the potential to bias findings, since e-cigarette use among college students may vary depending on the region of the country and the tobacco control measures/regulations implemented in the state. The majority of the sample was either white or Hispanic, which may not reflect the diversity on other college campuses around the country. Therefore, the ability to generalize our results is limited. The survey question measuring perceived risk of health damage elicits a personal assessment, but it is difficult to analyze the difference between “a lot” and “a little.” Future studies should offer a more in-depth assessment to provide a wider range of responses allowing researchers to assess different aspects of risk rather than a single item. Another limitation is the self-report nature of the online survey since respondents may not provide accurate, honest answers for fear of presenting themselves in an unfavorable manner. There are other aspects, such as vaping and non-disposable products, to be studied as this phenomenon continues to grow and becomes more complex. Nevertheless, this study is a first step toward learning more about e-cigarettes among emerging adults.

Results from this study are similar to past studies, despite the fact that there has been a limited amount of research regarding e-cigarettes among college students. College students are very aware of electronic cigarettes (e.g., Trumbo & Harper, 2013). Similar to the present study,
Trumbo and Harper (2013) also found students tended to have a somewhat negative attitude toward the use of e-cigarettes, but were more accepting of e-cigarette use in public. Previous research has also found an association between use of tobacco products and e-cigarette outcomes: “being a current cigarette smoker was positively associated with positive expectancies and inversely with negative expectancies” (Pokhrel et al., 2014). An argument has been posed that people are not using the device to quit smoking, but rather as another method of smoking in social settings where policies ban traditional cigarettes (Fairchild, Bayer, & Colgrove, 2014), which is supported by the current findings. Since the sample of college students did not agree that e-cigarettes will help them quit smoking, it is unlikely that those who are using the product are using it as a cessation aid. Furthermore, the sample did not favor imposing a ban on e-cigarettes.

Findings from the current study highlight recommendations for public health efforts related to e-cigarettes. Intervention efforts need to focus on banning the sale of e-cigarettes to minors, as little is known about the long-term risks of these products, but current research indicates harmful ingredients are used. The FDA should move swiftly to regulate them so that their potential harms are better understood so that they can contribute to the goal of risk reduction and health promotion (Fairchild, Bayer, & Colgrove, 2014). Of note, lawmakers are working to make e-cigarettes subject to the same regulations as tobacco. Large cities have recently banned e-cigarette use in restaurants, bars, and most other indoor public spaces (Sisak, 2014). The findings also reveal e-cigarette education needs to address evidence-based facts (as a source of knowledge) and health risks as well as explain the influence of media and changing smoking regulations. Although more research needs to be conducted to determine the effects of e-cigarettes on users’ health, it may be more important to help people to understand how difficult it is to quit and length of time it takes for health damage from smoking to occur (Gerking &
Khaddaria, 2012). Previous researchers have found that young adults who believe that they can quit with less difficulty before their health begins to suffer may not pay attention to the messages about the health effects, no matter what they know about the long term health risks. In the present study’s findings, perceived risk was associated with attitude, therefore these efforts to increase perceived risk seem quite relevant to these emerging adults. Furthermore, the improvements in smoking cessation aids may contribute to more smoking among young people because they believe they will be able to quit before experiencing negative health effects of smoking (Gerking & Khaddaria, 2012). Increasing perceptions of risk will be a particular challenge for public health officials. More studies should be done to explore these associations and to identify best strategies for intervention. Education and regulation of e-cigarettes are needed to increase knowledge and perceptions of risk among emerging adults in order to prevent health risks association with their use.

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