

DISSERTATION

AWARENESS OF E-CIGARETTES AND CORRELATION OF USE AMONG HIGH
SCHOOL STUDENTS

Submitted by

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ABSTRACT

AWARENESS OF E-CIGARETTES AND CORRELATION OF USE AMONG HIGH SCHOOL STUDENTS

The purpose of this study was to assess awareness of e-cigarettes, to identify the factors associated with initial and continuing use of e-cigarettes, and to explore the reasons to use e-cigarettes among high school students. Three high schools in Colorado participated in the study. High school students (n = 251) who were enrolled in health classes were surveyed in the fall semester of 2015. The majority of students were sophomores (59%), followed by freshmen (28%), juniors (8%), and seniors (3%). A majority of students reported never using e-cigarettes (81%) and a few students reported using them in the past (14%), using them occasionally (4%), and a very few (.4%) using them everyday.

Pearson's chi-squared tests were performed to examine correlations among variables since most of the variables were nominal and assumptions of the parametric data were violated. The awareness of e-cigarettes included seeing, hearing, or watching e-cigarette advertising, receiving information through social media, and sharing information about e-cigarettes with close friends. Findings revealed no significant correlations between seeing, hearing, or watching e-cigarette advertising and current use of e-cigarettes. Findings indicated a significant correlation between variables of receiving or sharing information about e-cigarettes and using e-cigarettes. Seventy-one percent of non-users, 21% of past users, and 7% of current users of e-cigarettes reported receiving information about e-cigarettes through social media. Sixty-percent of non-users, 29% of past users, and 11% of current users of e-cigarettes reported sharing information

about e-cigarettes with close friends. The implication of findings showed that there has been exposure to e-cigarette advertising among high schoolers.

The factors associated with initial and continuing use of e-cigarettes included teens' tobacco history, close friends', parents', and family members' e-cigarette and traditional cigarette use. Findings showed statistical significance between past, current, and future use of tobacco products and e-cigarette use in high schoolers. Fifty-one percent of students, who used tobacco in the past, reported past use of e-cigarettes, where 21% of students, who used tobacco in the past, reported current use of e-cigarettes. Findings suggested being a former or current smoker was correlated with having ever used e-cigarettes and past e-cigarette use. E-cigarettes may be used as a smoking cessation tool or alternative to other tobacco products. Further research is needed on the use of e-cigarettes among tobacco users. A few students (2%) considered e-cigarettes as a future use of tobacco products alone or with waterpipe tobacco and traditional cigarettes because of being seen as "fun", "cool", "harmless", and because "friends used them." The associations between parents', family members', and close friends' use of cigarettes and e-cigarettes, and teens' current use of e-cigarettes were explored. Findings showed family members', and close friends' e-cigarette use was related to teens' e-cigarette use. Thirty-eight percent, who used e-cigarettes in the past or are currently using e-cigarettes, reported having at least one family member using e-cigarettes, and 45% who used e-cigarettes in the past or are currently using e-cigarettes reported close friends' e-cigarette use. Findings suggested that close friends' and family members' e-cigarette use may model behavior for teens and may provide a source for e-cigarette experimentation. Teens reported that "peer pressure" and "fitting into a social group" were some of the reasons that teens might initiate and continue use of e-cigarettes.

Mann-Whitney *U* test was performed to explore gender differences in e-cigarette users' reasons to use e-cigarettes, and gender differences in non-e-cigarette users' reasons for the teens' e-cigarette use. Reasons included curiosity, addiction, healthier than tobacco, cheaper than tobacco, quitting smoking, dealing with stress, losing weight, and socializing with friends. Females who used e-cigarettes in the past or are currently using e-cigarettes had a higher mean rank than males on the variables of dealing with stress (15.68; 8.05) and addiction (15.42; 7.55), respectively. Females, who never used e-cigarettes, had higher mean rank than males on variable of dealing with stress (119.50; 95.51) and losing weight (119.68; 97.25) as to teens' reasons to use e-cigarettes. E-cigarette messages and claims related to stress management and weight control might be leading young girls to experiment with or use e-cigarettes.

It is crucial to restrict e-cigarette advertising and to educate teens on nicotine addiction and risk of respiratory diseases. Health educators should educate teens on the health effects of e-cigarettes and the health risk of dual or multiple use of tobacco products, and about using e-cigarettes as a cessation tool driven by perceptions of reduced harm and being an alternative to tobacco smoking.

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DEFINITION OF TERMS

Electronic cigarettes or e-cigarettes are a battery powered nicotine delivery system that employs heat to vaporize a liquid nicotine solution without burning tobacco (Goniewicz, Hajek, & McRobbie, 2014a). They generally consist of three main components: a cartridge, an atomizer, and a battery. When an e-cigarette user inhales, an airflow sensor activates a battery to heat the atomizer vaporizing the propylene glycol and nicotine, and as a result of inhalation, a dose of nicotine as aerosol vapor is delivered to the user's lungs, and the residual aerosol is exhaled to environment (Trtchounian, Williams, & Talbot, 2010).

Electronic cigarettes have many names including *ENDS (Electronic Nicotine Delivery Systems)*, *e-hookahs*, *hookah pens*, *e-cigars*, *e-pipes*, and *vape pipes* (Adkison et al., 2013; Gostin & Glasner, 2014; Zhu et al., 2014). E-cigarettes come in many varieties, but usually are organized into three basic categories; cigalike (similar to conventional cigarettes in shape and size), eGos (larger and different than cigalikes with a removable tank for refilling e-liquid), and mods (larger than eGos with custom parts) (Zhu et al.). Some of the e-cigarette models and brands are represented in Table 1.

Vape is defined as “the act of smoking an e-cigarette” by the Oxford Dictionary and was recognized as the word of the year in 2014 (Neal, 2014, para. 1). “The word, which was first used in 1980s, can be employed as a verb to mean inhaling and exhaling the vapor produced by electronic cigarettes but also as a noun to refer to the devices themselves” (para. 3).

“*Ever*” *e-cigarette use*, the situation in which a person has tried, an e-cigarette at least once—even just a puff—including any use greater than that, from one-time use, to occasional use, to daily past and/or current use.

The *Center for Disease Control and Prevention (CDC)* is the federal agency for comprehensive tobacco prevention and control. “The Office on Smoking and Health (OSH) helps states and communities implement tobacco control programs by featuring national and local campaigns and events, linking to state and community resources, producing guidelines, and compiling data” (CDC, 2014, para. 1).

The *Food and Drug Administration (FDA)* is the federal agency empowered through the Family Smoking Prevention and Tobacco Control Act (2009) to regulate manufacturing, distribution, and marketing of tobacco products (FDA, 2014; Gostin & Glasner 2014; Paradise, 2014).

U.S. Poison Centers, as a member of *American Association of Poison Control Centers (AAPCC)*, monitors incidences of poisoning and their sources, and provides annual reports on poison statistics from the National Poison Data System (NPDS), continuing education for poison center staff, and toxic surveillance in collaboration with federal agencies (AAPCC, 2014).

Global Advisors on Smokefree Policy (GASP) is a non-profit organization that is committed to promoting smokefree air and tobacco-free lives (GASP, 2014).

CHAPTER 1: INTRODUCTION

Electronic nicotine delivery systems (ENDS), known as e-cigarettes or electronic cigarettes, are battery powered devices that deliver nicotine without burning tobacco (Etter, Bullen, Flouris, Laugesen, & Eissenberg, 2011). An electronic cigarette consists of three main components: a cartridge, an atomizer, and a battery. An e-cigarette cartridge usually contains a fluid composed of nicotine, ranging from 0 to 24 mg/ml, and humectants such as propylene glycol or glycerol and flavorings. An atomizer aerosolizes the fluid when heated by the battery (Trtchounian et al., 2010). “In a typical device configuration, instead of burning tobacco, a user draws air through the device; an airflow sensor or a physical power button activates a battery that powers an atomizer to produce an aerosol from liquid containing nicotine and flavorings” (Cheng, 2014, p. 11). The vapor carries a dose of nicotine into the user’s lungs through inhalation, and a residual aerosol is released into the environment through exhalation (Trtchounian et al.).

E-cigarettes were invented by an American engineer Herbert A. Gilbert in 1963. Although he filed for a patent for his invention in 1965, his invention was never commercialized (Gilbert, 1965). Hon Lik, a Chinese pharmacist, was credited with his invention of an electronic cigarette in 2003. The Chinese electronic company Ruyan received a patent for e-cigarettes in 2007, sold them over the Internet, and exported them to retail establishments in Europe and the United States (Cummings et al., 2014).

E-cigarettes have become popular especially among young people in recent years despite limited research on their safety and efficacy. E-cigarette advertising appears in various media including television (TV), radio, print, online, and at retail point of sale, and has contributed to the popularity of the product and raised awareness among youth. According to Legacy for Health

Report (2014), 29.3 million teens and young adults, accounting for 58% or 14.1 million 12-17 year olds, were exposed to e-cigarette ads on TV. Nearly 32.2 million teens and young adults, including 9.5 million (39%) 12-17 year olds, were reached through print ads in 2013. Youth awareness of e-cigarette advertising at retail sites, on TV, and through websites has been high. Sixty percent of teens ages 13-17 and 69% of young adults ages 18-21 reported seeing e-cigarette advertisements at convenience stores, supermarkets, or gas stations, and 45% of teens and 56% of young adults reported seeing e-cigarette advertisements on TV (Legacy, 2014).

The prevalence of e-cigarette use has been increasing among middle and high school students in the United States. Findings from the National Youth Tobacco Survey showed that among all students grades 6-12, the number of those who had ever used e-cigarettes rose from 3.3% to 6.8%, and current use of e-cigarettes rose from 1.1% to 2.1% during 2011 and 2012 (Carroll Chapman & Wu, 2014; Corey et al., 2013). This increasing prevalence of e-cigarette use among adolescents raises concerns that it may serve as a gateway to traditional cigarette smoking among non-smokers or delay smoking cessation among current adolescent smokers (Camenga et al., 2014a).

It is important to understand why and how adolescents use e-cigarettes because teens and young adults may become susceptible to lifelong nicotine addiction through e-cigarettes and traditional cigarettes. Although a few studies have explored e-cigarette awareness and use among adolescents, existing data are lacking for understanding factors influencing adolescent e-cigarette use and correlating with e-cigarette use or non-use. This study explored e-cigarette awareness and examined the correlates of use among high school students.

Purpose

The purpose of this study was to assess awareness of e-cigarettes, identify the factors associated with initial and continuing use of e-cigarettes, and to explore the reasons for e-cigarette use among high school students.

Specific aims:

Aim 1: To explore awareness of e-cigarettes and the sources of awareness among high school students through

- e-cigarette advertisements on TV
- e-cigarette advertisements on the radio
- e-cigarette advertisements in magazines or newspaper
- social media
- contact with peers

Aim 2: To identify the factors that are associated with the initial and continuing use of e-cigarettes by teens

- who have ever smoked traditional cigarettes
- who have used tobacco products in the past, present, or future
- whose parents smoke cigarettes or e-cigarettes, or have in the past
- whose close friends or peers smoke cigarettes or e-cigarettes, or have in the past
- whose family member(s) smoke cigarettes or e-cigarettes, or have in the past
- who have seen, heard, or watched e-cigarette advertisements
- who have received or shared information about e-cigarettes

Aim 3: To explore reasons teens use e-cigarettes and the correlation with gender. Reasons included:

- curiosity
- addiction
- healthier than smoking tobacco
- cheaper than smoking tobacco
- to quit smoking
- to deal with stress
- to lose weight
- to socialize with friends

To accomplish these aims, the researcher collected data from high school students using a self-authored questionnaire.

Research Questions

The research explored associations between smoking cigarettes and current use of e-cigarettes, relationships between e-cigarette advertisements and e-cigarette use, and reasons to use e-cigarettes by gender. The research questions included:

A. Research questions related to e-cigarette awareness:

1. What is the correlation between seeing, hearing, or watching advertising and using e-cigarettes?
2. What is the correlation between receiving or sharing information about e-cigarettes and trying or using e-cigarettes?

B. Research questions related to e-cigarette use:

3. What is the correlation between the use of e-cigarettes, and past, current, and future use of tobacco products?

4. Is there an association between close friends' e-cigarette use and teens' current use of e-cigarettes?
5. Is there an association between parent or other family member(s)' e-cigarette use and teen's current use of e-cigarettes?

C. Research questions related to reasons to use e-cigarettes:

6. Is there a difference between males' and females' reasons to use e-cigarettes?
7. Is there a difference between the opinions of teen males and females who do not use e-cigarettes about teenagers' reasons to use e-cigarettes?

D. Research questions related to smoking history:

8. Is there an association between smoking cigarettes and using e-cigarettes among teens?
9. What is the association among close friends, parents, and family members' smoking, and teens trying e-cigarettes and their current use of e-cigarettes?

Significance

A study of e-cigarette use among high school students was important for several reasons. First, an understanding of factors associated with e-cigarette use or non-use among high school students will help health educators and public health workers design health education programs to prevent e-cigarette use among youth. Second, assessing awareness and sources of e-cigarettes will inform policy makers on the impact of e-cigarette promotion, advertising, and sales on young teenagers. Third, understanding the underlying reasons to use this product will help public health workers develop specific interventions or campaigns to help inform adolescents about the scientific knowledge regarding e-cigarette safety, efficacy, unproven marketing claims, and addiction.

Although electronic cigarettes have been gaining popularity among adolescents, research has shown that there are uncertainties about e-cigarettes as to their safety, efficacy, manufacturing, and regulation. Study findings have addressed that e-cigarette vapors, which contain some toxic substances, were associated with mouth and throat irritation, dry cough at initial use, and increased risk of asthma (Callahan-Lyon, 2014; Vardavas et al., 2012). E-cigarettes contain liquid nicotine, which is very addictive and may serve as a gateway to smoking traditional cigarettes among young adolescents (CDC, 2013). In addition, little is known about the efficacy of e-cigarettes as a harm reduction strategy or smoking cessation tool, warranting further study (Goniewicz et al., 2014b; Siegel, Tanwar, & Wood, 2011). E-cigarettes are manufactured to look like cigarettes and copying smoking gestures may delay smoking cessation or lead to dual use with traditional cigarettes (Brown, Beard, Kotz, Michie, & West, 2014).

A few research findings indicated varying nicotine concentrations in e-cigarette cartridges and refill solutions, risk of nicotine toxicity due to poor labeling and packaging, and lack of standardization in manufacturing process (Callahan-Lyon, 2014; Ordonez, Forrester, & Kleinschmidt, 2013; Trtchounian et al., 2010). Despite the Food and Drug Administration's (FDA) effort to regulate e-cigarettes as drugs or medical devices, e-cigarettes are still considered tobacco products and lack restrictions on their sale, advertising, and/or promotion (Paradise, 2014). It is paramount to inform adolescents about e-cigarette safety, efficacy, regulations, manufacturing, and unproved advertising claims before companies reinvent a popular smoking trend and appeal to youth by normalizing vaping.

Studying the adolescent population is needed because of the vulnerability of teens toward risk behaviors. According to adolescent development research, adolescents appear to be

sensation-seeking and have a willingness to engage in risky behaviors to obtain perceived rewards due to neurological and hormonal changes during puberty. Tobacco, alcohol, and other drug use are some of the risky behaviors that contributes to mortality and morbidity among young adolescents (Mason et al., 2013). With regard to tobacco use among youth, the risk of lifelong nicotine addiction, underage use of tobacco, and the dual use of tobacco and e-cigarettes are of concern to public health educators.

Researcher's Perspective

I started my career studying nursing and continued working as a nurse practitioner at a cardiology department where angioplasty and stenting procedures were done. I witnessed that people who were heavily addicted to smoking wanted to smoke right after the procedures. Those patients had been smoking for many years and they were addicted to nicotine, the main substance of tobacco products. I realized the importance of tobacco prevention and health education before people are condemned to a lifelong addiction to smoking.





I continued my career by studying physical education and sports, and teaching them at both the elementary and middle school levels. I have always thought that physical activity and play were fundamental components for child and adolescent well-being. Physical activity or participation in sports can help children to be healthy and fit; discourage use of cigarettes, alcohol, and drugs; and promote self-esteem and self-care that contribute to healthy lifestyle behaviors.

To combine my educational and health experiences in my doctoral studies with emphasis on educational leadership and health and exercise, I found it appropriate to focus on prevention of youth tobacco use. Recently, with the efforts of public health workers and policy makers, tobacco use among adolescents and adults has been declining, but the introduction of e-cigarettes

has changed the trend with use among young people increasing since 2007. I wanted to contribute to research by focusing on e-cigarette use among high school students. My dissertation is intended to inform health educators and policy makers on teens' awareness of e-cigarettes, the reasons for use, and the factors associated with e-cigarette use among high school students. This study may assist health educators in developing preventive strategies and health education programs to inform youth decision-making on e-cigarette use.

Table 1

Examples of different e-cigarette products. Adapted from Grana, Benowitz, & Glantz’s report for World Health Organization Tobacco Free Initiative (2013).

Product	Description	Some Brands
Disposable e-cigarette 	Cigarette-shaped device consisting of a battery and a cartridge containing an atomizer to heat a solution (with or without nicotine). Not rechargeable or refillable and is intended to be discarded after product stops producing aerosol. Sometimes called an e-hookah.	NJOY OneJoy, Aer Disposable, Flavorvapes
Rechargeable e-cigarette 	Cigarette-shaped device consisting of a battery that connects to an atomizer used to heat a solution typically containing nicotine. Often contains an element that regulates puff duration and /or how many puffs may be taken consecutively.	Blu, GreenSmoke, EonSmoke
Pen-style, medium-sized rechargeable e-cigarette 	Larger than a cigarette, often with a higher capacity battery, may contain a prefilled cartridge or a refillable cartridge (often called a clearomizer). These devices often come with a manual switch allowing to regulate length and frequency of puffs.	Vapor King Storm, Totally Wicked Tornado
Tank-style, large-sized rechargeable e-cigarette 	Much larger than a cigarette with a higher capacity battery and typically contains a large, refillable cartridge. Often contains manual switches and a battery casing for customizing battery capacity. Can be easily modified.	Volcano Lavatube

CHAPTER 2: REVIEW OF LITERATURE

History of E-cigarettes

The first electronic cigarette was created by an American engineer, Herbert A. Gilbert in 1963. The objectives of his invention were to provide a safe and harmless method of smoking by replacing burning tobacco with heated, moist, flavored air. A smokeless non-tobacco cigarette consisted of an internal tube, a flavor cartridge, heating in the tube, a tubular liner, an internal wall to produce turbulence between the heating and tubular liner, and a mouth-piece. The similarities of the mechanism of smokeless non-tobacco cigarettes and today's electronic cigarette can be seen in Figure 1. Although he filed a patent for his invention called "smokeless non tobacco cigarette" in 1965, it was not commercialized (Gilbert, 1965, p. 1).

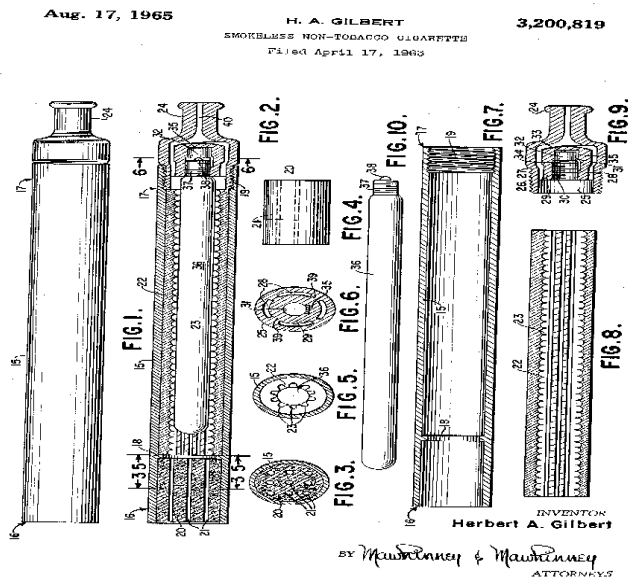


Figure 1. Smokeless Non-tobacco Cigarette by H.A. Gilbert. Adapted from United States Patent Office, 1965.

Hon Lik, a Chinese pharmacist, reinvented the modern electronic cigarette in 2003 (Bell & Keane, 2012; Cummings et al., 2014; Foulds, Veldheer, & Berg, 2011; Lim & Kim, 2014). His electronic cigarettes were introduced in China as an aid for smoking cessation and replacement of traditional cigarettes in 2004. Ruyan, a Chinese electronic company, sold e-cigarettes over the Internet and exported them to retail establishments in Europe and in the United States (Cummings et al.). The company received its first international patent in 2007 (Bell & Keane).

Description of E-Cigarette

Electronic cigarettes, also known as e-cigarettes or electronic nicotine delivery systems (ENDS), are battery-operated devices that deliver an inhalable nicotine vapor to users without burning tobacco (Ayers, Ribisl, & Brownstein, 2011; Etter et al., 2011). While there are many different kinds of e-cigarette devices on the market, including disposable e-cigarettes, the original electronic cigarettes consisted of three main components: a cartridge, an atomizer, and a battery, illustrated in Figure 2. (Tanski & Sargent, 2014; Trtchounian et al., 2010; Worsley, Jones, & Marshman, 2014).



Figure 2. Inside the e-cigarette adapted from the illustration of Paul Weston on Focus-Science and Technology.

The liquid in the cartridge, known as e-liquid, or e-juice, contains nicotine, flavorings, propylene glycol or glycerol (Trtchounian et al., 2010; Worsley et al., 2014). The concentration of nicotine varies by brand and product, ranging from 0 to 24 mg/ml. Some e-cigarette cartridges labeled as nicotine-free may contain only the flavors and a liquid. A wide range of natural and artificial flavors including fruit, chocolate, mint, and candy are available as flavored nicotine solutions (Worsley et al.).

The atomizer is an electronic heating element that produces a vapor by heating a liquid nicotine solution. It is usually powered by a battery, which may be rechargeable. “When a smoker draws air through the cigarette, an airflow sensor activates the battery that turns the tip of the cigarette red to simulate smoking and heats the atomizer to vaporize the propylene glycol and nicotine” (Trtchounian et al., 2010, p. 905). The aerosol vapor containing a dose of nicotine is

delivered into the smoker's lungs through inhalation and rest of the aerosol exhaled into the environment (Trtchounian et al.). In early models, the atomizer or heating element and the cartridge containing liquid solution were separated. In newer models, those two units are combined into a single unit called a "cartomizer" (Williams & Talbot, 2011; Williams, Villarreal, Bozhilov, Lin, & Talbot, 2013).

Prevalence of E-cigarette Use among Adolescents

The prevalence of e-cigarette use among adolescents seems to be increasing in the United States. According to the National Youth Tobacco Survey during 2011 and 2012, "ever" e-cigarette use and current e-cigarette use almost doubled among U.S. middle and high school students with an estimate of 1.78 million students having ever used e-cigarettes. Approximately 160,000 students who had ever used e-cigarettes reported never using conventional cigarettes (Corey et al., 2013). Specifically, between 2011 and 2012 the percentage of middle school students ever using e-cigarettes rose significantly from 1.4 to 2.7; current e-cigarette use rose from 0.6% to 1.1%; and dual use of e-cigarettes and conventional cigarettes rose from 0.3% to 0.7% (Carroll Chapman & Wu, 2014; Corey et al., 2013). The prevalence of "ever" e-cigarette use among high school students was higher than middle school students. "Among high school students, "ever" e-cigarette use increased from 4.7% to 10.0% during 2011-2012, current e-cigarette use increased from 1.5% to 2.8% and dual use of conventional cigarettes and e-cigarettes increased from 1.2% to 2.2%" (Corey et al., p. 729). A significant proportion of middle (61%) and high school (81%) student e-cigarette users reported current smoking. In contrast, the proportion of middle school students who had never smoked a traditional cigarette compared with high school students who were "ever" e-cigarette users reported was 20.3% and 7.2%, respectively (Carroll Chapman & Wu; Corey et al.). Thus, the awareness of and

experimentation with e-cigarettes are on the rise among adolescent smokers and adolescent non-smokers.

Similarly, Camenga et al. (2014a) found that, during 2011 and 2012, the prevalence of past 30-day electronic cigarette use increased from 0.9% to 2.3%, and current use of both conventional cigarettes and e-cigarettes increased from 0.8% to 1.9% among high school students in Connecticut and New York. The findings indicated that current cigarette use strongly predicted past 30-day use of e-cigarettes among high school students (Camenga et al.).

In addition, Pepper et al. (2013) surveyed a national sample of males ages 11-19 to investigate their awareness of e-cigarettes and their willingness to try them. About two-thirds of young adults (67%) were aware of e-cigarettes and 18% of those were willing to try an e-cigarette if it was offered by best friends. White males were more likely to be aware of e-cigarettes than Hispanic/Latino males and males of other races. Sons of parents who were current smokers were less willing to try e-cigarettes, compared with sons of parents who had never or seldom smoked. Sons living in households with high annual incomes were also less willing to try e-cigarettes. The ones who had less negative beliefs about typical smoking were more willing to try e-cigarettes (Pepper et al., 2013).

Adolescent e-cigarette use is a public health concern in other countries besides the United States. Goniewicz and Zielinska-Danch (2012) estimated the prevalence of e-cigarette use among Polish high school and university students using a nationally representative sample of 13,787. Of the high school students, ages 15-19, 23.5 % had ever used an e-cigarette, 8.2% had used it within the past 30 days, and 3.2% of students who had never used tobacco used e-cigarettes. Polish youth perceived that e-cigarettes are safer than tobacco and identified e-cigarettes as a common source of nicotine. Adolescent boys, students having a smoking parent or partner,

students who experienced smoking, and current smokers were more likely to try e-cigarettes (Goniewicz & Zielinska-Danch, 2012). Similarly, an analysis of survey data from Korean middle and high schools showed that adolescent boys who either were dissatisfied with school, had previously smoked, or had a family member who smoked had significantly higher rates of e-cigarette use (Cho, Shin, & Moon, 2011). In contrast, a national survey sampling of U.S. males ages 11-19 found that sons of parents who were current smokers were less likely to try e-cigarettes than sons of parents who had never or rarely smoked (Pepper et al., 2013).

Prevalence of E-cigarette Use among Adults

The prevalence of e-cigarette use among adults has been increasing since 2009. Data from Consumer Styles Survey of 2009-2010 showed that awareness of electronic nicotine delivery systems (ENDS) among US adults doubled from 16.4% to 32.2% and the “ever” use of ENDS increased from 0.6% to 2.7% during 2010 and 2011 (Regan, Promoff, Shanta, & Arrazola, 2013). From the Health Styles survey of 2010 and 2011, King, Alam, Promoff, Arrazola, and Dube (2013) found that 6 of 10 adults were aware of e-cigarettes representing a total of 57% in 2011, compared to 4 of 10, accounting for 40% in 2010. In addition, the “ever” use of e-cigarettes doubled the estimates of 2010; 6.2%, 3.3% respectively. The highest increase of “ever” e-cigarette use was among current smokers with 21%, followed by former smokers with 7.4%, and non-smokers with 1.3% (King et al., 2013). In a similar study, Pearson, Richardson, Niaura, Vallone, and Abrams (2012) found that 40.2% of people, ages 18 and older, had heard about e-cigarettes, and 3.4% of the general population had “ever” used e-cigarettes as assessed by a nationally representative online survey. Correspondingly, the common use of e-cigarettes was among current smokers (11.4%), former smokers (2.0%), and non-smokers (0.8) (Pearson et al., 2012). Pepper et al. (2014b) analyzed a national sample of 17,522 U.S. adults and

found that 86% of adults had heard of e-cigarettes in 2013, 11% were former users, and 6% were current users of e-cigarettes.

Moreover, Choi and Forster (2013) utilizing data from the Minnesota Adolescent Community Cohort of 2010-2011 found that about 70% of young adults were aware of e-cigarettes, 7% had ever used e-cigarettes, and 1% had used e-cigarettes in the past 30 days. With regard to the characteristics associated with awareness and use of electronic cigarettes among young U.S. adults, Choi and Forster stated that among “men, those who were enrolled in or graduated from college, those who were current or former smokers and those who had at least 1 close friend who smoked had higher odds of awareness of e-cigarettes than those who did not attend college, were never established smokers, and whose friends did not smoke” (p. 557). Consistent with study findings, three studies indicated that males, younger adults, non-Hispanic whites, and those with at least a college degree were more likely to be aware of electronic nicotine delivery systems (King et al., 2013; Pearson et al., 2012; Pepper et al., 2014b). Among those who were aware of e-cigarettes, males who were current or former smokers and had a close friend who smoked had higher odds of ever using e-cigarettes as supported by studies (Choi & Forster, 2013; Regan et al., 2013).

Sutfin et al. (2013) estimated the prevalence of e-cigarette use among college students in North Carolina and identified correlates of e-cigarette use. About 5% reported “ever” having used e-cigarettes, and 1.5% reported using e-cigarettes in the past month. Being a male, current smoking status, binge drinking, “ever” use of hookah, illegal drug use, and marijuana use were significantly correlated with “ever” use of e-cigarettes. Additionally, being a fraternity member and living-off campus were correlated with “ever” e-cigarette use. In contrast to other studies (Choi & Forster, 2013; Pearson et al., 2012; Regan et al., 2013), Sutfin et al. (2013) found that

Hispanic students and students from other races were more likely to use e-cigarettes than non-Hispanic whites. A study focused on e-cigarette use outcome expectancies among college students in Hawaii indicated the higher positive expectancy factors (social enhancement, affect regulation, positive sensory experience) were significantly associated with past 30-day e-cigarette use, and intentions and willingness to use e-cigarettes in the future. Current smokers had higher positive and lower negative expectancies (negative health consequences) (Pokhrel, Little, Fagan, Muranaka, & Herzog, 2014).

The higher prevalence of awareness, trial, and use of electronic nicotine delivery systems (ENDS) was reported in countries where the use of ENDS was permitted. According to the International Tobacco Control Four Country Survey of 2010-2011, 73% in the U.S. and 54% in the U.K., 39% in Canada and 20% in Australia were aware of ENDS. The trial and usage of ENDS were higher in U.S. and U.K. compared with Canada and Australia where ENDS are banned; trial 14%, 9%, 4%, 2%, and usage, 6%, 4%, 1%, 1%, respectively. Unlike Australia and Canada, in U.S. ENDS trial was common among younger, white, non-daily, high-income smokers. In the U.K., ENDS use was reported among younger, high-income smokers, women and minority populations (Adkison et al., 2013).

Health Effects of E-cigarettes

Although there are limited data on the short and long-term health effects of e-cigarettes, a few studies evaluated their health effects. Findings of an experimental laboratory-based intervention study showed that after five minutes of using e-cigarettes containing nicotine, propylene glycol, linalool, tobacco essence, and methyl vanillin, there was an associated increase in lung flow resistance and decrease in fractional exhaled nitric oxide concentration. Nitric oxide has an important role in the respiratory track and is a marker of pathophysiology of airway

diseases associated with smoking (Vardavas et al., 2012). However, an experimental study among e-cigarette and tobacco smokers found that active and passive e-cigarette smoking did not affect markers of blood cell counts where active cigarette smoking and passive cigarette smoking increased circulating white blood cells (Flouris et al., 2012). Systematic review of published studies related to the health effects of e-cigarettes indicated that e-cigarettes aerosols, composed of water, propylene glycol, glycerin, nicotine and flavorings, were associated with mouth and throat irritation, dry cough at initial use, decreased fractional exhaled nitric oxide, increased respiratory impedance and respiratory flow resistance, and increased risk of asthma (Callahan-Lyon, 2014; Vardavas et al., 2012).

A few studies identified a variety of chemicals in e-cigarette refill solutions, cartridges, and aerosols. Cheng (2014) reviewed the available evidence evaluating the chemicals in e-cigarettes and found that nicotine and chemical substances including tobacco-specific nitrosamines (TSNAs), aldehydes, metals, volatile organic compounds (VCOs), phenolic compounds, polycyclic aromatic tobacco alkaloids, and drugs were identified in the cartridges, refill solutions, and aerosols (Cheng, 2014). The nicotine levels in e-cigarettes varied across brands and models and the levels of nicotine listed on the labels of cartridges significantly differed from the measured values (Cheng, 2014; Cobb, Bryon, Abrams, & Shields, 2010; Goniewicz, Kuma, Gawron, Knysak, & Kosmider, 2013; Schober et al., 2014; Westenberger, 2009). For example, Goniewicz et al. (2013) found that nicotine amounts in 9 of 20 analyzed cartridges and 3 of 15 nicotine refill solutions differed more than 20% from values declared by the manufacturers. In line with this finding, Kirschner, Gerona, and Jacobitz (2013) reported that measured e-cigarettes liquid concentrations differed from declared by up to 50%.

Additionally, Goniewicz et al. (2014b) analyzed 12 models of e-cigarettes and their vapor and detected some carbonyl compounds such as formaldehyde, acetaldehyde, and acrolein in all examined vapors. Those carbonyl compounds might have been products of a heated glycerin, which has been identified as toxic, irritating, and carcinogenic. In addition, the toxic metals including cadmium, nickel, and lead were identified in all vapors generated by e-cigarettes (Goniewicz et al., 2014b). Consistent with these findings Williams et al. (2013) identified a total of 22 elements including lead, nickel, and chromium that are potentially harmful chemicals and have adverse health effects on the respiratory system (Williams et al., 2013).

Varying nicotine concentrations in e-cigarette cartridges and refill solutions also pose a risk of nicotine toxicity due to accidental ingestion, inhalation, dermal, and ocular exposure among young children, adolescents, and adults (Callahan-Lyon, 2014; Ordonez et al., 2013). According to the U.S. Poison Center, a total of 1,700 exposures pertaining to e-cigarette devices and components were reported to poison centers between 2011 and 2013. Children ages 5 years and younger represented the largest proportion of exposures with 717 (42.2%) cases and adults ages 20-39 years represented second largest group with 466 (27.4%) cases of exposure (Vakkalanka, Hardison, & Holstege, 2014). The intentional use or abuse of cartridges and refill bottles were also reported. The death of a 29 year-old male due to suicide with an injection of refilling liquid was described by the U.S. Poison Center (Vakkalanka et al., 2014). The containers of refill solutions lack child safety and warnings on health risks.

Environmental Effects of E-cigarettes

Environmental impacts of e-cigarettes due to secondhand aerosol are varied. Schober et al. (2014) analyzed the indoor air concentration and quality after vaping sessions finding that e-cigarettes are not emission free. Substantial amounts of propanediol, glycerin, and nicotine, as

well as high concentrations of particulate matter (PM) were detected in the indoor air and the seven polycyclic aromatic hydrocarbon (PAH) concentrations classified as probable carcinogens were measured higher by 20% on average during vaping sessions (Schober et al., 2014). In line with these findings, Fuoco, Buonanno, Stabile, and Vigo (2014) analyzed mainstream aerosol generated by e-cigarettes and compared with conventional tobacco cigarettes concluded that the particle concentrations of mainstream aerosols generated by e-cigarettes were in the 120-165 nm range which is similar to that of conventional tobacco cigarettes (Fuoco et al., 2014). However, McAuley, Hopke, Zhao, and Babaian (2012) found that e-cigarette vapor posed significantly lower risk of harm to human health than cigarette smoking under the same testing conditions. The particle concentrations in the vapor were lower than cigarettes, but these results were reported as uncertain due to instrumental problems (McAuley et al., 2012). In addition, Czogala et al. (2014) measured the airborne markers of secondhand exposure, reporting that nicotine was detected in the air after generating vapor from e-cigarettes through a smoking machine. The level of second exposure to nicotine varied depending on the e-cigarette brand ranging from 0.82 to 6.23 $\mu\text{g}/\text{m}^3$ (Czogala et al., 2014). Even though the health and environmental effects of short term exposure to secondhand e-cigarette vapors remains unclear, several studies emphasize that future research should study the potential health effects of long term exposure to secondhand e-cigarette vapors to inform smoke-free policies (Czogala et al.; Schober et al.).

E-cigarettes as a Cessation Tool

E-cigarettes have been popularized as a smoking cessation aid, even though little is known about their efficacy (Siegel et al., 2011). Findings from a cross-sectional online survey based on a sample of first-time purchasers of a particular e-cigarettes showed that more than two thirds of participants (66.8%) reduced the number of tobacco cigarettes smoked per day and

nearly half of participants quit smoking for a period of time after trying e-cigarettes (Siegel et al., 2011). In accordance with previous research, the findings of a prospective study of 40 regular smokers in Italy displayed an overall 80% reduction in the number of cigarettes smoked a day at week 24 compared to baseline and sustained a 50% reduction in the number of cigarettes per day at the end of the study. The pleasure of inhalation and exhalation of the vapor, cleaner and fresher breath, and absence of odors were reported as the most positive features of e-cigarettes identified by participants (Polosa et al., 2011).

E-cigarettes may provide a coping mechanism for conditioned smoking cues that replace some of the rituals associated with smoking gestures (Caponnetto et al., 2011; Polosa et al., 2011). However, Brown et al. (2014) argued that “e-cigarettes might re-normalize smoking, promote experimentation among young people who otherwise may not have tried or lead to dual use together with traditional cigarettes, and thereby deter some smokers from stopping” (Brown et al., p. 1537). Concerns have been expressed by Hajek (2013) that e-cigarettes might replace traditional cigarettes and increase smoking rates by attracting new recruits and reducing quit attempts. This situation is called “renormalizing smoking” (Hajek, 2013, p. 1615)

In addition, Brown et al. (2014) assessed the effectiveness of e-cigarettes to aid smoking cessation compared with nicotine replacement therapy (NRT) and unaided quitting in a general population of smokers attempting to quit. Findings demonstrated that 20% of e-cigarette users, 10% of nicotine replacement therapy users, and 15% of those using no aid reported non-smoking. E-cigarette users were more likely to abstain from smoking than those who used nicotine replacement therapy or used no aids. Although e-cigarettes appeared to help cessation, the debate about long-term effects of e-cigarettes on cigarette smoking prevalence continues (Brown et al.).

In a similar study, Bullen et al. (2013) assessed whether e-cigarettes containing nicotine were more effective than nicotine patches and placebo e-cigarettes with a randomized controlled trial in Auckland, New Zealand, and found the group using nicotine e-cigarettes reported highest abstinence (7.3%), followed by the patches group (5.8%), and placebo e-cigarette group (4.1%), but the differences were not statistically significant. The findings suggested “. . . e-cigarettes, with or without nicotine, were modestly effective at helping smokers quit, with similar achievement of abstinence as with nicotine patches, and few adverse events” (Bullen et al., p. 1629). The study pointed out that even though e-cigarettes seem to have higher acceptability among smokers, more research is needed on the benefits and dangers of e-cigarettes before placing them in tobacco control.

Little is known about physicians’ beliefs, attitudes, and behaviors related to e-cigarette and smoking cessation. Kandra et al. (2014) measured perspectives on e-cigarettes by using a random sample of 787 North Carolina physicians, and found that two-thirds (67%) believed that e-cigarettes are a helpful aid for smoking cessation, and one-third of the physicians (35%) recommended them to their patients. Older physicians, who believed there is a lower risk of cancer from e-cigarettes and documented tobacco treatment counseling, were more likely to recommend e-cigarettes. Some physicians (13%) believed that e-cigarettes were already approved by the FDA for smoking cessation, when in fact they were not. It is important for physicians to stay current with evidence-based research on e-cigarettes to prevent discrepancies and to give clear and evidence-based information to patients (Kandra et al.).

E-cigarette Advertising

The market and marketing in electronic cigarettes has been growing rapidly since 2007 in the United States (Grana & Ling, 2014). Total estimated advertising expenditures were \$6.4

million in 2011, and nearly tripled to \$18.3 million in 2012 according to e-cigarette advertising data from Kantar Media and Nielsen (Kim, Arnold, & Makarenko, 2014). Specifically, magazine advertising expenditures were highest with an estimated \$10.8 million, followed by TV advertising expenditures with an estimated \$5.0 million, and newspaper and Internet advertising expenditures, which were lowest (Kim et al., 2014).

TV Advertising

Although the health risks of electronic cigarettes are unknown, e-cigarette companies are currently advertising their products on television to a broad audience that includes 24 million youth. Data from Nielsen on e-cigarette advertising on television networks showed “50 % of all youth in US television households were exposed to an average of 21 e-cigarette advertisements from October 2012 through September 2013” (Duke et al., 2014, p. 31). Most e-cigarette advertising reaching youth audiences through cable television was during highest rated youth programs such as *The Bachelor*, *Big Brother*, and *Survivor*, and included celebrity endorsements and unregulated messages about the benefits of e-cigarettes (Duke et al., 2014). Empirical evidence shows a relationship between exposure to smoking in movies and smoking initiation among young adults (Heatherton & Sargent, 2009; Morgenstern et al., 2013).

In addition, MediaCom’s analysis of the e-cigarette industry advertising, expenditures, and estimated audience exposure showed that e-cigarette advertisers spent \$39 million on national television, radio, newspaper, and magazines ads from June through November, 2013. Approximately 29 million teens and young adults were exposed to e-cigarette ads on television, and 32 million teens and young adults were exposed to print ads (Legacy, 2014).

Analyzing data from a national sample of U.S. adults, Pepper et al. found that 31% of non-smokers, 35% of former smokers, and 40% of current smokers reported seeing e-cigarette advertising on television and identified it as a source of awareness (Pepper et al., 2014b).

Print (Magazine) Advertising

The noncombustible tobacco products (NCPs), categorized as smokeless tobacco have the opportunity to increase their segment of the U.S. tobacco market, since restrictions and regulations are implemented on combustible tobacco products including cigarettes by the Food and Drug Administration (FDA). Tobacco companies spent approximately \$20 million on print, TV, online, radio, and mail advertising for noncombustible tobacco products (NCPs) in the United States in 2012 (Richardson, Ganz, Stalgaitis, Abrams, & Vallone, 2014). A large portion of this spending was to promote blu e-cigarettes through television and print ads. E-cigarette print ads appeared in magazines such as *Maxim*, *Rolling Stone*, *Men's Journal*, and *Playboy* targeting white males. In line with these target audiences, ads appeared in other magazines including *Star* and *US Weekly*, targeting white females. An analysis of print advertisement showed emphasized themes of harm reduction, alternatives to cigarettes, and sexuality to promote e-cigarettes (Richardson et al.).

Online Advertising

E-cigarettes are mostly advertised and sold over the Internet since there are no imposed restrictions on their advertisements and sales there, and it is easy to set up a new e-cigarette business online with small financial investment. Zhu et al. (2014) examined e-cigarette brands that are advertised and sold on the Internet and found 460 brands and 7,700 flavors of e-cigarettes available, and generally three models of e-cigarette including cigalikes, eGos, and mods. The model of cigalikes resembles traditional cigarettes in shape and size, and cigalikes are

available in either disposable or refillable models. EGos and mods contain a removable tank that can be refilled with e-liquid containing nicotine. The messages to promote these brands included; “healthier than cigarettes, could be used where smoking banned, cheaper than cigarettes, effective quitting aid (indirect claim), effective quitting aid (direct claim), and disclaimer” (Zhu et al., 2014, p. 5).

In a similar study, a content analysis of retail websites showed the most common messages claimed electronic cigarettes as being healthier, cheaper, cleaner, and more modern than cigarettes. In terms of health benefit claims, 95% of sites included statements about the absence of “tar” or “carcinogens,” 64% included testimonials about using e-cigarettes to quit smoking, and 76% included statements that e-cigarettes emit “only water vapor” that is harmless to others. Moreover, 88% of websites emphasized the option to smoke anywhere, including in smoke free environments such as offices, bars, and airplanes. In response to smoke free policies, most of the websites declared that electronic cigarettes eliminate secondhand smoke by using water vapor. A majority of websites also offered flavors such as vanilla, chocolate, coffee, and other candy or dessert essences. The most common lifestyle claims included increased ability to socialize, enhanced social status, and romantic opportunities (Grana & Ling, 2014).

In addition to retail website advertisements, e-cigarettes are advertised and promoted through YouTube videos. Peak et al. (2014) analyzed the content of videos on YouTube, finding that 82.5% of video samples sponsored by e-cigarette companies presented health claims and economic and social benefits. Some of the specific types of health claims were “e-cigarette is less harmful than other tobacco products,” “e-cigarette is healthy,” and “e-cigarette can help quit smoking” (Peak et al., 2014, p. 553). Approximately 15.5 million viewers including 1.2 million young adults (>18 years old) were exposed to the videos by 2011. YouTube viewers are more

likely to learn about e-cigarettes and be persuaded with unproven health claims than other promotional messages. Although social media, including YouTube, seem to be innovative online marketing techniques for e-cigarette companies, it has been suggested that tobacco control experts should monitor persuasive and potentially misleading messages provided by marketers (Peak et al.).

Twitter is also used as a marketing platform for e-cigarettes. Huang et al. (2014) identified 73, 672 tweets from Twitter Fire House, and among those 99% were relevant to e-cigarettes and 89.6% were classified as commercial. The vast majority of tweets included either promotional messages or a Uniform Resource Locator (URL) linked to commercial websites promoting e-cigarette use. Commercial e-cigarette tweets mentioned smoking cessation with a link to commercial e-cigarette sites and included prices and discount appeals. E-cigarette marketing on Twitter may provide a platform that increases the popularity and appeal of e-cigarettes to young adults initiating use of e-cigarettes. The authors suggested “. . . it is imperative for the Food and Drug Administration to closely monitor content and reach of such strategies and adopt appropriate social media marketing regulations for tobacco products, including e-cigarettes, that are consistent with the Family Smoking Prevention and Tobacco Control Act” (Huang et al., 2014, p. 29).

In addition, e-cigarettes are advertised and promoted by retailers near college campuses. Assessments of point of purchase in North Carolina and Virginia showed that interior and exterior e-cigarette advertising increased in all types of stores including convenience stores, tobacco shops, pharmacies, and supermarkets between 2012 and 2013. The convenience stores near college campuses had the greatest increase in the availability of disposable and rechargeable e-cigarette kits and in advertising among store types. Prime advertising and price reducing

promotions in convenience stores raise concern that such advertising placement may persuade young people to purchase e-cigarettes (Wagoner et al., 2014).

Rules and Regulations

The Food and Drug Administration (FDA) has concerns about the nicotine delivery system including product ingredients, nicotine levels, safety of mechanical parts, accuracy of e-cigarette advertisement claims as an alternative to tobacco products, and claims about ability to smoke everywhere (Paradise, 2014). Despite the authority of the FDA to regulate particular products as drugs or medical devices, the FDA's authority has been limited with regard to regulating e-cigarettes as drugs or medical devices. The FDA was sued by Sottera Inc. for regulating e-cigarettes as a drug-device combination and for blocking their importation to the United States (Kirshner, 2011). The District Court for the District of Columbia Circuit issued a decision in the case of *Sottera Inc. v FDA* (Chen & Husten, 2014; Paradise, 2014). The court held that e-cigarettes can be regulated as tobacco products, not drugs or devices, under the Family Smoking Prevention and Tobacco Control Act of 2009 (Chen & Husten; Paradise).

Efforts to regulate e-cigarettes at state and local levels have either amended existing smoke-free laws or passed laws and regulations regarding the sale, distribution, possession, and use of tobacco products. According to Global Advisors Smoke Free Policy (GASP), 27 states have amended their smoke-free laws to include banning e-cigarettes in public places and 34 states have passed laws that ban selling e-cigarettes to minors which is referred to 18 and younger in some states, and others referred to 21 and younger (GASP, 2014; Paradise, 2014). New Jersey, in 2010, was the first state in the nation to amend the Smoke Free Air Act and ban the use of e-cigarettes in public and work places and sale to minors. New York, Massachusetts, Washington, Kentucky, Illinois, and California are a few of the states that amended smoking

ordinances explicitly to ban selling e-cigarettes to minors and prohibiting use of e-cigarettes in workplaces. Moreover, Hawaii became the first state that “bans sale of and requires tobacco products to be sold face-to-face, not through the internet” (GASP, 2014, p. 3). Likewise, Oregon was the first state to have settled in court with a leading e-cigarette manufacturer and its distributors to ban the sale of e-cigarettes in the state (GASP; Paradise). Arkansas, Arizona, Alabama, Colorado, Kansas, Maryland, Mississippi, Vermont, Wisconsin and West Virginia are among states that have passed ordinances to prohibit the sale of e-cigarettes to minors with varying age limits from younger than 18 to younger than 21 years (GASP).

In 2016, Food and Drug Administrations (FDA) finalized issuing a set of rules to regulate manufacturing, importing, packaging, labeling, advertising, promotion, sale, and distribution of all e-cigarettes including vaporizers, vape pens, hookah pens, and electronic cigarettes. Manufacturers have to send a pre-approval form and go through product approval process before they market a new product. Manufacturers and importers are required to report quantities of harmful and potentially harmful found in tobacco products or smoke according to the Family Smoking Prevention and Tobacco Control Act. The packs of cigarettes and advertisement are required to contain a health warning and a graphic element displaying the negative health effects of smoking. Manufacturers or importers are required to submit information about the product, its ingredients and constituents, and the health and behavioral effects of the product before distribution (FDA, 2015; 2016).

Some countries as Argentina, Singapore, Brazil, Canada, Israel, and Panama have banned the importation, distribution, and sale of e-cigarettes. In addition to sale of e-cigarettes, a few countries including Australia (state of Victoria), Argentina, Brazil, and Turkey have banned the advertisement of e-cigarettes. The United Kingdom has regulated e-cigarettes as medicine,

requiring a license that e-cigarette manufacturers prove the quality including the amount of nicotine they deliver (GASP, 2014).

Theories

Many arguments have been made proposing theories to explain the factors with awareness, experimentation, and initiation and use of tobacco and drugs. The gateway, social marketing, and social cognitive theory are some of the theories that have emerged in debates about tobacco use including electronic cigarettes. Gateway theory originated from the notion of a “gateway drug” and has been applied in the arguments that e-cigarettes may lead to nicotine dependence and use of other tobacco products. Social marketing theory was established through the application of marketing principles and strategies into the social issues and health problems. However, social marketing strategies have been used by tobacco companies to promote and advertise their products to adolescents and adults. Social cognitive theory was identified as an extension of Social Learning Theory and often emerged in tobacco arguments emphasizing the link between peer and parent smoking and adolescent use of tobacco.

The Gateway Theory

Gateway theory is known as “gateway hypothesis” and suggests “certain drugs act as a gateway to the usage of other drugs” (Bell & Keane, 2014, p. 45). This notion has been used in discussions of a variety of substances involving cigarettes, alcohol, and drugs. The origins of the gateway lie in “stepping stone theory” which highlights that drug users increase their risk of involvement and progress to other, more serious drugs. The gateway theory also represents the convergence of Kandel’s stages of progression (1975) and Dupont’s gateway drugs model (1984). Kandel referenced two longitudinal cohort studies of New York high school students and suggested that adolescent drug use has four distinct stages; adolescents’ use of beer and wine,

proceeding to hard liquor and cigarettes, progressing to marijuana, and increasing the likelihood of using other illicit drugs. DuPont's gateway drug theory emphasized a vulnerability to drug use, the dangers of safe seeming drugs, the role of addiction and harder drug use, and the use of gateway drugs (Bell & Keane).

The gateway theory reemerged in the discussion of e-cigarettes with the concern about their potential as a gateway to nicotine dependence in young adolescents. Despite the lack of research on e-cigarette safety and efficacy for smoking cessation, or as substitutes for smoking, empirical research shows that awareness and experimentation with e-cigarettes among both smoking and non-smoking young adolescents and adults are on the rise. Findings suggest that e-cigarette use may lead to lifelong nicotine dependence and subsequent use of conventional cigarettes and other tobacco products. The patterns of e-cigarette and cigarette usage indicate a chain reaction of "awareness of e-cigarettes → experimentation with e-cigarettes → nicotine dependence → smoking" (Bell & Keane, 2014, p.49).

Application of the gateway theory will be used to inform this study of the relationship between e-cigarette use and smoking. The use and awareness of e-cigarettes among smokers and non-smokers in relation to their smoking habits will be highlighted within the theoretical framework.

Social Marketing Theory

The social marketing approach was established by Kotler and Zaltman in 1971, referring to the design and implementation of programs to increase the acceptability of social ideas while involving the application of product planning, pricing, communication, and distribution in marketing research (MacFadyen, Stead, & Hastings, 1999). This definition was critiqued by Rangun and Karim (1991) arguing that "social marketing involves changing attitudes, beliefs,

and behaviors of individuals or organizations for a social benefit, and the social change is the primary purpose of the campaign” (Andreasen, quoted from Rangun and Karim, 1994, p.109). In later discussions, many scholars and researchers have believed that social marketing involves an organized effort by a group aiming to persuade target groups to accept, adapt, or give up certain ideas, attitudes, and behaviors (Andreasen, 1994).

The social marketing concept is applied to health programs and campaigns to solve public health problems in the United States. The American Cancer Society applied social marketing principles to their annual campaign “The Great American Smokeout” to reduce the incidence of smoking (Andreasen, 1994). Social marketing approaches have been applied to obesity to encourage individuals to eat more fruits and vegetables and exercise more (Wymer, 2010).

Many tobacco producers have used marketing strategies and techniques to spread tobacco use and addiction globally for decades. Research established that advertising and promotional activities have been aimed to encourage people to start smoking and to ensure existing smokers continue smoking. Tobacco companies developed marketing strategies by using principles of social marketing theory: product, price, placement, and promotion. Tobacco products are manufactured with varying amounts of nicotine and tar, and with flavorings that have a signature taste and strength to appeal to and suit a particular social group. Price is an important factor for smokers in their choice of brands. Therefore, tobacco companies make a range of premium, economy, and mid-priced brands to provide options for buyers’ budgets. Placement, which is availability of products to the public, is an important element of popularity of particular brands. Tobacco companies’ goals are to ensure that their products are available to all smokers and conveniently purchased almost anywhere including supermarkets, gas stations, and vending

machines, etc. Promotional activities are used to increase the public awareness of cigarette brands. Tobacco companies sponsor sporting events and use their brand images to achieve extensive publicity. They design the cigarette packages with eye-catching images and colors and display them in the best possible position at retail stores to appeal to potential customers (Anderson, Hastings, & MacFadyen, 2002).

Social marketing theory informs this study of the awareness of e-cigarettes and the sources of awareness including e-cigarette advertisement on TV, radio, magazines, and social media. It helps to explain the relationship between awareness and use of e-cigarette by young adolescents.

Social Cognitive Theory

Social cognitive theory (Bandura 1977, 1986), which is an extension of social learning theory posits that behavior is a function of personal and environmental factors, and an interactive process of reciprocal determinism that is the interaction of individuals' factors and social/environmental cues. According to social cognitive theory, sense of self-efficacy is a person's confidence in his or her ability to perform and sustain behavior. The social and physical environment of the individual plays a major role in learning or observing the individual's behavior. Vicarious learning as a consequence of observing and modeling others' behaviors is the key principle of social cognitive theory (Edberg, 2010; Schiavo, 2007).

Social learning theory (Bandura, 1977) acknowledges that "both social processes and cognitive mediation are as important in the acquisition and maintenance of behavior, such as smoking" (Kobus, 2003, p. 39). Behaviors can be learned through observing others engaged in a behavior, modeling this behavior, and applying the rewards or punishment associated with the behavior (Kobus). In the case of youth, smoking behavior is viewed as being most likely to

imitate smoking behavior of those they have the greatest amount of contact with such as parents and peers. The findings from McAllister et al. (1984) and Webster et al. (1994) have pointed to the greater role of peers in teenagers' use of tobacco. The systematic review of studies by Avenevoli and Merikangas (2003) suggests that mother and father smoking have been both related to adolescent smoking in some studies.

Social cognitive theory informs this study concerning factors associated with initiation and the use of e-cigarettes. Specifically, the theory is going to help explain the association between parents' smoking, peers' smoking, and adolescent e-cigarette use.

CHAPTER 3: METHODS

A quantitative research design was employed for this study. The research utilized a cross-sectional survey aimed at exploring awareness of e-cigarettes, identifying the factors associated with the initiation and use of e-cigarettes, and exploring the reasons to use e-cigarettes among high school students.

The research focused on associations between smoking cigarettes and current use of e-cigarettes, relationships between e-cigarette advertisements and e-cigarette use, and reasons to use e-cigarettes and gender. The study had several dependent and independent variables. The current use of e-cigarettes, trying e-cigarettes, intention to use e-cigarettes, and reasons to use were identified as dependent variables. Age, gender, grade level, parents smoking, peers smoking, seeing e-cigarette advertisements, and receiving information about e-cigarettes through social media and peers were identified as independent variables. Table 2 presents dependent variables and their measures and Table 3 presents independent variables and their measures.

Data gathering took place in three high schools. High school students surveyed in the fall of 2015 were currently taking health education classes.

Instrument

The survey (Appendix A) assessed a general scope of e-cigarette awareness, sources of awareness, and reasons to use e-cigarettes. It consisted of five parts including e-cigarette awareness, e-cigarette use, reasons to use e-cigarettes, tobacco smoking history, and demographics with 26 multiple choice questions and two open ended questions. The first part focused on the construct of e-cigarette awareness and measured high school students e-cigarette awareness and the sources of awareness as advertisements on TV, radio, in magazines or newspapers, social media, and from peers. The second part addressed e-cigarette use and

measured current use of e-cigarettes, initiation, current and future use of tobacco products, peers' and parents' use of e-cigarettes. Open ended questions that asked about teens' reasons for future tobacco use were also included in this section. The third part explored reasons to use e-cigarettes among teens, who use e-cigarettes, and how other teens who don't use e-cigarettes perceive the reasons for e-cigarette use. The fourth part of the survey examined teens' tobacco smoking including peers, parents, and other family member(s) smoking. The last part described the teens' demographics, including age, grade level, and gender. This part included an open ended question on their thoughts about teens and e-cigarettes.

The researcher developed the survey by adapting some items from a research questionnaire developed by Etter and Bullen (2011). The survey was pilot tested with a similar sample of high school students (N = 43) to explore reliability and validity of the instrument. The scale of reasons to use e-cigarettes (8 items) was found to have a Cronbach's alpha of .819, n = 29. The correlation for the reasons teenagers may use e-cigarettes indicated good internal consistency (Gliner, Morgan, & Leech, 2009).

Pilot testing informed researcher on research procedures and research questions that are misleading, inappropriate, redundant, or complicated. Data from pilot showed some of the questions needed improvements. The question measuring knowledge about e-cigarettes had been modified. The answer selection of "nothing, a little, some, and a lot" replaced with a scale of 1-10 (one referring know nothing and ten referring know a lot) for knowledge. The demographics had been reviewed and reorganized with informal statements for age, class, and gender. Directions for some the questions had been simplified to prevent ambiguity. Parent consent form, cover letter, and script had been reviewed and shortened.

Table 2

Dependent variables and their measures

Variable	Variable Description	Variable Measures
Current use of e-cigarettes B-8	Do you use electronic cigarettes?	1 = No, I have never used it 2 = No, but I have used it in the past 3 = Yes, I use it occasionally (not daily) 4 = Yes, I use it everyday
Ever tried e-cigarettes B-7	Have you ever tried an e-cigarette even a puff?	1 = Yes 2 = No
Initiation of tobacco B-9	Which one of the following did you use first?	1 = Traditional cigarettes 2 = Smokeless tobacco (snus or chewing tobacco) 3 = Waterpipe tobacco smoking (hookah or narghile) 4 = Electronic cigarettes 5 = None of them
Current use of tobacco B-10	Which one of the following are you currently using?	1 = Traditional cigarettes 2 = Smokeless tobacco (snus or chewing tobacco) 3 = Waterpipe tobacco smoking (hookah or narghile) 4 = Electronic cigarettes 5 = None of them
Future use of tobacco B-11	Which one of the following may you consider to use in the future?	1 = Traditional cigarettes 2 = Smokeless tobacco (snus or chewing tobacco) 3 = Waterpipe tobacco smoking (hookah or narghile) 4 = Electronic cigarettes 5 = None of them
Reasons to use e-cigarettes B-15 & 16	Please indicate the level of agreement on each of following statements. I or teens use e-cigarettes because of curiosity because of addiction because it is healthier than tobacco because it is cheaper than tobacco to quit smoking to deal with stress to lose weight to socialize with friends	1 = Strongly disagree 2 = Disagree 3 = Feel Neutral 4 = Agree 5 = Strongly Agree

Table 3

Independent variables and their measures

Variable	Variable Description	Variable Measures
Awareness of e-cigarettes:		
Watching TV advertisement A-2	Have you watched advertisements of e-cigarettes on TV?	1 = Yes 2 = No
Hearing radio advertisement A-3	Have you heard e-cigarettes advertisements on the radio?	1 = Yes 2 = No
Seeing magazine or newspaper advertisement A-4	Have you seen advertisements of e-cigarettes in magazines or newspapers?	1 = Yes 2 = No
Receiving information through social media A-5	Have you received information about e-cigarettes through social media?	1 = Yes 2 = No
Sharing information through peers A-6	Have your peers or friends shared information about electronic cigarettes with you?	1 = Yes 2 = No
Peers, Parent, and Family use of e-cigarettes:		
Peers' e-cigarette use B-12	Do one or more close friends use electronic cigarettes?	1 = Yes 2 = No 3 = Don't know
Parents' e-cigarette use B-13	Does your mother or father use electronic cigarettes?	1 = Yes, both my mom and dad use 2 = Yes, my mom uses 3 = Yes my dad uses 4 = No, neither my mom nor dad use it 5 = I don't know if they do
Family members' e-cigarette use B-14	Who else in your family uses electronic cigarettes?	1 = Brother(s)/ Sister(s) 2 = Grandmother 3 = Grandfather 4 = Uncle 5 = Aunt 6 = Other, cousin 7 = None one uses 8 = I don't know if they do
Tobacco Smoking History:		
Teens' current use of cigarettes D-18	Do you smoke cigarettes?	1 = No, I have never used it 2 = No, but I have used it in the past 3 = Yes, occasionally (not daily) 4 = Yes, I smoke everyday
Close friend (s) smoking D-21	Do one or more close friends smoke cigarettes?	1 = Yes 2 = No 3 = Don't know
Parents smoking D-22	Do your mother or father smoke cigarettes?	1 = Yes, both my my mom and dad smokes 2 = Yes, only my mom smokes 3 = Yes only my dad smokes 4 = No, neither my mom and dad smokes 5 = I don't know if they do
Demographics:		
Age D-24	My age is	1 = 13; 2 = 14; 3 = 15; 4 = 16; 4 = 17 5 = 18 and older
Grade Level D-25	My class is	1 = Freshman; 2 = Sophomore; 3 = Junior 4 = Senior
Gender D-26	My gender is	1 = Male; 2 = Female; 3 = Other; 4 = Prefer not to respond

Participants and Site

The study sample consisted of high school students in a large Colorado school district. There are nine high schools; four comprehensive high schools were considered appropriate for the study within the school district.

This research initially included four high schools (grades 9-12), but three high schools labeled A, B, C participated. The characteristics of participant schools are represented in Table 4. High school students are required to take 2.5 credits of health through classes in health and wellness, or health, or health electives. The students who enrolled in these classes were asked to voluntarily complete the e-cigarette survey.

Table 4

Characteristics of Participant Schools

High School	Total Enrollment	Health Class Sessions	Health Class Enrollment
A	1900	6	179
B	2000	4	119
C	1600	3	90

Procedures

Approvals for this study were obtained through the Colorado State University's Institutional Review Board (IRB) (Appendix B) and the school district (Appendix C). Permission to participate in the survey was also obtained from students' parents through a parental consent form (Appendix D).

The researcher contacted instructors of health classes to arrange dates and times for data collection. The pen and paper survey was administered during class time. Students who had parental consent forms received the cover letter (Appendix E). The survey administrator read the script for data collection (Appendix F), informed the students about research, and stated that participation was voluntary, anonymous, and could be stopped at any time. Students were given 15-20 minutes to complete the survey.

Data Analysis

The goal was to explore associations and examine correlations among variables of e-cigarette awareness, e-cigarette use, tobacco use, and reasons to use e-cigarettes among high school students. The Statistical Package for the Social Sciences Version 22.0 (SPSS, 2013) was utilized for the data analysis.

The correlations among variables of e-cigarette awareness use and e-cigarette use were examined through Pearson's chi-squared test, since most of the variables were nominal and assumptions of the parametric data were violated. The associations among the variables of smoking history that identified initial, current, and intention of future smoking, parent and peer smoking and teens' e-cigarette use were explored by Pearson's chi-squared test. The gender differences on variables of reasons to use e-cigarettes were examined by Mann-Whitney *U* test because the assumptions of parametric data were violated.

Responses for open-ended questions for future use of tobacco and teens and electronic cigarettes were read and transcribed into Word documents. The responses for teens' future use of tobacco were categorized as reasons for not considering tobacco use in the future and reasons for considering tobacco use in the future. Under those two categories, responses were read twice, and repeated words and phrases were counted. The emerging themes were highlighted and

summarized. Similarly, the students' opinions about teens and electronic cigarettes were read twice and transcribed into a Word documents. Each response was labeled as one or more of the categories. Repeated words and phrases were counted and highlighted. The emerging themes were summarized and presented on a table with descriptive quotes.

CHAPTER 4: FINDINGS

This chapter presents findings, including details about the sample and statistical interpretations of research questions. The purpose of this study was to assess teens' awareness of e-cigarettes, to explore the factors associated with initial and continuing use of e-cigarettes, and identify reasons to use e-cigarettes. The goal was to explore associations among various variables and differences by gender. The research questions were analyzed using methods such as Pearson's chi-squared test and Phi Cramer's V, when appropriate, to explore associations and effect sizes.

Sample

This research initially included four public high schools along the Colorado Front Range. Three high schools participated. A total of 251 high school students enrolled in health, health and wellness, and teen choices classes volunteered to complete the e-cigarette survey. Of those students, 54% from high school A, 35% from high school B, and 11% were from high school C. The majority of students were sophomores (59%), followed by freshmen (28%), juniors (8%), and seniors (3%). Most students were 15 years old (54%), and 14 years old (27%). Participants included 49% males and 47% females. The details of the demographics of the sample are displayed in Table 5.

In addition to demographics, students' self-reported knowledge of e-cigarettes was measured with a 0-10 scale. The responses were combined and recoded as 0 being "know nothing," 1-3 "know a little," 4-6 "know some," 7-9 "know more," and 10 "know a lot." The students' knowledge on e-cigarettes are displayed in Table 6. Two fifths of students (41%) reported having some knowledge about e-cigarettes, 14% reported having more knowledge and 36% reported having a little knowledge about e-cigarettes.

Table 5

Demographic Characteristics of Participants (N = 251)

Characteristic	Frequency	Percent ^a
High School		
A	135	54
B	88	35
C	28	11
Total	251	100.0
Year in School		
Sophomore	148	59
Freshmen	71	28
Junior	20	8
Senior	8	3
Missing	4	2
Total	251	100.0
Age (years)		
15	135	54
14	68	27
16	32	13
17	9	4
18 and older	2	.8
13	1	.4
Missing	4	2
Total	251	101.2
Gender		
Male	122	49
Female	118	47
Other	3	1
Prefer not to respond	4	1
Missing	4	2
Total	251	100.0

^aTotals may not equal 100% because of rounding.

Table 6

Teens' Knowledge about E-cigarettes

Knowledge	Frequency	Percent
Know a lot	4	2
Know more	36	14
Know some	103	41
Know a little	91	36
Know nothing	17	7
Total	251	100

Initial Data Assessment

Descriptive statistics were reviewed for each variable to find outliers, missing values, and non-normal distributions. The descriptive of variables is displayed in Tables 7-12. Demographic distributions of students by school, gender, year in school, and age were reviewed. The independent variables of watching e-cigarette TV advertisements, seeing magazine or newspaper e-cigarette advertisements, and hearing e-cigarette advertisements on the radio, were nominal with two levels. The dependent variables of e-cigarette use; trying e-cigarettes; past, current, and future tobacco use were nominal with four or more levels. The assumptions of parametric data, such as normality, homogeneity of variance, and independence, were not met.

E-cigarette use among high school students showed a majority of students (81%) never used e-cigarettes and a few students (14%) used them in the past (Table 7). Four percent reported using e-cigarettes occasionally and .4% reported using them everyday. Seventy-eight percent of students reported never trying e-cigarettes and 21% of students reported having tried e-cigarettes. Forty-three percent indicated having close friends or peers who never used e-cigarettes, and 29% indicated having close friends or peers who use e-cigarettes. Eighty-six percent stated neither mom nor dad use e-cigarettes, and 49% stated no family members use e-cigarettes.

Table 7

Descriptive Current of E-cigarette Use among High School Students and Their Family Members

Variables	Frequency	Percent ^a
Current use of e-cigarettes		
No, I have never used	204	81
No, but I used in the past	34	14
Yes, I use electronic cigarettes occasionally	11	4
Yes, I use electronic cigarettes everyday	2	.8
Total	251	99.8
Ever tried e-cigarettes		
No	196	78
Yes	53	21
Missing	2	.8
Total	251	99.8
Peers' or close friends' e-cigarette use		
No	108	43
Yes	73	29
Don't know	63	25
Missing	7	3
Total	251	100.0
Parents' e-cigarette use		
No, neither my mom nor dad use	216	86
I don't know if they do	11	4
Yes, my dad uses	8	3
Yes, my mom uses	7	3
Yes, both my mom and dad use	3	1
Missing	6	2
Total	251	99.0
Family members' e-cigarette use		
No one uses	124	49
I don't know if they do	56	22
More than one family member use	18	7
Aunt	11	4
Brother(s)/Sister(s)	9	4
Other, cousin	8	3
Uncle	7	3
Grandfather	5	2
Missing	13	5
Total	251	99.0

^aTotals may not equal 100% because of rounding.

Most students reported that they had not experienced first use of tobacco (94%) and indicated they are not currently using tobacco (88%) or they would not consider to use tobacco in the future (79%) (Table 8). A few students (8%) were currently using multiple tobacco products including waterpipe tobacco, electronic cigarettes, and traditional cigarettes. Less than one-sixth of students' (14%) first use was waterpipe tobacco. Six percent used e-cigarettes and 4% used traditional cigarettes as the first use of tobacco. A few students (3% or less) reported current use of multiple tobacco products, including electronic cigarettes, traditional cigarettes, waterpipe tobacco, and smokeless tobacco. Seventy-nine percent did not consider using tobacco products in the future. Eight percent indicated considering using waterpipe tobacco in the future.

Table 8

Descriptive First, Current, and Future Tobacco Use among High School Students

Variable	Frequency	Percent
First use of tobacco		
None	186	74
Waterpipe tobacco smoking	36	14
Electronic cigarettes	15	6
Traditional cigarettes	11	4
Smokeless tobacco	1	.4
Missing	2	.8
Total	251	99.2
Current use of tobacco		
None	220	88
Multiple tobacco use	8	3
Waterpipe tobacco smoking	7	3
Electronic cigarettes	4	2
Traditional cigarettes	4	2
Smokeless tobacco	1	.4
Missing	7	3
Total	251	101.4
Future tobacco use		
None	197	79
Waterpipe tobacco smoking	20	8
Multiple tobacco use	16	6
Electronic cigarettes	6	2
Traditional cigarettes	4	2
Smokeless tobacco	1	.4
Missing	7	3
Total	251	100.4

^aTotals may not equal to 100% because of rounding.

Students' tobacco history indicated 83% never smoked a cigarette even a puff (Table 9). Less than 10% reported smoking in the past and less than 5% reported using cigarettes occasionally. Half of the students (55%) reported that none of their peers smoke. Twenty-three percent reported their peers' smoke. Almost four-fifths of students (79%) had non-smoking parents, 5% had a mom who smoked, and 6% had a dad who smoked. Twenty-eight percent reported having more than one family member using tobacco, and one-third had no family member smoking.

Table 9

Descriptive Tobacco History among High School Students and Their Family Members

Variable	Frequency	Percent ^a
Ever smoked a cigarette even a puff		
No	208	83
Yes	34	14
Missing	9	4
Total	251	101.0
Smoking history		
No, I have never smoked	207	83
No, but I have smoked in the past	23	9
Yes, occasionally (not daily)	11	4
Missing	10	4
Total	251	100.0
Number cigarettes you smoked		
Less than 10 cigarettes	10	4
10-19 cigarettes	3	1
20-29 cigarettes	3	1
Missing	235	94
Total	251	100.0
Tried to quit smoking		
Yes	7	3
No	7	3
Missing	237	94
Total	251	100.0
Peers' smoking		
No	137	55
Yes	58	23
Don't know	45	18
Missing	11	4
Total	251	100.0
Parents' smoking		
No, neither my mom nor dad smoke	197	79
Yes, my mom smokes	14	6
Yes, my dad smokes	13	5
Yes, both my mom and dad smoke	12	5
I don't know if they do	5	2
Missing	10	4
Total	251	101.0

Family members' smoking		
No one uses	82	33
More than one family member use	69	28
I don't know if they do	31	12
Grandfather	10	4
Uncle	14	6
Aunt	11	4
Other, cousins	13	5
Brother(s)/Sister(s)	6	2
Missing	15	6
Total	251	100.0

^aTotals may not equal 100% because of rounding.

The students reported awareness of e-cigarettes by watching TV ads (75%), seeing newspaper or magazines ads (72%), hearing radio ads (38%), and interacting with social media (49%). More students (59%) did not share information about e-cigarettes with peers than did (41%). The details of the findings are presented in Table 10.

Table 10

Descriptive Awareness of E-cigarettes among High School Students

Variable	Frequency	Percent ^a
Watching TV e-cigarette ads		
Yes	189	75
No	62	25
Total	251	100.0
Hearing radio e-cigarette ads		
No	155	62
Yes	96	38
Total	251	100.0
Seeing magazines or newspaper e-cigarette ads		
Yes	180	72
No	70	28
Missing	1	.4
Total	251	100.4
Receiving information through social media		
No	129	51
Yes	122	49
Total	251	100.0
Sharing information with peers		
No	149	59
Yes	102	41
Total	251	100.0

^aTotals may not equal 100% because of rounding.

Reasons to use e-cigarettes were explored by gender among students who had used (n = 34) or were currently using e-cigarettes (n = 13). The foremost reasons to use e-cigarettes among e-cigarette users (n = 27) included curiosity (M = 3.73, SD = .83), healthier (M = 3.48, SD = 1.05), to deal with stress (M = 3.00, SD = 1.23), and to socialize (M = 2.93, SD = .92). The details of the findings are presented in Table 11.

Table 11

Reasons to Use among High Schoolers who Used in the Past or are Currently Using E-cigarettes

Reasons	<u>Strongly Disagree</u> <i>n</i>	<u>Disagree</u> <i>n</i>	<u>Feel Neutral</u> <i>n</i>	<u>Agree</u> <i>n</i>	<u>Strongly Agree</u> <i>n</i>	<u>M</u>	<u>SD</u>
Curiosity	-	2	7	13	4	3.73	.83
Healthier	1	3	10	8	5	3.48	1.05
To deal with stress	4	5	6	9	2	3.00	1.23
To socialize	1	8	11	6	1	2.93	.92
Cheaper	2	12	8	3	2	2.67	1.04
To quit smoking	7	9	5	4	1	2.35	1.16
Addiction	13	8	3	3	-	1.85	1.03
To lose weight	14	7	3	3	-	1.81	1.04

Students who never used e-cigarettes ($n = 204$) reported a level agreement for the reasons that teens might use e-cigarettes. Reasons for teens' e-cigarette use were analyzed by gender. The foremost reasons were curiosity ($M = 3.75$, $SD = .84$), to socialize ($M = 3.73$, $SD = 1.06$), to deal with stress ($M = 3.67$, $SD = .98$), addiction ($M = 3.46$, $SD = .98$), and healthier ($M = 3.16$, $SD = 1.07$). The details of the findings are presented in Table 12.

Table 12

Reasons High Schoolers, who Never Used E-cigarettes, Think Teenagers may Use E-cigarettes

Reasons	<u>Strongly Disagree</u> <i>n</i>	<u>Disagree</u> <i>n</i>	<u>Feel Neutral</u> <i>n</i>	<u>Agree</u> <i>n</i>	<u>Strongly Agree</u> <i>n</i>	<u>M</u>	<u>SD</u>
Curiosity	4	13	39	119	27	3.75	.84
To socialize	6	21	49	74	54	3.73	1.06
To deal with stress	7	17	49	92	37	3.67	.98
Addiction	5	32	57	85	25	3.46	.98
Cheaper	7	32	94	53	17	3.20	.92
Healthier	9	44	74	55	20	3.16	1.02
To quit smoking	28	57	67	41	7	2.71	1.05
To lose weight	35	69	61	31	8	2.55	1.07

Research Questions

In this section, research questions are addressed and findings outlined. This discussion includes details about the statistical tests applied to research questions, statistical interpretation, research questions with significance level and effect sizes, and the summary of results.

As most of the independent and dependent variables were nominal, and the assumptions of normal distribution were violated, non-parametric statistical analyses were performed to answer the research questions. Pearson's chi-squared tests were conducted to examine correlations among seeing, hearing, or watching e-cigarette advertising and using e-cigarettes; receiving or sharing information about e-cigarettes and trying or using e-cigarettes; use of e-cigarettes, and past, current and future use of tobacco products. When the correlations were significant among those variables ($p \leq .05$), Cramer's V and Phi were used to reveal effect sizes. The effect sizes were interpreted according to Rea and Parker's interpretation of Cramer's V and Phi, and displayed in Table 13. Mann-Whitney U tests were conducted to explore differences between variables. Effect sizes (r) were calculated for significant differences ($p \leq .05$) among variables and interpreted according to Cohen (1988).

Table 13

Interpretation of Calculated Cramer's V, Phi, and Lambda Measures of Association

Measure	Interpretation
.00 and under .10	Negligible association
.10 and under .20	Weak association
.20 and under .40	Moderate association
.40 and under .60	Relatively strong association
.60 and under .80	Strong association
.80 to 1.00	Very strong association

Note: Adapted from Designing and Conducting Survey Research (p. 189) by Rea, L. M. and Parker, R. A., 2005, Jossey-Bass, San Francisco, CA.

Seeing, Hearing or Watching E-cigarette Ads and E-cigarette Use

Pearson's chi-squared test examined correlations between watching, hearing, or seeing e-cigarette advertisement and current use of e-cigarettes (n = 251). Table 14 displayed no significant correlations for three independent variables on the current use of e-cigarettes. Although watching, hearing, or seeing e-cigarette advertisements, and being aware of e-cigarette advertisements, did not relate to e-cigarette use among high school students; 82% of students who never used e-cigarettes, 13% of students who used e-cigarettes in the past, and 5% students who used e-cigarettes currently reported watching e-cigarette advertisements on TV. Of those, who never used e-cigarettes, 76% expressed having heard radio e-cigarette advertisements and 78% expressed having seen e-cigarette advertisements in magazines or newspapers. There was a similar pattern between watching e-cigarettes TV ads and seeing magazine or newspaper e-cigarettes ads by non-, past, and current users of e-cigarettes. Most of the students who never used e-cigarettes reported watching e-cigarette TV ads as well as seeing magazine and or newspaper ads (82%; 78% respectively). The patterns among past and current e-cigarette users for watching, hearing, and seeing e-cigarette ads were similar. The patterns for students who reported not watching and seeing magazine or newspaper e-cigarette ads were similar. Students who reported not hearing radio e-cigarette ads had a different pattern. Most students reported not hearing radio e-cigarette ads.

Table 14

Awareness of TV, Radio, Magazine or Newspaper Advertisement and Current E-cigarette Use

Use of e-cigarettes	<u>Watched TV ads</u>				$\chi^2 (2)$	<i>p</i>	
	<u>Yes</u>		<u>No</u>				
	<i>n</i>	%	<i>n</i>	%			
Never used	155	82	49	79	.37	.833	
Past use	25	13	9	15			
Current use	9	5	4	7			
Total	189	100.0	62	101.0			
		<u>Heard radio ads</u>					
Never used	73	76	131	85	2.86	.240	
Past use	17	18	17	11			
Current use	6	6	7	5			
Total	96	100.0	155	101.0			
		<u>Saw magazine or newspaper ads</u>					
Never used	141	78	62	89	3.48	.175	
Past use	28	16	6	9			
Current use	11	6	2	3			
Total	180	100.0	70	101.0			

Receiving or Sharing Information about E-cigarettes and Trying or Using E-cigarettes

A chi-squared test of independence was performed to examine the correlation between students' receiving information about e-cigarettes through social media including Facebook, Instagram, YouTube, Twitter and blogs, and using e-cigarettes (Table 15). Findings revealed a significant correlation between variables of receiving information about e-cigarettes and using e-cigarettes; $\chi^2 (2, N = 251) = 15.68, p = .000$. The effect size, Cramer's $V = .25$, $\Phi = .25, p = .000$, suggested awareness of e-cigarettes through social media and current use of e-cigarettes was moderately associated. Seventy-one percent of non-users, 21% of past users, and 7% of current users of e-cigarettes stated having received information about e-cigarettes through social media.

Ninety-one percent of non-users, 6% of past users, and 3% of current users of e-cigarettes did not receive information through social media.

Chi-squared tests revealed there was a significant correlation between sharing information about e-cigarettes with peers or close friends and using e-cigarettes; $\chi^2 (2, N = 251) = 52.10, p = .000$. The effect size (Cramer's $V = .46$, Phi = $.46, p = .000$) revealed a relatively strong association between the variables of peers sharing information about e-cigarettes and using e-cigarettes. Sixty-percent of non-users, 29% of past users, and 11% of current users of e-cigarettes reported sharing information about e-cigarettes with peers. Ninety-six percent of non-users, 3% of past users, and 1% of current users did not share information with peers.

Table 15

Correlations between Receiving or Sharing Information about E-cigarettes and Using E-cigarettes

Use of e-cigarettes	<u>Received information through social media</u>				$\chi^2 (2)$	<i>p</i>
	<u>Yes</u>		<u>No</u>			
	<i>n</i>	%	<i>n</i>	%		
Never used	87	71	117	91	15.68	.000
Past use	26	21	8	6		
Current use	9	7	4	3		
Total	122	99.0	129	100.0		
	<u>Shared information with peers</u>					
Never used	61	60	143	96	52.10	.000
Past use	30	29	4	3		
Current use	11	11	2	1		
Total	102	100.0	149	100.0		

Chi-squared results showed a significant correlation between variables of receiving information through social media and having ever tried e-cigarettes among high school students; $\chi^2(1, N = 249) = 12.60, p = .000$ (Table 16). The effect size of Cramer's V and Phi indicated a moderate association between receiving information about e-cigarettes through social media and trying e-cigarettes (Cramer's V = .23, Phi = .23, $p = .000$). Thirty-one percent of students who received information through social media reported trying e-cigarettes, while 12% who did not receive information through social media reported trying e-cigarettes as well. Eighty-eight percent who did not receive information reported never trying e-cigarettes, and 69% who did receive information reported never trying e-cigarettes.

Chi-squared test results revealed a significant correlation between variables of sharing information about e-cigarettes with peers or close friends, and trying e-cigarettes among high school students ($\chi^2(1, N = 249) = 42.80, p = .000$). The effect size of Cramer's V and Phi indicated a relatively strong association between sharing information with peers and trying e-cigarettes (Cramer's V = .42, Phi = .42, $p = .000$). Forty-two percent of students, who shared information about e-cigarettes with peers, reported trying e-cigarettes, whereas 7% of students who did not share information with close friends reported trying e-cigarettes. Ninety-three percent reported neither having shared information with close friends nor having tried e-cigarettes. Fifty-eight percent who shared information with close friends reported never trying e-cigarettes.

Table 16

Correlations between Receiving or Sharing Information about E-cigarettes and Trying E-cigarettes

Ever tried e-cig	<u>Received information through social media</u>				$\chi^2(1)$	<i>p</i>		
	<u>Yes</u>		<u>No</u>					
	<i>n</i>	%	<i>n</i>	%				
No	83	69	113	88	12.60	.000		
Yes	37	31	16	12				
Total	120	100.0	129	100.0				
	<u>Shared information with peers</u>				$\chi^2(1)$	<i>p</i>		
No	58	58	138	93			42.80	.000
Yes	42	42	11	7				
Total	100	100.0	149	100.0				

Past, Current, and Future Use of Tobacco Products and Use of E-cigarettes

Chi-squared tests were performed to examine the correlations between past, current, and future use of tobacco products, and the use of e-cigarettes (Table 17). The variables of past, current, and future use of tobacco products were combined and recoded as use and non-use to prevent violations of expected cell counts of less than five. Findings showed statistical significance between e-cigarette use and past use of tobacco products among high schoolers ($\chi^2(2, N = 249) = 157.08, p = .000$). The effect size of Cramer's V and Phi was .79 ($p = .000$). Past use of tobacco use was strongly associated with current use of e-cigarettes. Students who used tobacco products in the past had a tendency to use e-cigarettes. Fifty-one percent of students who used tobacco in the past reported past use of e-cigarettes, whereas 21% of students who used tobacco in the past reported current use of e-cigarettes.

There were statistically significant correlations between current use of e-cigarettes, and current ($\chi^2(2, N = 244) = 83.27, p = .000$) and future use of tobacco products ($\chi^2(2, N = 244) = 68.37, p = .000$) among high school students. The effect size of Cramer's V and Phi showed

relatively strong associations within the variables of e-cigarette use for the current (Cramer's $V = .58$; $\Phi = .58$, $p = .000$) and future use (Cramer's $V = .53$; $\Phi = .53$, $p = .000$) of tobacco products. Thirty-three percent of non-users, 25% of past users, and 42% of current users of e-cigarettes mentioned using tobacco currently. Forty percent of non-users, 38% past users, and 21% current users of e-cigarettes reported use of tobacco products in the future.

Table 17

Correlations between Past, Current, and Future Use of Tobacco Products and Current Use of E-cigarettes

Use of e-cigarettes	<u>Past tobacco use</u>		<u>Non-use</u>		$\chi^2(2)$	p
	<i>n</i>	%	<i>n</i>	%		
Never used	18	29	185	99	157.08	.000
Past use	32	51	1	.5		
Current use	13	21	0	0		
Total	63	101.0	186	99.5		
	<u>Current tobacco use</u>		<u>Non-use</u>		83.27	.000
Never used	8	33	191	87		
Past use	6	25	27	12		
Current use	10	42	2	.9		
Total	24	100.0	220	99.9		
	<u>Future tobacco use</u>		<u>Non-use</u>		68.37	.000
Never used	19	40	179	90		
Past use	18	38	16	8		
Current use	10	21	2	1		
Total	47	99.0	197	99.0		

Close Friends', Parents', and Family Members' E-cigarette Use and Teens' Use of E-cigarettes

Chi-squared tests were executed to explore associations between close friends', parents', and family members' e-cigarette use and teens' current use of e-cigarettes. The details of the

findings are displayed in Table 18. The variables of teens' current use of e-cigarettes were combined and recoded as use and non-use to prevent violations of expected cell counts of less than five. Use included past or current use of e-cigarettes. The variables of close friends', parents' and family members' e-cigarette use were combined and recoded as "yes," "no," and "don't know" to prevent violations. "Yes" referred to use and "no" referred to non-use of e-cigarettes.

Findings revealed statistically significant association between close friends' and teens' e-cigarette use ($\chi^2(2, N = 244) = 47.29, p = .000$). The effect size of Cramer's V and Phi for the variables of close friends' e-cigarette use and teens' current use of e-cigarettes were .44, $p = .000$. The association was moderate. Fifty-five percent who never used e-cigarettes, and 45% who used e-cigarettes in the past or are currently using e-cigarettes reported close friends' e-cigarette use. Ninety-three percent who never used e-cigarettes reported not having close friends as e-cigarette users.

Findings showed statistically significant association between family members' e-cigarette use and teens' e-cigarette use ($\chi^2(2, N = 238) = 20.03, p = .000$). The effect size of Cramer's V and Phi for the variables of family members' e-cigarette use and teens' current use of e-cigarettes were .29, $p = .000$. Family members' e-cigarette use was moderately associated with teens' e-cigarette use. Thirty-eight percent who used e-cigarettes in the past or are currently using e-cigarettes reported having at least one family member using e-cigarettes. Sixty-two percent of non-users reported having family members using e-cigarettes. Ninety percent who never used e-cigarettes reported having family members as non-users. There was no statistical significance between parents' e-cigarette use and teens' e-cigarette use ($\chi^2(2, N = 245) = 5.16, p = .076$).

Table 18

Associations between Close Friends', Parents', and Family Members' E-cigarette Use and Teens' Use of E-cigarettes

Use of e-cigarettes	<u>Close friends' e-cigarette use</u>						$\chi^2(2)$	<i>p</i>	
	<u>Yes</u>		<u>No</u>		<u>Don't know</u>				
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%			
Non-use	40	55	100	93	58	92	47.29	.000	
Use	33	45	8	7	5	8			
Total	73	100.0	108	100.0	63	100.0			
			<u>Parents' e-cigarette use</u>						
Non-use	11	61	179	83	9	82	5.16	.076	
Use	7	39	37	17	2	18			
Total	18	100.0	216	100.0	11	100.0			
			<u>Family members' e-cigarette use</u>						
Non-use	36	62	111	90	47	84	20.03	.000	
Use	22	38	13	11	9	16			
Total	58	100.0	124	101.0	56	100.0			

Gender Differences in E-cigarette Users' Reasons to Use E-cigarettes

Teens who use e-cigarettes have various reasons for using them, and those reasons might differ by gender. The Mann-Whitney *U* test was performed to explore those differences in reasons of e-cigarette use between males and females ($n = 11-15$) who smoked e-cigarettes in the past or are currently using them. Reasons to use e-cigarettes included curiosity, addiction, healthier than smoking tobacco, cheaper than smoking tobacco, quitting smoking, dealing with stress, and losing weight. The findings are displayed in Table 19.

Female students (16.53) had significantly higher mean ranks than male students (9.36) on the variable of addiction, ($U = 37.00, p = .010, r = -.50$) and dealing with stress ($U = 29.50, p = .007, r = -.53$). According to Cohen (1988), effect sizes were large. Females ($U = 16.53; U = 16.39$), who used e-cigarettes in the past or are currently using e-cigarettes, ranked higher than

males ($U = 9.36$; $U = 8.68$) in terms of reasons for using e-cigarettes for addiction and dealing with stress, respectively.

There were no statistically significant differences between males and females ($n = 11-15$) for such reasons to use e-cigarettes as curiosity, healthier than smoking tobacco, cheaper than smoking tobacco, quitting smoking, losing weight, and to socializing with friends.

Table 19

Comparing Male and Female Current or Past E-cigarette Users' Reasons to Use E-cigarettes

Reasons to use e-cigarettes	N	Mean Rank	Mann-Whitney <i>U</i>	<i>p</i>	<i>r</i>
Curiosity			54.50	.178	
Male	11	15.05			
Female	14	11.39			
Addiction			37.00	.010	-.50
Male	11	9.36			
Female	15	16.53			
Healthier than tobacco			66.50	.387	
Male	11	12.05			
Female	15	14.57			
Cheaper than tobacco			75.50	.701	
Male	11	12.86			
Female	15	13.97			
To quit smoking			76.00	.955	
Male	11	12.91			
Female	14	13.07			
To deal with stress			29.50	.007	-.53
Male	11	8.68			
Female	14	16.39			
To lose weight			69.00	.448	
Male	11	12.27			
Female	15	14.40			
To socialize with friends			80.00	.891	
Male	11	13.73			
Female	15	13.33			

Gender Differences in Non-users' Reasons for Teens' Use of E-cigarettes

Mann-Whitney U test was performed to explore differences between females and males who never smoked e-cigarettes ($n = 93-102$) regarding the reasons they think teenagers may use e-cigarettes. The findings are displayed in Table 20. Females were significantly different from males on the variable of dealing with stress ($U = 3842.0, p = .027, r = -.16$) and losing weight ($U = 3665.0, p = .004, r = -.20$). Inspection of the two groups' mean ranks indicated that females (105.74; 109.59) had significantly higher mean ranks than males (89.04; 87.43) for the reasons, to deal with stress and to lose weight, respectively. The effect size was small to medium (Cohen, 1988).

There were no statistically significant differences between males and females mean ranks for the six reasons to use e-cigarettes including curiosity, addiction, healthier than smoking tobacco, cheaper than smoking tobacco, quitting smoking, and socializing with friends.

Table 20

Comparing Male and Female Non-E-cigarette Users' Reasons for Teens' E-cigarette Use

Reasons to use e-cig	N	Mean Rank	Mann Whitney <i>U</i>	<i>p</i>	<i>r</i>
Curiosity			4770.5	.817	
Male	100	96.21			
Female	93	97.85			
Addiction			4411.5	.376	
Male	102	94.85			
Female	93	101.56			
Healthier than tobacco			3904.0	.046	
Male	101	104.35			
Female	92	88.93			
Cheaper than tobacco			4692.5	.991	
Male	101	97.54			
Female	93	97.46			
To quit smoking			4456.0	.698	
Male	100	97.94			
Female	92	94.93			
To deal with stress			3842.0	.027	-.16
Male	101	89.04			
Female	92	105.74			
To lose weight			3665.0	.004	-.20
Male	102	87.43			
Female	93	109.59			
To socialize with friends			4569.0	.645	
Male	102	96.26			
Female	93	99.87			

Teens' Cigarette Smoking and Current Use of E-cigarettes

A chi-squared test was performed to determine if there is a statistically significant association between the variables of traditional cigarette smoking and the use of e-cigarettes among high school students. The findings are displayed in Table 21. The variable of teens' current use of e-cigarettes was combined and recoded as use and non-use to prevent violations of expected cell counts of less than five. Use included past or current use of e-cigarettes. The variable of teens' cigarette smoking was combined and recoded as never used, past use and current use. Findings indicated that there was a statistically significant association between teens' traditional cigarette smoking and their use of e-cigarettes ($\chi^2 (2, N = 241) = 64.67, p = .000$). The effect size revealed a relatively strong association between teens' traditional cigarette smoking and current use of e-cigarettes (Cramer's $V = .51, p = .000$; Phi = $.51, p = .000$).

Table 21

Associations between Teens' Cigarette Smoking and Current Use of E-cigarettes

Use of e-cig	Status of cigarette smoking						$\chi^2 (2)$	<i>p</i>
	Never smoked		Smoked in the past		Currently smoking			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
Non-use	185	89	9	39	2	18	64.67	.000
Use	22	11	14	61	9	82		
Total	207	100.0	23	100.0	11	100.0		

Close Friends', Parents', Family Members' Cigarette Smoking and Teens' Use of or Trial with E-cigarettes

Chi-squared tests were used to determine associations between close friends', parents', other family members' cigarette smoking, and teens trying e-cigarettes and current use of

e-cigarettes. The variable of teens' current use of e-cigarettes was recoded as use and non-use to prevent violations of expected cells counts of less than five. The variables of close friends', parents', and family members' smoking cigarettes were combined and recoded as "yes", "no", and "don't know". "Yes" referred to smoking cigarettes and "no" referred to not smoking. Findings revealed statistical significance between close friends' cigarette smoking and teens' current use of e-cigarettes ($\chi^2(2, N = 240) = 38.84, p = .000$). The effect size indicated relatively strong association between the two variables (Cramer's $V = .40, p = .000$; Phi = $.40, p = .000$). There was no statistical significance between parents' smoking ($\chi^2(2, N = 241) = 1.51, p = .470$) and family members' smoking ($\chi^2(2, N = 236) = 4.12, p = .127$), and teens' e-cigarette use. The details of the findings are displayed in Table 22.

Findings showed statistical significance between close friends' cigarette smoking and teens trying e-cigarettes ($\chi^2(2, N = 239) = 38.84, p = .000$). The effect size of Cramer's V and Phi indicated a relatively strong association between close friends smoking and teens' trying e-cigarettes (Cramer's $V = .40, p = .000$; Phi = $.40, p = .000$). There was no statistical significance between parents' smoking ($\chi^2(2, N = 240) = 2.33, p = .311$) or family members' smoking ($\chi^2(2, N = 235) = 1.92, p = .383$), and teens' trying e-cigarettes. The details of the findings are displayed in Table 23.

Table 22

Associations between Close Friends', Parents', and Family Members' Smoking Cigarettes and Teens' Current Use of E-cigarettes

Use of e-cigarettes	<u>Close friends' smoking cigarettes</u>						$\chi^2(2)$	<i>p</i>
	<u>Yes</u>		<u>No</u>		<u>Don't know</u>			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
Non-use	31	53	123	90	41	91	38.84	.000
Use	27	47	14	10	4	9		
Total	58	100.0	137	100.0	62	100.0		
			<u>Parents' smoking cigarettes</u>					
Non-use	29	74	163	83	4	80	1.51	.470
Use	10	26	34	17	1	20		
Total	39	100.0	197	100.0	5	100.0		
			<u>Family members' smoking cigarettes</u>					
Non-use	94	76	71	87	27	87	4.12	.127
Use	29	24	11	13	4	13		
Total	123	100.0	82	100.0	31	100.0		

Table 23

Associations between Close Friends', Parents', and Family Members' Smoking Cigarettes and Teens' Having Ever Tried E-cigarettes

Ever tried e-cigarettes	<u>Close friends' smoking cigarettes</u>						$\chi^2(2)$	<i>p</i>
	<u>Yes</u>		<u>No</u>		<u>Don't know</u>			
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
No	28	49	118	86	41	91	37.78	.000
Yes	29	51	19	14	4	9		
Total	57	100.0	137	100.0	45	100.0		
			<u>Parents' smoking cigarettes</u>					
No	28	72	157	80	3	60	2.33	.311
Yes	11	28	39	20	2	40		
Total	39	100.0	196	100.0	5	100.0		
			<u>Family members' smoking cigarettes</u>					
No	92	75	67	83	25	81	1.92	.383
Yes	31	25	14	17	6	20		
Total	123	100.0	81	100.0	31	101.0		

Teens' Future Use of Tobacco Products

High schoolers were asked whether they would consider using tobacco products in the future and their reasons for doing so. As to future use, 79% responded that they would use none of the tobacco products, 8% responded that they might use waterpipe tobacco, 2% might use traditional cigarettes, 2% might use electronic cigarettes, .4% might use smokeless tobacco. Six percent reported that they might use multiple tobacco products in the future. The details of findings are displayed in Table 24.

Table 24

Teens' Considerations for Future Use of Tobacco Products

Tobacco Products	Frequency ^a	Percent ^a
None of these	197	79
Waterpipe tobacco	20	8
Waterpipe tobacco and electronic cigarettes	8	3
Electronic cigarettes	6	2
Traditional cigarettes	4	2
Traditional cigarettes, waterpipe tobacco, and electronic cigarettes	4	2
Traditional cigarettes and waterpipe tobacco	3	1
Traditional cigarettes and electronic cigarettes	1	.4
Smokeless tobacco	1	.4
Missing	7	3

^aStudents could mark more than one response, so column totals do not add to 251 and 100%.

The reasons for future use of tobacco products, including waterpipe tobacco and electronic cigarettes were transcribed and emerging themes defined. The most commonly cited reasons were “fun,” “harmless,” “cool,” and “friends.” Waterpipe tobacco smoking and electronic cigarettes were perceived as safe, better than other tobacco products, and cool. These were considered for possible use because of family and friends’ use, taste, and doing tricks with them.

Teens who would not consider using tobacco products were asked their reasons for future use. Their answers were transcribed, the most commonly cited reasons were counted, and emerging themes were presented. The most commonly cited reasons were “bad for you,” “known health effects,” “don’t want to smoke,” “bad for your health,” “pointless,” “no need,” “unhealthy,” and “addictive.” The details of the findings are displayed in Table 25. Some of the most interesting quotes that describe the most common reasons for possible tobacco use in the future are presented in Tables 26. Table 27 displayed themes and quotes that describes teens’ reasons for not considering to use tobacco products in the future.

Table 25

Teens’ Reasons for Not Using Tobacco Products in the Future

Reason	Frequency	Percent
Bad for you	21	8
Known health effects	16	6
Don’t want to smoke	9	4
Dumb	7	3
Unhealthy	6	2
Bad for your health	5	2
Seen effects of it	4	2
Pointless	4	2
Waste of money	3	1
Athlete	3	1
Don’t want to die	3	1
Don’t want to be addicted	2	.8
Don’t want to harm body	2	.8
Don’t want lung cancer	2	.8
Health reasons	2	.8
Want healthy lungs	2	.8

Table 26

Themes and Quotes of Teens' Reasons for Not Using Tobacco Products in the Future

Themes	Quotes
Bad for you	<p>“Because it’s bad for you.”</p> <p>“Because all of these are terrible for you.”</p> <p>“Because they are bad for you and I don’t want to make bad decisions.”</p> <p>“Because cigarettes are bad for you and I don’t want lung cancer.”</p> <p>“Smoking is bad for your health down the road.”</p>
Known health effects	<p>“I know the consequences and harmful outcomes of using them.”</p> <p>“I know that all of these are bad for one’s health and can put a person at risk physically, socially, or emotionally. They can also ruin one’s reputation.”</p> <p>“I know that smoking causes serious deadly health problems, therefore I don’t want to use them.”</p>
Dumb	<p>“Smoking just seems dumb, and is bad for you. I have better stuff to do like making sure I get into college.”</p> <p>“I only did it once, it was dumb.”</p>
Unhealthy	<p>“It’s unhealthy.”</p> <p>“Smoking is very unhealthy and not something I want to do.”</p>
Seen effect of it	<p>“My family has seen the effect smoking has on a person. No thanks!”</p> <p>“I have an awful immune system already and I know the terrible effects on my body.”</p>
Don’t want to be addicted	<p>“I don’t want to have any addictions and they are bad for me.”</p> <p>“I have no desire to form an especially unhealthy addiction I don’t know what is really in them. I don’t want to be addicted.”</p> <p>“I think they are addictive and destroy your lungs.”</p>

Table 27

Tobacco Products and Quotes of Teens' Reasons to Consider Using in the Future

Tobacco Products	Quotes
Electronic cigarettes	<p>“From my limited knowledge I can conclude that they are safe and they look interesting and my dad uses one.”</p> <p>“Because you can have it zero nicotine, and just make your own e-juice.”</p> <p>“I like the taste.”</p>
Waterpipe tobacco smoking, and electronic cigarettes	<p>“Not because they are ‘cool’ it is a choice that I want to try them.”</p> <p>“Looks cool.”</p> <p>“Seems harmless.”</p> <p>“Family and friends use them.”</p> <p>“They look cool and fun.”</p> <p>“Hookah and electronic cigarettes are much better.”</p> <p>“It’s just water vapor and it is fun for tricks.”</p>
Traditional cigarettes, waterpipe tobacco smoking, and electronic cigarettes.	<p>“I like the taste and how I feel using it.”</p> <p>“Purely recreational, not as a consistent thing.”</p>
Traditional cigarettes, electronic cigarettes	<p>“It would be fun to try.”</p>
Traditional cigarettes and waterpipe tobacco smoking	<p>“Helps with stress and anxiety.”</p>

Teens and Electronic Cigarettes

High schoolers were asked about teens and electronic cigarettes. Their thoughts were transcribed and categorized, and emerging themes were defined. The most cited reasons for teens’ electronic cigarette use were “cool,” “healthier,” “safer,” “fit in,” “socialize,” “peer pressure,” “family,” “curiosity,” “fun,” “choice,” “addiction,” “deal with stress,” “quit smoking,” and “better than regular cigarettes.” Most high schoolers think that teens use e-cigarettes to be cool, or they think e-cigarettes are cool. Some think that teens use e-cigarettes because of peer

pressure, friends, and family. Some think e-cigarettes are better than regular cigarettes, and that they are safer to use. Some mentioned that they do not know much about it. Table 28 presents students' thoughts about teens and e-cigarettes in descending order of frequency cited.

Table 28

High Schoolers' Thoughts about Teens and Electronic Cigarettes

Thoughts	Frequency	Percent
Cool	22	9
Don't know	21	8
Healthier than cigarettes	16	6
Better than cigarettes	15	6
Choice	9	4
Fit in	8	3
Deal with stress	8	3
Fun	8	3
Addiction	8	3
Better alternative	7	3
As bad as cigarettes	6	2
Not as bad	5	2
Curiosity	5	2
Family	5	2
To socialize	5	2
Peer pressure	4	2
Safe	4	2
Experiment	3	1
To lose weight	1	.4
Easy to hide	1	.4

Table 29

Themes and Quotes of High Schoolers' Thoughts about Teens and Electronic Cigarettes

Themes	Quotes
Cool	<p>“Most teenagers use electronic cigarettes because it’s cool.”</p> <p>“I think some teens use electronic cigarettes because they want to seem cool for their friends and impress somebody.”</p> <p>“I think any type of drug is wrong including electronic cigarettes. I think the main reason teens use them is to feel cool.”</p> <p>“From as they seem healthier, you don’t have to use a lighter which is pretty neat, also it’s cool how it has a labeled amount of puffs and has different flavors.”</p>
Don’t know much about	<p>“I don’t know all that much about them. From what I have heard that they are healthier than normal cigarettes but should probably still not be used by teens.”</p> <p>“I don’t know very much about them and have never seen someone smoking one or talking about one who goes to this school. I don’t think they are very well known.”</p> <p>“I don’t know much about them, but what I do know is they should not be used & a good amount of high schoolers have and use them.”</p>
Choice	<p>I am ok with it because it is their choice. I don’t try to run someone’s life, so should you be.”</p> <p>“I think it’s their choice if they want to smoke e-cigarettes all the side effects have been told them but it’s their choice.”</p> <p>My thought about teens using electronic cigarettes. I think teens have a choice so they can make their own decisions.”</p> <p>“I feel like teens use electronic cigs because they want to feel more like an adult and have choices in their life and also friend influenced.”</p>
Fit in	<p>“I think teens use e-cigarettes because of peer pressure, and to try something else or may be fit in with certain groups.”</p> <p>“I think teens use electronic cigarettes because they want to fit in and “be cool” or just try it and then get addicted.”</p>

“I think people who smoke e-cigs are just trying either fit in or just experiment”

Family

“I believe teens smoke because of social pressures like family and friends usually. There are many other things that put teens at risk I believe teens smoke because of social pressures like family and friends usually. There are many other things that put teens at risk.”

Peer pressure

“I think that people think that they are healthier, but they aren’t. People who do it I feel bad for and I think that 90% of involvement is peer pressure. I think teens that use electronic cigarettes are pushed in it by peer pressure or they are trying to stop smoking traditional cigarettes.”

“I think that teens use e-cigarettes because of what they know. If someone is raised around cigarettes of any kind that is what they learn as “normal” I also think that a huge reason of why people smoke is because of peer pressure. Because so many people smoke & do drugs, it is now a “norm”. I think that no matter what age you are, smoking is bad & it will have consequences.”

CHAPTER 5: DISCUSSION

This dissertation examined awareness of e-cigarettes, the factors associated with initial and continuing use of e-cigarettes, and the reasons for using e-cigarettes among high school students. Data were collected from high school students enrolled in health classes. Nine research questions were answered by using Pearson's chi-squared test and Mann–Whitney *U* analysis of cross-sectional survey data. The awareness of cigarettes was measured by assessing and analyzing high school students' seeing, hearing, or watching e-cigarette advertising, receiving information through social media, and sharing information about e-cigarettes with close friends. The correlation between being aware of e-cigarettes and trying or using e-cigarettes was examined. The associations among close friends', parents', and family members' use of e-cigarettes and tobacco products, and teens' current use of e-cigarettes were explored. Reasons to use e-cigarettes were analyzed by gender. In this section, the author expresses these associations and correlations, and discusses the discrepancies and similarities between some of the findings and previous studies. Further discussion relates to theoretical implications of findings, and states limitations and recommendations.

Research Questions

Research questions explored associations with e-cigarette awareness; close friends', parents', and family members' e-cigarette and cigarette use; teens' past, current, and future use of tobacco products; and teens' use of e-cigarettes. They also examined gender differences in teens' reasons to use e-cigarettes. In the following paragraphs, this dissertation's findings were discussed with other studies' findings from literature.

Awareness of E-cigarettes and Use of E-cigarettes

Research questions that focused on awareness of e-cigarettes and use of e-cigarettes were analyzed by using Pearson's chi-squared tests. Awareness of e-cigarettes was measured by assessing students' exposure through watching, hearing, or seeing e-cigarette advertising, receiving information through social media, and sharing information about e-cigarettes with close friends. Findings indicated becoming aware of e-cigarettes through seeing, hearing, or watching e-cigarette advertising did not relate to e-cigarette use among high school students. However, most of the students reported watching (82%), hearing (76%), or seeing (78%) e-cigarette advertisements. Similarly, data from the 2014 National Youth Tobacco survey showed high school students reported exposure to e-cigarette advertising from retail stores (56%), Internet (43%), TV and movies (38%), and newspaper and magazines (35%) (Singh et al., 2016). A nationally representative sample of U.S. adults showed that 86% of U.S. adults were aware of e-cigarettes and 47% of participants reported ever having seen or heard information about e-cigarettes on television, on the radio, in print media or online (Emery, Vera, Huang, & Szczypka, 2014).

Awareness of e-cigarettes was higher among students who had never used e-cigarettes. The implication of this finding shows there has been exposure to e-cigarette advertising among high schoolers. A comprehensive meta-analysis of cigarette advertising indicates that exposure to cigarette advertising predicts cigarette smoking initiation (Capella, Webster, & Kinard, 2011). Models or celebrities who engage in smoking behavior in advertisements might influence consumer attitude toward smoking.

Findings revealed significant correlations among awareness of e-cigarettes through social media and close friends, and e-cigarette experimentation and use among high school students.

Seventy-one percent of non-users, 21% of past e-cigarette users, and 4% of current e-cigarette users reported receiving information through social media. Consistent with findings from a U.S. national sample, it was revealed that most adolescent males (67%), who had not tried e-cigarettes had heard of them and were willing to try them (Pepper et al., 2013). Similar to the present study, findings from a survey of nationally representative high school and university students in Poland estimated that 86% of Polish students were aware of e-cigarettes, and 24% of high schoolers ages 15-19 had “ever” used e-cigarettes (Goniewicz & Zielinska-Danch, 2012). In contrast, data from middle and high school students in Korea showed smaller portions of students reported having seen or heard of e-cigarettes (10%) and using e-cigarettes (.5%) (Cho et al., 2011).

In line with the current study, Cho et al. (2011) indicated peer influence was a predictor of e-cigarette use, and the Internet was the biggest sources of information on e-cigarettes, followed by friends and television. A systematical review of studies on electronic cigarettes reported the most common sources of awareness were the Internet, friends or personal contacts, and advertisements (Pepper & Brewer, 2014a).

Data from a cohort of U.S. Midwestern adults ages 20 to 28 showed that 70% of young adults were aware of e-cigarettes, 7% had ever used e-cigarettes, and 1% had used e-cigarettes in the last 30 days (Choi, Foster, 2013). Regan’s et al. (2013) survey of U.S. adults in 2009-2010 showed that awareness of e-cigarettes doubled from 16% to 32% in 2010.

Among adolescents awareness and use of e-cigarettes are increasing in the U.S. and other countries. According to the International Tobacco Control Four-Country Survey in 2010-2011, overall e-cigarette awareness was 46%, accounting for “U.S.:73%, UK: 54%, Canada: 40%, Australia: 20%” (Adkison et al., 2013, p. 207). Of those aware of e-cigarettes 16% had tried

e-cigarettes, and of those who tried e-cigarettes 38% reported current use. Awareness and trial of e-cigarettes were higher in countries where e-cigarettes were mostly permitted (Adkison et al.)

Tobacco History and Use of E-cigarettes

Research questions that focused on tobacco history and use of e-cigarettes were examined through chi-squared tests. Tobacco history included teens' past, current, and future use of tobacco products. Results revealed a statistically significant association between e-cigarette use and past and current use of tobacco products including traditional cigarettes, smokeless tobacco, and waterpipe tobacco. Fifty-one percent of former and 21% of current e-cigarette users reported tobacco use in the past; 25% of former and 42% of current e-cigarette users reported current tobacco use; 40% of non-users, 38% of past users, and 21% of current e-cigarette users reported possible future use of tobacco products. Being a former and current smoker was correlated with having ever used e-cigarettes and past e-cigarette use. Consistent with the current study's findings, and across a number of studies of youth, being a former or current smoker was a predictor of e-cigarette use or of a willingness to try e-cigarettes (Camenga, et al., 2014a; Cho et al., 2011; Choi & Forster, 2013; Goniewicz & Zielinska-Danch, 2012; Pepper et al., 2013).

In the present study, a few former and current e-cigarette users reported possible future use of tobacco products including traditional cigarettes, smokeless tobacco, waterpipe tobacco, and electronic cigarettes. E-cigarette use among adolescents is related to intention to use other tobacco products in the future. Consistent with these findings, a longitudinal cohort study of e-cigarette use among adolescents in California estimated that baseline e-cigarette "ever" users were more likely to report use of any combustible tobacco product (cigarettes, cigars, and hookah) at the six- (31%) and 12-month (25%) follow up (Leventhal et al., 2015). Another longitudinal cohort study of adolescents and young adults found that at baseline, e-cigarette

smokers progressed to cigarette smoking over the 1-year follow-up (Primack, Soneji, Stoolmiller, Fine, & Sargent, 2015).

The experimentation with or use of other tobacco products, including traditional cigarettes, hookah, cigars, and snus is common among e-cigarette users. Data from the 2013 Florida Youth Tobacco Survey described that cigarette and waterpipe tobacco smoking were significantly associated with having ever used and currently using e-cigarettes among high school students. The data indicated that 36% of “ever” cigarette smokers and 43% of “ever” waterpipe tobacco smokers reported “ever” using e-cigarettes, and 16% of “ever” cigarette smokers reported current e-cigarette use (Barnett, Soule, Forrest, Porter, & Tomar, 2015). Findings from Texas Youth Survey indicated that current e-cigarette users reported current use of cigarettes (39%), chewing tobacco (25%), and hookah (32%) (Cooper, Case, & Loukas, 2015). Findings from a cross-sectional study of high school students in New York and Connecticut demonstrated current e-cigarette users reported using alternative tobacco products including cigars, hookah, smokeless tobacco, and blunt (marijuana with tobacco) (Camenga, et al., 2014b). Regarding hookah use, qualitative study findings indicated that e-cigarettes were used as a substitute for hookah among young adults because of flavor and convenience (Pokhrel, Herzog, Muranaka, Regmi, & Fagan, 2015b).

E-cigarette experimentation and recent use among adolescents and adults, especially former and current smokers, have been increasing. According to the National Youth Tobacco Survey (2011-2012), high schoolers dual use of e-cigarettes and conventional cigarettes rose from 1.2% to 2.2%. Nearly seven percent of students who were “ever” e-cigarette users reported never smoking cigarettes and 80% of current e-cigarette users reported current conventional cigarette smoking (Corey et al., 2013). Data from two suburban high schools in Connecticut and

New York demonstrated that the prevalence of dual cigarette and e-cigarettes use increased from .8% to 1.9% between 2010 and 2011, suggesting that being a current smoker is the strongest predictor of e-cigarettes use among adolescents (Camenga et al., 2014a).

Former and current smokers are more likely to try e-cigarettes than non-smokers. Findings from a cross-sectional survey of Parisian teens ages 12 to 19 revealed a significant association between e-cigarette experimentation and current smoking status: 7% of non-smokers, 37% of former smokers, 38% of occasional smokers, and 63% of daily smokers reported experimenting with e-cigarettes (Dautzenberg, Berlin, Tanguy, Rieu, & Birkui, 2015). A study of teenagers and young adults in Poland reported that current smokers (11%) and students who experimented with smoking cigarettes (38%) are more likely than non-smokers to experiment with e-cigarettes or have used e-cigarettes in the last 30 days (.8%) (Goniewicz & Zielinska-Danch, 2012).

This dissertation's findings and those of previous studies displayed significant associations between smoking cigarettes and e-cigarette use. This study was limited to explaining underlying mechanisms for the use of e-cigarettes among former and current tobacco users. The most likely explanations from literature were presented. E-cigarettes are advertised and marketed as healthier, cheaper, safer, more flavorful, and as cool gadgets compared with cigarettes. Some teens may respond positively to marketing claims by experimenting with e-cigarettes. Recent studies found that smokers, who were exposed to e-cigarette advertising, were more likely to try e-cigarettes (Pepper, Emery, Ribisl, Southwell, & Brewer, 2014c). Findings from an online survey of Florida adult smokers indicated that current smokers were aware of and receptive to e-cigarette television advertisement and intended to try e-cigarettes (Kim, Lee, Shafer, Nonnemaker, & Makarenko, 2015). The potential influence of e-cigarette advertising and

marketing are of concern. The e-cigarette advertising may increase awareness and motivate use among teens. Regulations restricting e-cigarette advertising are critical. Specific campaigns that help young adolescents learn about research-based knowledge about e-cigarettes are urgently needed to decrease and prevent the use of e-cigarettes among youth.

E-cigarettes are advertised as an alternative to cigarette smoking and as a smoking cessation tool. Some current smokers might use them to quit smoking. Controversies exist in the literature about using e-cigarettes as smoking cessation tool. The studies that examined the effectiveness of e-cigarettes on smoking cessation suggested that e-cigarette users were more likely to report abstinence from smoking for a period of time than smokers who used nicotine replacement therapy or unaided quitting (Brown et al., 2014; Siegel et al., 2011). However, a few studies expressed concerns that e-cigarettes might provide a coping mechanism for conditioned smoking cues, replacing some of the rituals associated with smoking gestures (Caponnetto et al., 2011; Polosa et al., 2011). This might lead to re-normalizing smoking instead of quitting smoking (Brown et al., 2014; Hajek, 2013). This dissertation's findings were limited to explaining the use of e-cigarettes for smoking cessation, but the researcher believed that e-cigarettes should not be promoted as cessation tool or part of a quitting effort due to the uncertainties surrounding safety and efficacy and concerns about re-normalizing smoking.

In addition, former or current smokers might use e-cigarettes to smoke substances or drugs other than tobacco. A study of Connecticut high school students showed that e-cigarettes were used to vaporize cannabis leaves, hash oil, and wax infused with tetrahydrocannabinol (THC) (Morean, Kong, Camenga, Cavallo, & Krishnan-Sarin, 2015). The use of e-cigarettes for vaping cannabis and other concentrated oils can pose risks to young adolescent health. School policies prohibiting e-cigarette use, and health education classes on harmful effects of e-

cigarettes may play important roles in discouraging adolescents from using e-cigarettes to vape drugs.

E-cigarettes might be used as an alternative to other tobacco products when cigarettes or other tobacco products are not available or permitted. Findings from a qualitative study of young adults e-cigarette users indicated that e-cigarettes were more likely used to substitute for cigarettes or hookah when those smoking options were not available or permitted. E-cigarettes were preferred to use especially indoors or in a private vehicle since there is no odor or second hand smoke exposure to others (Pokhrel et al., 2015b).

Close Friends' E-cigarette or Cigarette Use, and Teens' E-cigarette Use

This dissertation's findings showed significant association between close friends' e-cigarette or traditional cigarette use, and teens' e-cigarette use. In line with these findings, a study of a national sample of adolescent teenagers by Pepper et al. (2013) found adolescent boys were willing to try an e-cigarette if it was offered by one of their best friends. Data from high schoolers in North Carolina indicated peer tobacco use predicted e-cigarette use (Anand et al., 2015). A study of Parisian teenagers reported e-cigarette experimentation was significantly associated with current smoking status of best friends (Dautzenberg et al., 2015). Another study of Polish high schools and universities indicating that current smoking by parents or partner were significant predictors of students' trial and current use (Goniewicz & Zielinska-Danch, 2012).

Close friends or peers may influence teens' initial e-cigarette or conventional cigarette use. Review of study findings identified peer smoking as significantly associated with initiation of, experimentation with, and current and "ever" use of cigarettes in adolescents (Avenevoli & Merikangas, 2003). Longitudinal studies also showed that a friend's smoking was a significant

influence on teens' trying smoking (Bricker, Peterson, Sarason, Andersen, & Rajan, 2007; Liao, Huang, Huh, Pentz, & Chou, 2013).

In addition, peer e-cigarette use was related with gateway drug use. A cross-sectional survey of seventh graders in Southern California indicated peer e-cigarette use predicted cigarette or alcohol use (Pentz et al., 2015). Peer modeling of substance use or peer pressure to try substances may be underlying risk factors for progression from e-cigarettes to other drugs.

Present and previous studies showed close friends' or peers' tobacco use including e-cigarettes was related to teens' e-cigarette use. Peers modeling of e-cigarette use, peer pressure, and peers' norms may play an important role in engaging smoking behavior and gateway drug use. This cross-sectional study was limited. Future longitudinal studies should examine peer influences on transition from e-cigarettes to cigarettes and other drugs among adolescents.

Parents' E-cigarette or Cigarette Use, and Teens' E-cigarette Use

Findings revealed no significant association between parents' e-cigarette or traditional cigarette use and teens' e-cigarette use. Inconsistent with these findings, a cross-sectional study of high schoolers in North Carolina indicated e-cigarette use was positively associated with mothers' e-cigarette use, and parents' tobacco use (Anand et al., 2015). The Dautzenberg et al., (2015) study of Parisian teenagers reported e-cigarette experimentation was significantly associated with current smoking status of the father and mother and with prohibition of tobacco use by one or two parents. Goniewicz et al., (2012) indicated boys in Poland who had a parent or partner who smoked were at high risk of trial and current use of e-cigarettes. Conversely, findings from other studies showed that teenagers whose parents were currently smoking, were less aware of and willing to try e-cigarettes compared with teenagers whose parents had never or rarely smoked (Pepper et al., 2013).

Even though this present study did not find a significant association between parents tobacco and e-cigarette use, more studies highlighted association between parents' tobacco use and teens' e-cigarette use. The Cho et al. (2011) study of Korean middle and high schoolers found e-cigarette experimentation and use were higher for those students who had smokers among family members than those who did not have close relatives who smoked. Fotiou et al. (2015) study of Greek students age 15 showed lifetime e-cigarette use significantly correlated with peers and parents smoking, poor communication in the family, and a non-supportive family.

Parents play an important role in teens' lives regarding teens' e-cigarette smoking behavior. Although there are controversial findings about parental smoking status in relation to teens' e-cigarette use, parents are considered as role models and their smoking behavior is more likely to influence teens' perception or behavior. Parental social norms, parents' ownership of tobacco or e-cigarettes, and parents' approval of tobacco, influence teens' initial smoking and experimentation (Pentz et al., 2015; Scalici & Schulz, 2014).

However, parents can also play an important role in prevention of tobacco use, including e-cigarettes, by monitoring teens' behavior, protecting them against smoking, and influencing health beliefs and choice of peers (Avenevoli & Merikangas, 2003; Mahabee-Gittens, Xiao, Gordon, & Khoury, 2013). Parents' modeling of non-tobacco use, monitoring teen behavior, and communicating with teens are all important in the effort to prevent teen tobacco use including e-cigarettes. Surprisingly, prohibition of tobacco use by one or two parents was associated with e-cigarette use among Parisian teenagers (Dautzenberg et al., 2015). Teenagers' hormonal changes, rebellious behavior during puberty, cultural differences, and authoritative parental style might be some of the external factors contributing to association. Further studies should explore

parenting styles, parents' characteristics, and parents' social norms in relation to teens' e-cigarette use.

In addition, parents' perception and use of e-cigarettes in relation to the health and safety risks to their children were of concern. According to Garbutt et al. (2015) one in eight parents who had young children used e-cigarettes often, concurrently with regular cigarettes. Many parents who have less education and lower incomes were unaware of the potential health and safety risks of e-cigarettes and did not store e-liquid safely. Pediatricians should provide information about the health and safety hazards that e-cigarettes pose and raise awareness about the dangers of nicotine poisoning in children (Garbutt et al.). Preventive programs should include parents to increase their awareness of the potential health and safety hazards that e-cigarettes pose to children.

Family Members' E-cigarette or Cigarette Use, and Teens' E-cigarette Use

Findings revealed a significant association between family members' e-cigarette use and teens' e-cigarette use. Family members included siblings, grandparents, aunts, uncles, and cousins. In line with this finding, Dautzenberg et al. (2015) reported significant associations between current smoking status of siblings and the use of conventional cigarettes, shisha (hookah), cannabis, and e-cigarettes in adolescents. Siblings, like peers, play important roles in teens' lives and may be influential in teens' smoking onset. Avenevoli and Merikangas' (2003) review of studies revealed that siblings' smoking, especially that of older siblings, was predictive of adolescent current and lifetime smoking. Cho et al. (2011) indicated the rates of e-cigarette experience significantly were higher for those having cigarette smoking in their families. Family members may be role models for teens' smoking behavior. Further studies are necessary to explain specific roles of family members on the e-cigarette behavior of their adolescents.

Findings revealed that there was no statistical significance between family members' smoking cigarettes and teens' e-cigarette use. Inconsistent with these findings, studies focused on factors associated with e-cigarette use among high school students showed that cigarette smoking in the family was significantly associated with teens' e-cigarette use (Anand et al., 2015; Cho et al., 2011; Dautzenberg et al., 2015; Goniewicz & Zielinska-Danch, 2012). In addition, tobacco use by family members including siblings, grandparents, uncles, and aunts might be influential on teens' e-cigarette use. Further studies should explore associations between family members' tobacco use and teens' e-cigarette use with larger samples.

Gender Differences in E-cigarette Users' Reasons to Use E-cigarettes

Gender differences in past and current e-cigarette users' reasons to use e-cigarettes were explored. Reasons to use e-cigarettes included curiosity, addiction, healthier than smoking tobacco, cheaper than smoking tobacco, as a tool to quit smoking, as a way to deal with stress, and as a way to lose weight. Findings revealed that compared to males, females more frequently reported using e-cigarettes to deal with stress and because of addiction. Consistent with these findings, data from an online survey of e-cigarette users showed females are more likely than males to report using e-cigarettes to deal with stress or control mood (Pineiro et al., 2016). In contrast to current study findings, a study aiming to identify gender differences among e-cigarette users showed males had greater addiction expectancies related to e-cigarettes compared with females (Pineiro et al.). Another study of young adults in Hawaii showed social enhancement, affect regulation, positive sensory experience, concern for negative appearance, and concern for negative health consequences except addiction were significantly associated with lifetime or recent e-cigarette use (Pokhrel et al., 2014). Future studies should explore gender differences in e-cigarette use with larger and more diverse samples. A better understanding of

gender differences in e-cigarette use might provide valuable information about underlying mechanisms of initiation, experimentation, and continuing use of e-cigarettes. Observed gender differences might help in the design of interventions or campaigns specific to females or males aimed at the prevention and cessation of e-cigarettes uses.

Gender Differences in Non-users' Reasons for Teens' Use of E-cigarettes

Gender as a factor in teen non-users perceptions as to why other teenagers might use e-cigarettes was explored. Findings revealed that females more frequently than males reported that teenagers use e-cigarettes to deal with stress and to lose weight. Consistent with these findings, other surveys of e-cigarette users showed that females are more likely than males to report greater positive expectancies about e-cigarettes helping with weight control and stress or moods (Pineiro et al., 2016). The use of cigarettes for weight control emerged in tobacco literature. Young adolescent females are more likely to initiate smoking to lose weight (Cawley, Markowitz, & Tauras, 2004; Fulkerson & French, 2003). Female teenagers who are especially overweight may think that smoking curbs appetite and helps to lose weight. Females learn about e-cigarettes through TV, radio, magazines, and social media. Females may be more responsive and receptive to messages related to health and weight control from media and TV advertisements. Cigarettes are also used to deal with stress among women. Review of studies showed that stress was the main factor in females initiating smoking (Torres & O'Dell, 2016). Stress and weight control were two significant factors that high school students think teenagers use e-cigarettes. E-cigarette messages and claims related to health might be influential for teenagers initiating smoking e-cigarettes. Further research should examine the impact of these messages upon teenagers. E-cigarette advertising targeting young females should be restricted or banned to prevent e-cigarettes use among teens. Health education teachers should educate high

school girls on the harmful effects of e-cigarettes, healthy weight control, and stress management to prevent and decrease use of e-cigarettes among high schoolers.

Teens' Use of Cigarettes and E-cigarettes

Findings revealed significant association between teens' use of cigarettes and their current use of e-cigarettes. Studies focused on correlation of e-cigarette use among high schoolers revealed that e-cigarette use was significantly associated with tobacco use (Anand et al., 2015; Cooper et al., 2015; Dautzenberg et al., 2015; Goniewicz & Zielinska-Danch, 2012; Lee, Grana, & Glantz, 2014). Teen e-cigarette use was associated with the use of conventional cigarettes, as well as other tobacco products such as hookah, chew, and snus (Cooper et al., 2015; Dautzenberg et al., 2015). Dual use of e-cigarettes and conventional cigarettes or hookah is common among young adults. A qualitative study of dual users indicated that e-cigarettes were substituted for cigarettes and hookah when smoking is not allowed, and when cigarettes and hookah are not available (Pokhrel et al., 2015b).

In line with previous findings, young adults reported that e-cigarettes made tobacco use accessible and convenient since they can be used at anytime and anywhere (Choi, Fabian, Mottey, Corbett, & Forster, 2012) In addition, it was reported that some tobacco users used e-cigarettes to quit smoking or reduce cigarette use (Siegel et al., 2011). Longitudinal study of former adult smokers showed dual smokers of e-cigarettes decreased their traditional cigarette smoking (Etter & Bullen, 2014). Dual users also used e-cigarettes to vaporize other drugs including cannabis and hash oil (Morean et al., 2015). Dual use of e-cigarettes and other tobacco products among high schoolers is an emerging public health concern. Smoking policies banning the use of tobacco products on school property should include e-cigarettes to prevent and decrease e-cigarette use among high school students. Restricting or banning e-cigarette

marketing and promotion, banning sales of e-cigarettes to minors, and increasing taxes on e-cigarettes might reduce dual use of e-cigarettes along with traditional cigarettes in the long term.

Teens' Future Use of Tobacco Products

High schoolers were asked whether they might consider using tobacco products in the future and their reasons for such belief. Seventy-nine percent of students responded that they would use none of the tobacco products. Eight percent reported they might use waterpipe tobacco, 2% might use traditional cigarettes, 2% might use electronic cigarettes, .4% might use smokeless tobacco. Six percent reported they might use multiple tobacco products in the future. Teens who would not consider using tobacco products expressed their reasons. The most commonly cited themes were “bad for you,” “known health effects,” “do not want to smoke,” “pointless,” “no need,” “unhealthy,” and “addictive.” Most of the high schoolers in the sample preferred not to smoke in the future. They seemed aware of the health effects of tobacco. However, among those who considered tobacco use in the future, waterpipe tobacco smoking and use of multiple tobacco products were preferred. E-cigarettes appeared in single and multiple use of tobacco products. Students’ reasons included that using e-cigarettes might be fun, harmless, cool, and something to share with friends. This study sample was limited to students in health classes. Further studies are needed to explore deeper understanding of teens’ reasons for potential future tobacco use.

Teens and Electronic Cigarettes

High school students were asked about teens and electronic cigarettes. The most common emerging themes included “cool,” “healthier,” “safer,” “fit in,” “socialize,” “peer pressure,” “family,” “curiosity,” “fun,” “choice,” “addiction,” “deal with stress,” “quit smoking,” and “better than regular cigarettes.” Consistent with these findings, qualitative data showed that

young adults and adolescent e-cigarette experimentation themes included curiosity, flavors, family and peer influence, availability, cool, better alternative to cigarettes (Kong, Morean, Cavallo, Camenga, & Krishnan-Sarin, 2015). The variety of e-cigarette design, including custom designs, appeals to young adolescent and adults.

A large variety of flavors, such as fruits, candy, and chocolate are considered attractive. Observed and previous study themes are similar to the themes in marketing of e-cigarettes, such as perception of e-cigarettes as healthier and as a better alternative to cigarettes. Aggressive marketing, variety of designs and flavors of e-cigarettes, and family and peer use of e-cigarettes were some of the factors contributing to initial use of e-cigarettes among youth. Rules and regulation in e-cigarette advertising and manufacturing, policies banning the use of e-cigarettes, and health education about e-cigarettes might help to prevent and decrease use of e-cigarettes among youth.

Theoretical Implications of the Findings

Gateway Theory

Gateway theory has re-emerged in discussions about e-cigarettes concerning their potential as a gateway to cigarette smoking among young adolescents. The implication of gateway theory in e-cigarette use is that awareness of e-cigarettes may lead to experimentation with e-cigarettes, nicotine dependence, and smoking (Bell & Keane, 2014).

The findings of this dissertation indicated that a few teens who used tobacco in the past and who are currently using e-cigarettes reported considering to use tobacco products in the future. Tobacco products included traditional cigarettes, smokeless tobacco, waterpipe tobacco, and electronic cigarettes. Past and current e-cigarettes users' intention to use other tobacco products in the future suggests that the application of gateway theory in this study might be

appropriate. This cross-sectional study was limited. Future longitudinal studies are needed to identify the pattern of initial of e-cigarette and continuing use of other tobacco product use, and if a gateway to drug and alcohol usage among adolescents and young adults.

Social Marketing Theory

Social marketing theory applies the methods of product planning, pricing, communication, distribution, and market research to the design and implementation of programs meant to increase the acceptability of social ideas (MacFadyen et al., 1999). It has been successful in encouraging people to buy products, and to adopt behaviors that will empower healthy lifestyles and quality of life. Social marketing is often applied to programs and campaigns to advance public health. Public health educators have applied social marketing principles (product, price, place, and promotion) to antismoking campaigns designed to prevent initiation of smoking and to promote cessation.

Tobacco companies have also used social marketing principles to market and promote tobacco products, including e-cigarettes, to adolescents and adults. There has been no restriction or ban on advertising e-cigarettes. E-cigarettes have been advertised through TV, radio, newspapers, magazines, and social media including Facebook, Twitter, YouTube, and blogs.

Findings of this dissertation revealed a significant correlation between receiving information about e-cigarettes through social media and using or trying e-cigarettes among high school students. The use of social media including Facebook, Instagram, YouTube, Twitter, and blogs is common among teens. Social media constitutes one of the sources of e-cigarette awareness for high schoolers. Although findings displayed no significant correlation between seeing, hearing, or watching advertisements and using e-cigarettes among high schoolers, most of the non-users, past users, and current users of e-cigarettes reported watching e-cigarette

advertising on TV, hearing e-cigarette advertising on the radio or seeing e-cigarette advertising in magazines or newspapers. Television, radio, newspapers, and magazines might add additional sources for developing e-cigarette awareness for high school students. Further research with a larger and more diverse sample is needed to explore the effect of e-cigarette advertising on the initial and continuing use of e-cigarettes.

Social Cognitive Theory

Social cognitive theory posits that behavior is a function of personal and environmental factors. The social and physical environments of an individual play a major role in learning or observing behavior. Behaviors can be learned through observation of others engaged in a behavior. For instance, adolescents might take up smoking after seeing their parents or peers smoke. Longitudinal study findings showed parental and friends' smoking behavior was found to be predictive of the onset of adolescent smoking (Vries, Engels, Kremers, Wetzels, & Mudde, 2003).

Social cognitive theory has provided a useful framework for understanding association between peers', parents', and family members' e-cigarette and cigarette use, and teens' e-cigarette use. Findings demonstrated a statistically significant association between close friends' or peers' e-cigarette and cigarette use and teens' current use of e-cigarettes. Peers play important roles in teens lives during adolescent years. Socialization and acceptance by peer groups are crucial for teens (Cattellino et al., 2014). Peers may feel pressured or be influenced by their friends who are using e-cigarettes. Peers' modeling of e-cigarettes may increase the risk of engaging in smoking behavior among teens as well. Findings indicated a significant association between family members' e-cigarette use and teens' e-cigarette use. Family members modeling of e-cigarette use may influence teens' perceptions and attitudes toward smoking. They may be

considered as role models especially if the teen has a close relationship with family members. Although current study findings did not reveal significant association between parents' e-cigarette use and teens' e-cigarette use, a few studies indicated association between parents' tobacco use and teens' e-cigarette use (Anand et al., 2015; Dautzenberg et al., 2015; Goniewicz & Zielinska-Danch, 2012). Parents modeling of e-cigarette use may influence teens' use and perception of a safer alternative to tobacco. Future studies should examine the parental and peer influences on the initial and continuing use of e-cigarettes.

Limitations and Delimitations

This dissertation had several limitations. First, the sample was limited to high school students, who were enrolled in health classes. The study had a convenient sample of students in health classes. Therefore, the dissertation findings cannot be generalized to all high school students throughout the schools. However, health classes were required for all the high school students sampled and there was a high response rate for students taking the pen-paper survey in some of the health class sessions. Second, the findings of this dissertation were based on cross-sectional data, which could not establish causality or direction of association among variables. Future longitudinal studies are needed to identify the patterns of e-cigarette use and behavior change in adolescents.

Third, this dissertation relied on self-reported data from participants. The study assumed that the participants understood the questions and responded honestly and accurately. Since study results were limited to self-report, there was a possibility of underreporting or of never reporting use of e-cigarettes among adolescents. This limitation was also for the behaviors of others such as close friends, parents, and family members. In addition, recall bias might be another limitation for the questions of past e-cigarette and tobacco use.

The final limitation concerns the survey for data collection. This data gathering was limited to the survey developed by researcher. A few questions in the survey were problematic. Some of the students had difficulties answering questions about reasons to use e-cigarettes either because of a lack of familiarity with surveys or because they skipped the directions to the questions. For instance, some of the students who were not currently using e-cigarettes indicated reasons to use e-cigarettes instead of indicating a teen's reasons to use e-cigarettes. Additionally, the questions measuring past, current, and future use of tobacco products had many categories that required combinations to prevent violations of expected count during statistical analysis. The survey may be reviewed and edited for use in future studies.

The study included a higher number of sophomores than freshmen that might affect study findings. The e-cigarette use among freshmen was expected to be higher than other grade levels. Future studies should focus on freshman e-cigarette use with a larger representative sample. More qualitative data may be helpful to get insights into teens' e-cigarette and tobacco use. Future studies should support self-reported data with interviews or focus groups to gain richer and deeper contexts of e-cigarette use among teens. This survey did not include ethnicity and socioeconomic status as a variable. Both the variable of ethnicity and socioeconomic status might be explanatory variables in tobacco related studies. Future study designs should include those two variables.

Conclusions

The data from the convenient sample of high school students from health classes showed 4% current use and 14% past use of e-cigarettes. These estimates were lower than expected. The limitations of the study, including convenient sample and self-reported data, might be related to these estimates. In addition, school district's code of conduct bans tobacco use including

e-cigarettes, and county proposal ban of e-cigarettes in public might be related to low e-cigarette use among high schoolers.

The research focused on awareness of e-cigarettes, the factors associated with initial and continuing use of e-cigarettes, and reasons for using e-cigarettes among high school students. Awareness of e-cigarettes included seeing, hearing, or watching e-cigarette advertising, and receiving or sharing information about e-cigarettes. Seeing, hearing, or watching e-cigarette advertising did not relate to e-cigarette use among high school students. However, nearly four-fifths of students who never used e-cigarettes reported watching e-cigarette advertising on TV, and seeing e-cigarette advertising in magazines or newspapers. High e-cigarette awareness in non-users indicated exposure to e-cigarette advertising among high schoolers. Further studies should focus on the association between exposure to cigarette advertising and initial use of e-cigarettes.

In addition, receiving information through social media or sharing information with peers was related to using or trying e-cigarettes among high schoolers. E-cigarettes are aggressively marketed to young adolescents and adults through social media. Some of the students seemed to respond to social media e-cigarette marketing by experimenting with e-cigarettes. In support of efforts to prevent e-cigarette use among youth, it is urgent that e-cigarette advertising be restricted or banned. Peers may play important role in disseminating information about e-cigarettes and using them. Teens whose peers or close friends shared information with them about e-cigarettes had a tendency to try or use e-cigarettes.

Even though the current study did not find a significant association between parents' e-cigarette use and teens' e-cigarette use, other studies focusing on e-cigarette use among adolescents and young adults indicated that tobacco use by fathers, mothers, and peers was

associated with teens' e-cigarette use, including initial use, experimentation, and continuing use (Anand et al., 2015; Dautzenberg et al., 2015; Goniewicz & Zielinska-Danch, 2012). Parents serve as role models, and their e-cigarette use may influence teens' perception of non-smoking or smoking behavior. Parents' e-cigarettes may provide a source for teens' experimentation with e-cigarettes. Parents' e-cigarette use at home may pose potential health and safety risks. E-cigarette cartridges and refill solutions have hazardous chemicals and nicotine in them that pose the risk of nicotine toxicity in young children and adolescents due to accidental ingestion, inhalation, or dermal or ocular exposure (Callahan-Lyon, 2014). Pediatricians should educate parents on e-cigarette use and the potential exposure of children to nicotine and other toxic chemicals found in e-cigarettes. They should also raise awareness on teens' experimentation with e-cigarettes.

Close friends' and family members' cigarette and e-cigarette use and was significantly associated with teens' e-cigarette use. Peers or close friends may play important roles in teens' lives. Being a part of social group may be crucial for teens. In the current study, teens reported that they use e-cigarettes to fit into social groups. Family members, including siblings, grandparents, aunts, and uncles may influence teens' perception of or behavior regarding e-cigarette use. Sibling tobacco and e-cigarette use was associated with teens' "ever" and current tobacco use including e-cigarettes (Avenevoli & Merikangas, 2003; Dautzenberg et al., 2015). Further studies should focus on how family members' e-cigarette use impacts teens' e-cigarette use.

Past and current use of tobacco was significantly associated with e-cigarette use among high school students. Most of the former and current users of e-cigarettes reported either past or current use of tobacco. Studies indicated that being a former or current smoker was a predictor of

e-cigarette use or willingness to try e-cigarettes (Cho et al., 2011; Choi & Forster, 2013; Pepper et al., 2013). This current study was limited to explaining underlying reasons for e-cigarette use among past and current tobacco users. The most likely explanations from literature were presented. Current tobacco users may use e-cigarettes to quit smoking. Some tobacco users may concurrently use e-cigarettes and other tobacco products in order to have access to nicotine when smoking is not permitted or convenient. Former or current smokers might use e-cigarettes to smoke drugs other than tobacco. Future tobacco use was significantly associated with e-cigarette use. Past and current e-cigarette users reported potential future tobacco use including traditional cigarettes, smokeless tobacco, and waterpipe tobacco smoking. Only two percent of students reported considering using e-cigarettes in the future. Most high schoolers preferred not to smoke in the future because they think “it is bad, pointless, unhealthy, and addictive, and they know the associated health effects and do not want to smoke.”

Gender differences among e-cigarette users regarding reasons to use e-cigarettes were explored. Female teenagers, in contrast to males, reported more frequently using e-cigarettes to deal with stress and because of addiction. Females’ use of e-cigarettes and conventional cigarettes to deal with stress and mood was indicated in other studies (Pineiro et al., 2016). E-cigarette use related to stress and addiction among females should be of concern because it might progress to using other tobacco products. Gender differences among non-e-cigarette users regarding the reasons they think teenagers may use e-cigarettes were explored. Females reported more frequently than males that teenagers use e-cigarettes to deal with stress and to lose weight. A trend of smoking to curb appetite and lose weight has been identified in tobacco literature (Cawley et al., 2004; Fulkerson & French, 2003). E-cigarettes have been advertised as healthy and as a safe alternative to smoking, and have been promoted by a few Hollywood stars. Female

teenagers might be responsive to such cues in ads and promotions. Further studies are needed on the use of e-cigarettes among female teenagers.

Teens' use of tobacco products was associated with current use of e-cigarettes among high schoolers. Dual use of e-cigarettes and conventional cigarettes or hookah was used by few young adults. It was reported that e-cigarettes were used to quit smoking or as an alternative to tobacco products when tobacco use was not permitted or accessible (Pokhrel et al., 2015a; Siegel et al., 2011). E-cigarettes have been used to vaporize other drugs such as cannabis and hash oil (Morean et al., 2015). The use of e-cigarettes among adolescents and young adults as a smoking cessation tool, as an alternative to other tobacco products, and as a tool to use other drugs have been an emerging public health concern. Policies banning e-cigarette use on school property, and health education on the health risks of e-cigarettes and safety issues surrounding their use might help teens make better choices.

Findings indicated there were no statistically significant associations between parents' and family members' smoking, and teens' e-cigarette use. In contrast, other studies on e-cigarettes and tobacco indicated that parents' tobacco use and cigarette smoking in the family were significantly associated with teen's e-cigarette use (Anand et al., 2015; Cho et al., 2011). Parents and family members, including siblings, might be role models for teens. They may influence teens' perception and behavior concerning tobacco use including, e-cigarettes. This study was limited; further studies should explore the association between parents' and family members' smoking and teens' e-cigarette use.

This dissertation explored teens' future use of tobacco products and teens' thoughts about e-cigarettes through two open-ended questions. Over three-quarters of students reported having no intention to use any tobacco products in the future. They thought smoking was bad, addictive,

unhealthy, and pointless. They stated that they know about the health effects of smoking and do not want to smoke. Most teens in this study seemed aware of the health effects of smoking and were capable of making healthy choices for themselves in the future. A few students preferred potentially using waterpipe tobacco, electronic cigarettes, traditional cigarettes, and multiple tobacco products in the future because they thought smoking is cool, fun, and harmless. They acknowledged the influence of friends on smoking in a social group. In addition, some teens thought e-cigarettes were cool, healthier, safer, better than cigarettes, and fun. They thought teens use e-cigarettes to fit in, deal with stress, socialize, and quit smoking, and because of curiosity, addiction, peer pressure, and family.

Implications

The study has implications regarding awareness of e-cigarettes, factors associated with the use of e-cigarettes, and reasons to use e-cigarettes. E-cigarettes have been aggressively advertised through TV, radio, magazines, newspapers, and social media. Findings indicated e-cigarette users and non-users reported seeing, hearing, and watching e-cigarette advertising, and receiving information about e-cigarettes through social media. The implication of findings showed that there has been exposure to e-cigarette advertising among high schoolers. The increasing awareness of e-cigarettes among adolescents and young adults suggests that the initial or trial use of and experimentation with e-cigarettes may increase in the coming years.

Although increasing awareness of e-cigarettes among adolescents has been of concern, the Food and Drug Administration's (FDA, 2016) recent rules and regulations for e-cigarettes' manufacturing and marketing may discourage adolescents and young adults to initiate or try e-cigarettes. The required labeling and packaging of e-cigarettes, which is to contain a health

statement and graphic element displaying the harmful effects of smoking, may warn adolescents and help them to make better choices.

E-cigarette use was common among past and current tobacco users. Findings indicated being a former or current smoker is correlated with past, current, and future e-cigarette use. Findings implied that e-cigarettes may be used to quit smoking or as an alternative to other tobacco products, including traditional cigarettes, smokeless tobacco, and waterpipe tobacco smoking. Although e-cigarettes have been advertised as a safe smoking cessation tool, the Food and Drug Administration has not approved e-cigarettes as a cessation tool. It is important to educate adolescents and young adults about using e-cigarettes as a cessation tool driven by perceptions of reduced harm and as an alternative to tobacco smoking.

Findings indicated a few teens considered using dual or multiple tobacco products, including e-cigarettes, in the future. The implication of these findings showed that school district's code of conduct and county regulations on e-cigarettes may lessen teens' choices regarding tobacco. Their reasons for future use of tobacco included "fun, cool, harmless, and friends." E-cigarettes or other tobacco products are still perceived as fun, cool, and harmless by teenagers. Health educators should educate teens on the health effects of e-cigarettes and the health risk of dual or multiple use of tobacco products.

Peers' and family members' e-cigarette use was associated with teens' e-cigarette use. The implication showed peers and family members including siblings may be considered as role models who influence teens' smoking behavior. Social cognitive theory offered frameworks to explain how peers' or family members' smoking could influence teens' attitudes and behaviors regarding e-cigarette use. In addition, parents or family members' e-cigarettes may be a source for experimenting with e-cigarettes at home. The safety issues and health risks of e-liquid for

children was indicated in the literature. Peers or close friends appear to play an important role during adolescent years. The current study reported that peer pressure was one of the reported factors influencing teens' use of e-cigarettes. The finding suggests that the choice of peers is important in teens' engaging e-cigarette use. Parents monitoring and helping with the choice of peers may help teens to make healthy choices in their lives.

Findings revealed that compared to males, females who used e-cigarettes or who are currently using e-cigarettes more frequently reported using them because of stress and addiction. These findings showed that the use of e-cigarettes to deal with stress or to control mood among females might be related to e-cigarette advertising suggests that e-cigarettes may reduce stress. Nicotine as the main ingredient in e-cigarettes is known to be addictive. E-cigarette use can be addictive.

In addition, findings revealed that compared to males, females who never used e-cigarettes more frequently reported that they believe teens use e-cigarettes to deal with stress and to lose weight. E-cigarette messages and claims related to stress management and weight control might be misleading young girls to experiment with or use e-cigarettes. It is critical to restrict e-cigarette advertising targeting young girls or females.

Recommendations

The study was limited to a convenience sample of high school students in health classes that cannot be generalizable to all high school students. Future studies should include a representative sample of high school students. This dissertation focused on awareness of e-cigarettes, factors associated with use of e-cigarettes and reasons to use e-cigarettes. Teen awareness of cigarettes was measured by assessing reported watching, hearing, seeing

e-cigarette advertising, and by reports of receiving information through social media and sharing information with close friends or peers. This cross-sectional study was limited to associations between awareness and use of e-cigarettes. Longitudinal studies should focus on associations between exposure to e-cigarette advertising and e-cigarette experimentation or use among adolescents.

This study explored factors associated with initial and continuing use of e-cigarettes. The factors included teens' past, current, and potential future use of tobacco products, and peers', parents', and family members' e-cigarette and tobacco use. Future studies should look into those associations using a larger sample and consider the influences of socioeconomic status and ethnicity.

This study explored reasons to use e-cigarettes by gender among past and current e-cigarette users. Reasons included curiosity, addiction, healthier than tobacco, cheaper than tobacco, quitting smoking, dealing with stress, losing weight, and socializing with friends. Findings showed that females who used e-cigarettes, or are currently using, reported using e-cigarettes because of addiction and stress; and females who never used e-cigarettes reported that they believe teens use e-cigarettes to deal with stress and lose weight. Further research is needed on perceptions of e-cigarette use for stress management and weight control among young girls.

This dissertation explored teens' future use of tobacco products including e-cigarettes, and teens' thoughts about e-cigarettes. The qualitative data were limited by two-open ended questions. Further studies should use qualitative research methods such as focus groups or interviews to obtain rich and deep data on teens' e-cigarette use.

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APPENDICES

9. Which one of the following did you use first?
- a. Traditional cigarettes
 - b. Smokeless tobacco (snus or chewing tobacco)
 - c. Waterpipe tobacco smoking (hookah or narghile)
 - d. Electronic cigarettes
 - e. None of these
10. Which of the following are you currently using? Circle all that apply.
- a. Traditional cigarettes
 - b. Smokeless tobacco (snus or chewing tobacco)
 - c. Waterpipe tobacco smoking (hookah or narghile)
 - d. Electronic cigarettes
 - e. None of them
11. Which of the following may you consider to use in the future? Circle all that apply.
- a. Traditional cigarettes
 - b. Smokeless tobacco (snus or chewing tobacco)
 - c. Waterpipe tobacco smoking (hookah or narghile)
 - d. Electronic cigarettes
 - e. None of these

Please explain why? _____

12. Do one or more close friends use electronic cigarettes?
- a. Yes
 - b. No
 - c. Don't know
13. Does your mother or father (guardian) use electronic cigarettes?
- a. Yes both my mom and dad use
 - b. Yes, my mom uses
 - c. Yes, my dad uses
 - d. No, neither my mom nor dad use
14. Who else in your family use electronic cigarettes? Circle all that apply.
- a. Brother (s)/Sister(s)
 - b. Grandmother
 - c. Grandfather
 - d. Uncle
 - e. Aunt
 - f. Other, cousin
 - g. No one uses
 - h. I don't know

Part C. Reasons to use electronic cigarettes

Direction: Please fill the circle that most accurately reflects your ideas or experiences.

IF YOU USE E-CIGARETTES PLEASE ANSWER QUESTION 15, AND IF YOU DON'T USE E-CIGARETTES PLEASE GO TO AND ANSWER QUESTION 16.

15. Please indicate your level of agreement on each of following statements as reasons you use e-cigarettes.

I use e-cigarettes	Strongly Disagree	Disagree	Feel neutral	Agree	Strongly Agree
because of curiosity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
because of addiction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
because it is healthier than smoking tobacco	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
because it is cheaper than smoking tobacco	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to quit smoking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to deal with stress	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to lose weight	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to socialize with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. Please indicate your level of agreement on each of following statements as reasons you think teenagers may use e-cigarettes.

Teenagers use e-cigarettes	Strongly Disagree	Disagree	Feel neutral	Agree	Strongly Agree
because of curiosity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
because of addiction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
because it is healthier than smoking tobacco	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
because it is cheaper than smoking tobacco	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to quit smoking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to deal with stress	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to lose weight	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
to socialize with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Part D. Tobacco Smoking

Directions: Please circle the answer that most accurately reflects your experiences for each of the following items about tobacco and cigarettes (not e-cigarettes)

17. Have you ever smoked a cigarette even one puff?

- a. Yes
- b. No

18. Do you smoke cigarettes?

- a. No, I have never smoked
- b. No, but I have smoked in the past
- c. Yes, occasionally (not daily)
- d. Yes, I smoke everyday

If you circled is “a or b” in 18 (non-smokers), please skip questions 19 and 20, and go to question 21. If you circled “c or d” (smokers), continue with 19 to the end.

19. How many cigarettes have you smoked in the last 30 days?

- a. Less than 10 cigarettes
- b. 10-19 cigarettes
- c. 20-29 cigarettes
- d. More than 30 cigarettes

20. Have you ever tried to quit smoking?

- a. Yes
- b. No

21. Do one or more of your best friends smoke cigarettes?

- a. Yes
- b. No
- c. Don't know

22. Does your mother or father smoke cigarettes?

- a. Yes, both my mom and dad smoke
- b. Yes, my mom smokes
- c. Yes, my dad smokes
- d. No, neither my mom nor dad smoke

23. Who in your family smokes? Circle all that apply.

- a. Brother(s) / Sister(s)
- b. Grandmother
- c. Grandfather
- d. Uncle
- e. Aunt
- f. Other, cousins
- g. No one use
- h. I don't know

Part E. Demographics

Directions: Circle the one that applies for each 24, 25, and 26.

24. My age is

13 14 15 16 17 18 and older

25. My class is

Freshman Sophomore Junior Senior

26. My gender is

Male Female Other Prefer not to respond

Part F. Thoughts about electronic cigarettes

27. Please write your thoughts about teens and electronic cigarettes.

APPENDIX C

School District Approval



1/15/15

Aysun Santistevan,

Please consider this document as format approval for you to conduct research within [REDACTED] School District based on your application materials originally received 1/2/15. Research project name: "Awareness of E-cigarettes and Correlation of Use among High School Students."

* Date of project: Between January 2015 and June 2016 (If additional time is needed to complete the study, please notify me via email).

* I would like to add two conditions: 1) It is requested that the researcher provide [REDACTED] an electronic copy of the project summary at the end of the project, and 2) if you decide to submit an article for publication, please provide an electronic version of the article to [REDACTED] when completed.

* Priority consideration for future research partnerships with [REDACTED] will be given to individual researchers that have a demonstrated track record of submitting final reports for [REDACTED] consideration.

* Please feel free to use this email in your correspondent with [REDACTED] schools and personnel regarding this research project.

This approval letter signifies that you have successfully met all [REDACTED] criteria for conducting research within [REDACTED]. Approval from building principals where research activities may occur is also needed prior to beginning research activities at any particular [REDACTED] school. Providing principal(s) with a copy of this letter is an important step in your communication with principals, but please keep in mind that principals have the right to refuse to participate in any proposed research activities that involve the students, teachers, or facilities that they are responsible for. Furthermore, a principal may exercise their right of refusal at any point during the implementation of an authorized research proposal. Thank you for considering [REDACTED] School District as a research partner. Please feel free to contact me if you have any questions, and I look forward to reading your findings.

[REDACTED]
[REDACTED]
Director of Research and Evaluation
[REDACTED] School District
[REDACTED]
[REDACTED]

APPENDIX D

Parental Consent Form

Colorado State University
School of Education
College of Health and Human Science
Fort Collins, CO 80523-1588
(970) 491-6317
FAX: (970) 491-1317
http://soe.chhs.colostate.edu/

Parental Consent Form

Dear Parent;

I am a PhD candidate in the College of Health and Human Sciences at Colorado State University. I am doing research for my doctoral dissertation about students' awareness and use of electronic cigarettes. The Principal Investigator of this research is my advisor, Carole Makela, Ph.D., Professor, School of Education.

The purpose of this survey is to explore teen's awareness, opinions, experiences related to electronic cigarettes. I am interested in teens' opinions and experiences about e-cigarettes. The findings of this study may provide valuable information for health educators designing health education programs for youth and to inform policy makers on the impact electronic cigarette promotion and advertising has on teenagers. Your student will be asked to complete the survey during his/her class of Health Education. The survey will take approximately 15-20 minutes to complete and includes questions about electronic cigarette awareness, use, reasons to use/not to use electronic cigarette, tobacco smoking history, and demographics. There are no known risks or benefits from participating in this research. Taking the survey is voluntary and will have no impact on your teen's class grade.

This is an anonymous survey (no names or personal identifying information is asked for) that aims to maintain your teen's confidentiality and privacy. If you agree that your teen can participate in this survey, please sign the form and return the form to Mrs/Mr/Ms _____. Your signing this form will not be linked to your teen's responses nor does it mean that your teen is required to complete the survey. We will ask your teen's permission to voluntarily complete the survey and s/he can decide whether or not they would like to complete the survey in health class.

If you have any questions about the research, please contact Aysun Santistevan. If you have any questions about your student's rights as a volunteer in this research, contact the CSU IRB at: RICRO IRB@mail.colostate.edu; 970-491-1553.

Teen's name: _____

Grade (circle one): Freshmen Sophomore Junior Senior

I have read this form and know what the survey is about.

- [] My teen may take part in this survey
[] My teen may not take part in this survey

Parent's signature: _____ Date: _____

APPENDIX E

Cover Letter

Colorado State University
School of Education
College of Health and Human Science
Fort Collins, CO 80523-1588
(970) 491-6317
FAX: (970) 491-1317
<http://soe.chhs.colostate.edu/>

Electronic Cigarette Awareness and Correlates of Use among High School Students

Dear Participant,

Research suggests that electronic cigarettes have uncertainties as to their safety, efficacy, manufacturing and regulations. You are invited to participate in a research study of my doctoral dissertation about awareness and use of electronic cigarettes among youth. The principal investigator on the project is Carole Makela, Ph.D., Professor, School of Education. The co-investigator is Aysun Santistevan, PhD candidate for Education Sciences.

If you volunteer to participate in this study, you will be asked to complete survey during your class of Health Education. The anonymous survey will take approximately 15-20 minutes to complete and includes questions about electronic cigarette awareness, use, reasons to use/not to use electronic cigarette, tobacco smoking history, and a little about you.

Your participation is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time. You can skip any questions that you do not want to answer.

There are no known risks to participate in this research study. There may be no direct benefit to you associated with this research, but the research may provide valuable information to improve health education.

This study is anonymous. For this study, we are not asking your name or other identifiable data to maintain your privacy and confidentiality. When we write about the study to share with other researchers, we will write about the combined information gathered. You or your responses will not be identified in these written materials.

Thank you for your consideration for involvement in this study. Your consent will be assumed by the completion of the survey. If you have any questions about the research, please contact with Aysun Santistevan . If you have any questions about your rights as a volunteer in this research, contact the CSU IRB at: RICRO_IRB@mail.colostate.edu; 970-491-1553.

Sincerely,

Aysun Santistevan, Ph.D. Candidate
Email: Aysun.Santistevan@colostate.edu

Carole Makela, Ph.D., Professor
Carole.Makela@colostate.edu

APPENDIX F

Script for Data Collection

Script

Good morning/afternoon,

I am a PhD candidate for Interdisciplinary studies in the School of Education at Colorado State University. You are invited to participate in a research study about awareness and use of electronic cigarettes among youth. If you volunteer to participate you will be asked to complete the e-cigarette survey during this class of Health Education. The *anonymous* questionnaire will take approximately 15-20 minutes to complete. Your participation is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time.

Although there are no known risks to participate in this research study, the benefits to be gained through the result of this study that will provide valuable information for health educators to design health education.

This study is anonymous and, we are not obtaining your name or other identifiable data from you to maintain your privacy and confidentiality. We would like to thank you for your consideration for involvement in this study. Your consent will be assumed by the completion of the questionnaire.

Thank you for your time.