Smokers’ Awareness and Perceptions of Electronic Cigarettes

by

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Abstract

**Background:** Though smoking rates in the United States have decreased in past decades, the need for effective smoking cessation methods still exists. Advancements in smoking cessation technology include nicotine vapor delivery systems, more commonly known as electronic cigarettes or e-cigarettes.

**Aim:** The aim of this study is to assess tobacco smokers’ awareness of e-cigarettes and their attitudes toward their use.

**Methods:** A survey with questions on smoking habits, awareness of e-cigarettes, prior use of e-cigarettes, and attitudes toward the benefits of using e-cigarettes to reduce tobacco intake was administered to 170 respondents via social media.

**Results:** The results of the study showed that 108 of 109 smokers surveyed are aware of e-cigarettes as a cessation aid. Though only 78.9% of those surveyed had used them, 42.1% of participants who wanted to quit or were trying to quit smoking viewed e-cigarettes as an effective quitting aid.

**Conclusions:** The information collected suggests that smokers who want to quit have a positive perception toward the use of e-cigarettes as it relates to reducing tobacco intake. Because of this, they should be regarded as valuable tools in smoking cessation efforts.

*Keywords:* electronic cigarettes, e-cigarettes, perceptions, awareness, regulation
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Chapter 1: Smokers’ Awareness and Perceptions of Electronic Cigarettes

Background

Of the billion smokers in the world, an estimated five million die each year as a direct result of tobacco use (World Health Organization, 2014). This is the equivalent to one death every 6 seconds (WHO, 2014). Encouragingly, in the United States, the percentage of people who smoke more than 30 cigarettes per day declined from 12.6% in 2005 to 7.0% in 2012 (Centers for Disease Control and Prevention, 2014). This decline is promising and may be indicative of the tobacco control measures that have evolved over the past decades. It may also be attributed to the effectiveness of smoking cessation aids that are now being prescribed and sold as over-the-counter products. However, the fact remains that cigarettes are one of the greatest public health problems facing society.

Overcoming nicotine addiction is the most common barrier in reducing smoking prevalence. Cigarette manufacturers have developed extremely efficient delivery systems which have been shown to enhance nicotine addiction (Hart & Robertson, 1998). Because of this, as much as 85% of quitters relapse within 6 months (Zhou et al., 2009). It is in public health’s best interest to continue to study the most effective methods available to help overcome the barriers associated with quitting. In recent years, new technologies have resulted in a new products designed to effectively deliver nicotine to reduce the cravings suffered by smokers during the quitting process. One product that mimics the act of smoking while dramatically reducing the toxicity found in cigarette smoke is the electronic cigarette (E-cigarette).
E-cigarettes, also known as electronic nicotine delivery devices (ENDS), are used for recreational nicotine intake. They are a relatively new technology whose roots can be traced back to 2004 (Dockrell, Morrison, Bauld, & McNeill, 2013). Information regarding the safety, regulation, and prevalence of e-cigarette usage is continually being studied, but research has shown them to be as effective as other cessation aids. There is no doubt that the toxicity of e-cigarettes is significantly less than that of cigarette smoke, so public health should regard them as a potentially effective method in reducing smoking prevalence.

Research has shown that the use of e-cigarettes, especially among current and former smokers, is on the rise. Dockrell and colleagues (2013) found that British smokers’ awareness of e-cigarettes increased substantially between 2010 and 2012, and noted that the perceptions of e-cigarettes among the smokers studied suggests they may provide an avenue for quitting. Pearson, Richardson, Niaura, Vallone, and Abrams, (2012) found similar data in U.S. smokers; awareness is high and attitudes are positive toward their safety relative to cigarette smoke. However, there is little research that has been conducted on awareness, and research regarding perceptions of e-cigarettes has not produced enough information regarding the perceived safety, effectiveness, and affordability of e-cigarettes.

**Thesis Statement**

Knowing how much tobacco smokers know about e-cigarettes, how they feel about them as a cessation aid, and whether any current smokers are using them to try to quit smoking will be helpful in learning more about their perceived effectiveness as a
smoking cessation aid; this information will be useful to those who develop smoking cessation programs and policymakers as they start to regulate this product in the U.S.

**Purpose of the Study**

The purpose of this study was to assess tobacco smokers’ awareness of e-cigarettes and perceptions of their use in order to elucidate public health efforts in areas with high smoking prevalence. In order to understand the how e-cigarettes may be employed in public health, a solid grasp of their awareness and how they are perceived is needed. Obviously, if smokers are not aware that the product exists, they will not be inclined to use them. If smokers are aware of e-cigarettes but have negative perceptions of their safety or effectiveness, they will not be inclined to use them. In the fight against smoking, any method that may improve the chances of reducing or eliminating toxic tobacco smoke inhalation is well worth pursuing. Because of this, research must assess the awareness of e-cigarettes as well as smokers’ perception of them.

E-cigarettes, although new and unregulated, provide an additional avenue toward success in the struggle to reduce tobacco smoking prevalence. Since there have been positive results without severe side effects associated with their use, e-cigarettes need to be considered as serious smoking cessation tools. Prior research has not sufficiently studied awareness or perceptions associated with e-cigarette use. To measure these, a survey was administered with questions on smoking habits, awareness of e-cigarettes, prior use of e-cigarettes, and perceptions of the benefits or barriers relating to using e-cigarettes to reduce tobacco intake, which was administered to 170 respondents via Facebook and electronic mail. The information collected will further the limited current
research involving awareness and perceptions of e-cigarettes, and it will provide valuable information for public health practices relating to smoking cessation.

**Research Questions**

Research objectives for this study include answering the following questions: Do smokers know what e-cigarettes are? Have they used e-cigarettes? Do smokers view e-cigarettes in a positive light as a cessation aid? If they were to decide to quit smoking, would smokers try the e-cigarette to help them do so?

In answering the last question above, the research must consider the placebo effect. It is a well-known phenomenon in which a patient or participant believes the intervention will work. Because of this belief, the intervention has the desired effects. E-cigarettes, if used by those who believe they can assist in smoking cessation, are likely to prove useful in the struggle to quit smoking. Because of this, answering the above questions will provide insight into the awareness of and perceptions of e-cigarettes as smoking cessation aids, and will help predict the likelihood of use and success in quitting.

**Theoretical Base**

The theoretical base for this study was derived from the Theory of Planned Behavior (TPB), and the Health Belief Model (HBM). The TPB is based on the Theory of Reasoned Action, which posits that persons act according to attitudes toward a behavior and their subjective norms (DiClemente, Salazar, & Crosby, 2013). The TPB takes this theory a step further by adding perceived behavioral control to the Theory of Reasoned Action (DiClemente, Salazar, & Crosby, 2013). Similarly, the Health Belief Model is based on the theory that a person will engage in a health behavior depending
upon his/her belief about the health problem, his/her perceived benefits and barriers in performing the beneficial behavior, and perceived self-efficacy in accomplishing the beneficial behavior (DiClemente, Salazar, & Crosby, 2013). Both of these theoretical bases involve perceptions, which is a main focus of this study. The research questions and subsequent hypotheses were based on respondents’ perceptions of efficacy and social norms. Understanding respondents’ perceptions of e-cigarettes can lead researchers and public health policy makers to a better understanding of smokers’ potential actions in trying to quit. These actions may include e-cigarettes, so understanding smokers’ perceptions of efficacy related to e-cigarettes (HBM) is indeed important.

Definition of Terms

Operational Definitions of technical terms, jargon, or special word uses are provided below.

*Electronic Cigarette (e-cigarette):* An inhalational device designed to deliver nicotine vapor to the user.

*Electronic Nicotine Delivery System (ENDS):* An inhalational device designed to deliver nicotine vapor to the user.

*Smoker:* A person who smokes at least five cigarettes weekly

Assumptions

In administering this survey, it was assumed that all participants would answer truthfully and provide correct information to the researcher. Bordens & Abbott (2014) cite that some participants may present themselves in a socially acceptable manner.
instead of answering truthfully. No participant was asked for his or her name, and all were guaranteed that their answers would remain anonymous.

**Limitations**

The potential for bias in self-reported surveys exists, as does the possibility that the researcher’s attitude and/or demeanor led participants to make assumptions prior to completing the survey. The researcher has personal experience with the use of e-cigarettes as a quitting aid, so ensuring that any biases in his presentation of the surveys was extremely important.

**Delimitations**

One hundred seventy were surveyed for this study yielding a sample size large enough to satisfy the criteria needed to read results showing statistical significance \( p = < .05 \). The survey questions were designed to gather information on the criteria being assessed, but their short length eliminated the potential for conveyance of biasing information. While the study focused on a Facebook population, which limits the generalizability of the findings of this study, the results offered insight into the awareness and perceptions in a world reliant upon social media and networking.

**Significance of the Study**

This study provides additional insight into a limited body of research regarding smokers’ awareness related to e-cigarettes and the perceptions of their use. It examines both of these in a population of smokers on Facebook, which will provide information in an area with little current research. The study of this population provides a method for other populations to be studied, which will yield valuable results to public health efforts
in reducing smoking. It also provides insight into why smokers do or do not use e-cigarettes as a smoking aid, and may suggest methods to market these products more effectively based on theoretical framework.

**Summary**

Smoking is still a serious threat to public health, and even though there are a number of effective methods available to help smokers quit, any new technology that may improve a smoker’s chance of quitting deserves to be studied. E-cigarettes, though not currently regulated, have shown promising results in numerous studies. Research on smokers’ attitudes and perceptions of e-cigarettes continues, but still requires more development. This type of research will provide insight into the reasons a smoker will or will not use e-cigarettes, which will also provide valuable information to public health efforts.

The following chapter provides an in depth review of existing literature regarding e-cigarettes. There is much that supports their effectiveness and some that does not. In the literature review, the gaps in current research will become more apparent, as will the need for the research. The methods for this study as well as data analysis are outlined in Chapter 3. Then, Chapter 4 presents the research findings, followed by their implications in Chapter 5.
Chapter 2: Literature Review

Introduction

E-cigarettes are becoming more popular as time passes, and they have been shown to be effective in helping smokers quit. For example, Polosa and colleagues (2011) found that users of e-cigarettes were able to significantly reduce the number of cigarettes smoked and there were no reported negative side effects attributable the electronic nicotine delivery system. Odum, O’Dell, and Schepers (2012) found that patients saw positive results using electronic cigarette for smoking cessation. Simon (2013) found e-cigarettes to be as effective as the nicotine patch. Siegel, Tanwar, and Wood (2011) also found e-cigarettes to be a promising means of reducing smoking. However, there has been less research conducted on smokers’ awareness of e-cigarettes grouped by different age ranges or smoking habits. Interventions involving e-cigarettes will have to be tailored to the needs, attitudes, and beliefs of different types of people, so implementing a method to collect data regarding awareness in groups of people will be very valuable.

Attitudes and perceptions of e-cigarettes will also be vital in assessing their effectiveness in public health interventions. This includes the perceived self-efficacy and barriers of e-cigarette users. There has been research conducted outside of the U.S. that has studied awareness and perceptions of this new technology. There is a gap, however, in the amount of research that has been conducted within the U.S. More data on Americans’ awareness and perceptions of e-cigarettes is needed. Given that they are not currently regulated by the FDA, misinformation about e-cigarettes is spread through
social interactions which may be a deterrent to many who would benefit from their use (Choi & Forster, 2013). Other barriers may also be present, including financial concerns, so researchers in the U.S. must develop a better understanding to what motivates and demotivates smokers to use e-cigarettes.

The literature review will address three areas of research related to smokers’ awareness of and attitudes toward e-cigarettes. In the first section, research regarding the efficacy of e-cigarettes as smoking cessation aids is examined. Second, research studies related to smokers’ awareness of e-cigarettes will be addressed. The third area will include a discussion on smokers’ attitudes toward the use of e-cigarettes as a quitting tool. These sections will show what research has been conducted, and will identify the gaps that this study has addressed.

**Efficacy of E-cigarettes as Smoking Cessation Aids**

**A harm reduction strategy.** A harm reduction strategy, which involves replacing a harmful behavior with a less harmful behavior, is a controversial idea, especially within tobacco control efforts (Cahn & Siegel, 2011). Cahn and Siegel (2011) discuss e-cigarettes and the difficulty in classifying them because currently they are neither considered recreational nor nicotine replacement therapy. The authors open by explaining what an e-cigarette is, and then discuss their safety and efficacy. They examine the limited existing literature regarding the safety and efficacy of e-cigarettes, and also discuss arguments made against harm reduction strategies. It is this idea of harm reduction that may solidify the e-cigarette as a valuable tool in public health.
Cahn and Siegel (2011) focused on 16 studies that analyzed the contents of e-cigarette vapor and compared it to tobacco cigarettes. They write that there are over 5000 chemical compounds in tobacco cigarettes that have not yet been identified, while vapor from e-cigarettes has been thoroughly characterized. Researchers now know that the two compounds in e-cigarette vapor that most concern the FDA, tobacco-specific nitrosamines (TSNAs) and diethylene glycol (DEG), are found in much higher concentrations in tobacco cigarettes. Because of this, and the reduction of nicotine cravings identified with e-cigarette use in several studies, Cahn and Siegel (2014) conclude that e-cigarettes should not be banned. They believe the debate should not be focused on whether they are safe, rather, it should focus on reducing the harm of smoking tobacco cigarettes by replacing them with e-cigarettes.

Like all research, this study is not without its limitations. The authors admit that more research is needed before it can be concluded that e-cigarettes are effective quitting tools. Also, this study cannot definitively say that e-cigarettes are safe, which raises questions about accessing them, and the potential for nicotine addiction to occur in those who do not smoke tobacco. This concern begs regulators to pay attention to the potential of e-cigarettes, and beckons researchers to learn more about smokers’ awareness and perceptions of them.

**E-cigarettes and smoking cessation.** One of the central ideas behind the use of e-cigarettes is that they provide an action that mimics smoking while delivering nicotine without the toxic smoke. This is completely different from other cessation aids, including the nicotine patch. Bullen and colleagues (2013) set out to determine whether
e-cigarettes were more effective than the patch in smoking cessation attempts. Their study took place in Auckland, New Zealand, between September 2011 and July 2013, and included 657 randomized adult participants who wanted to quit smoking. Of the whole, 289 were randomized to nicotine e-cigarettes, 295 to nicotine patches, and 73 to placebo e-cigarettes.

The primary outcome of this study was self-reported smoking abstinence up to six months after the original quit day, which meant participants could have only smoked up to five cigarettes during that time. At six months, participants were verified using breath analyzers and carbon monoxide testing. Secondary outcomes, measured at months one, three, and six measured abstinence, abstinence within the past week, cigarettes smoked per day, and several other measures. Results showed the highest prevalence of continuous abstinence was in the nicotine e-cigarette use group, but there was not a statistically significant difference between e-cigarettes and the nicotine patch. Adherence to the study guidelines was also higher in the nicotine e-cigarette group. The researchers concluded that e-cigarettes were as effective, if not more effective, than nicotine patches in smoking cessation, however modest the results.

Limitations of the study include an effect size that reduced statistical power; more participants were lost to follow-up in the nicotine patch group and actual nicotine levels were lower than advertised (Cahn & Siegel, 2013). There may also have been response bias during self-reporting caused by perceived expectations or a desire to appease the researchers. Nevertheless, the results, though modest, support the argument for e-
cigarette regulation and use. Because of this, smokers’ awareness and perceptions of e-cigarettes must be studied.

**E-cigarettes as a tobacco substitute.** The popularity and use of e-cigarettes is growing, and consumers use them to quit and/or reduce smoking. Because of this, Capponetto and colleagues (2013) designed their randomized control trial to research smoking reduction and abstinence, as well as any side effects of using e-cigarettes. The study took place in Catania, Italy, from June 2010 to February 2011, and it was a three-armed, double-blind, controlled, randomized, clinical trial. Participants, who were smokers not wanting to quit, received e-cigarettes with high, medium, and no nicotine levels, and were invited to check in at two-week intervals. At that time, carbon monoxide levels and vital signs were taken, as were saliva samples. Any adverse effects were also documented. Outcome measures were a 50% reduction in tobacco cigarette consumption, complete abstinence from smoking, and adverse symptoms.

The statistical analysis was conducted using Statistical Package for Social Sciences version 17.0 for Windows (SPSS Inc., Chicago, IL). At the 52-week mark, 183 of the original 300 participants remained. Each of the three arms in the study showed a reduction in the mean number of cigarettes smoked per day while using e-cigarettes. A low incidence of side effects, including depression, insomnia, and irritability were reported, and researchers saw a significant reduction of baseline side effects including coughing and shortness of breath. At week 52, 26.9% of participants had quit smoking cigarettes using only e-cigarettes, and of those, most were able to eventually quit using the e-cigarette, as well. These results helped the researchers conclude that e-cigarettes
are a promising form of smoking reduction and abstinence, especially since the study group was not intending to quit smoking.

In assessing the limitations of this study, one must consider external validity. Because this study was conducted using individuals who did not intend to quit, it cannot be compared to other smoking cessation studies. Also, the sample size and loss to follow up must be considered. Finally, its generalizability, due to sample size, is questionable. However, this study provides valuable insight into a subpopulation in Italy, and the success noted in its results points to the need for even more research, especially in the United States.

**Summary.** As the previous studies have shown, e-cigarettes provide a promising means to reduce smoking. They can be an effective harm reduction tool when compared to tobacco smoke, they can assist those wanting to quit in doing so, and they can reduce cigarette consumption in those who do not intend to quit. These results suggest a continuing need for research, especially in the U.S., so that public health and regulatory officials will fully understand the potential held by these devices. They must also understand the awareness and perceptions held by smokers in order to assess when, how, and where, e-cigarettes might be employed in the fight to reduce smoking tobacco.

**Smokers’ Awareness of E-Cigarettes in the U.S., UK, and Poland**

**An awareness study.** Given the potential for e-cigarettes to become a viable smoking cessation aid, and the FDA’s intention to regulate them in the future (Regan, Promoff, Dube, & Arrazola, 2013), information regarding the public’s awareness of this product is indeed important. Prior to the study conducted by Regan and colleagues
(2013), there had been no investigation into what the authors called “awareness” of e-cigarettes in the United States (p. 19). The purpose of their research was to study people’s awareness of e-cigarettes; to collect data on whether they had ever used them, or had used them in the previous 30 days; and to study if awareness and use increased from 2009 to 2010 (Regan et al., 2013). The study used a mail-in consumer survey to develop a panel, stratified randomly, to obtain results from a sample of consumers that resembled the population in the United States.

Of the more than 20,000 people selected in 2009 and 2010, about half responded to the 3-question survey. The 3 questions asked which of a list of tobacco products they had heard of, which ones they had ever tried, and which they had used in the past 30 days. Respondents were able to check as many on the list that applied, including e-cigarettes. After data were compiled, weighted percentages were used at 95% confidence intervals to provide data matching the current U.S. population, and z-tests showed if awareness increased from 2009 to 2010. Regan and colleagues (2013) found that overall awareness increased from 16.4% to 32.2% ($z = 16.6; p < 0.01$), while the most marked was among smokers (2009: 20.7%; 2010: 49.6%).

Conclusions drawn from this study included the suggestion that awareness increased substantially from 2009 to 2010 within the U.S. However, this study does not provide information on how respondents became aware of them. It also limited the responses to awareness, which does not provide information on how aware the sample was regarding e-cigarette use and function. The survey type may have limited the study
because it was not population-based (Regan et al., 2013) and there is the possibility of response bias.

**Electronic cigarette prevalence in Great Britain.** Smoking is not just a serious public health problem in the U.S., it causes an estimated 100,000 deaths each year in the United Kingdom (Dockrell et al., 2013). Because of this, Dockrell and colleagues (2013) sought to elucidate information regarding the prevalence of e-cigarette use in Great Britain. They assembled a panel of 360,000 adults who were weighted to approximately resemble the demographic makeup or Great Britain. The survey identified smokers with a series of screening question who were then prompted to take another survey that assessed their awareness of e-cigarettes, as well as their perceptions.

The researchers then calculated confidence intervals from the weighted data, and, using a chi-square test, matched e-cigarette use with the survey year. They also examined demographic variables that were known to predict smoking in efforts to find correlations with e-cigarette use; none indicated an association. They found that, from 2010 to 2012, respondents who had not heard of e-cigarettes dropped from 38.2% (95% CI 36.0–40.6) in 2010 to 21.1% (95% CI 18.9–23.2) in 2012 ($p < .001$). The percent of respondents that had tried e-cigarettes or who were currently using them more than doubled.

Again in this study, it can be concluded that awareness and use of e-cigarettes has increased in past years. This study addressed awareness, not awareness of e-cigarettes, which records only if respondents knew they exist. Awareness of their functioning and created purpose was absent from this study. However, limitations in this study exist. The
internet-based survey may be limiting as it is not likely indicative of Great Britain’s population as a whole. This is a weakness that must be realized as access to internet resources may have been limited for many, and response bias is possible in those who participated. This suggests the necessity of studying subsamples of the larger population. Doing so will help public health efforts understand the needs of specific locations with regard to smoking cessation. Nevertheless, this study provided valuable information to public health practitioners in Great Britain.

**Prevalence in Polish young adults.** Since e-cigarettes are a new technology, researching their use among youth is increasingly important. A study of youth in Poland was conducted by Goniewicz and Zielinska-Danch (2012) to assess demographic factors related to whether youth had recently used or ever used e-cigarettes. Using a cluster sample of 20,240 high school and college students from 176 nationally representative campuses, data about e-cigarette use was collected during a national survey about the use of water pipes. The survey consisted of 90 questions relating to awareness and the use of snuff, e-cigarettes, water pipes, and cigarettes. Awareness data was collected by asking respondents if they had heard of e-cigarettes, had ever used e-cigarettes, or had used them in the past 90 days.

Sampling weights were used to approximate the population demographics; the 13,787 completed surveys yielded data that was assessed for independent relationships using multiple logistic regression. It was estimated that 86.4% (95% CI: 85.8–87.0) of Polish students age 15–24 had heard of e-cigarettes, 20.9% (95% CI: 20.1–21.6) had ever tried them, and 6.9% (95% CI: 6.4–7.4) had used them in the past 30 days. Youth with
parents who smoked were more likely to have used e-cigarettes and boys were more likely than girls to have tried them. Of the tobacco products on the survey (cigarettes, water pipes, snuff, and e-cigarettes), e-cigarettes were used the least.

As with the previously mentioned studies, smokers were more aware of e-cigarettes than were nonsmokers (Goniewicz & Zielinska-Danch, 2012). This study was likely the first to study the 15–24 age range related to e-cigarette prevalence, and it provides valuable information regarding e-cigarettes compared to other nicotine options. There are possible limitations as to the representativeness of the study, however. The authors admit that rural areas may be underrepresented, and that the population prevalence may be overestimated. Additionally, it did not focus exclusively on smokers although it can be seen that smokers who responded were more aware of e-cigarettes. It can be concluded that the high use among youth is indicative of the need to further study this age range, especially in countries outside the U.S.

**Awareness among young adults in the Mid-West U.S.** Choi and Forster (2014) identified the need to study Midwestern young adults to assess awareness and beliefs about e-cigarettes in this subpopulation. Their goal was to assess awareness and perceptions because this age range may still be in early stages of tobacco use and non-smokers may be tempted to use nicotine recreationally, possibly leading to addiction. The researchers used cluster random sampling in Minnesota, the Dakotas, Michigan, and Kansas, to study 4,826 participants, aged 12–16. Of those, 2,624 complete surveys were analyzed.
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Participants were asked if they were aware of e-cigarettes or devices that delivered nicotine and resembled cigarettes. Those who responded in the affirmative were then asked perception questions. Independent demographic variables were also measured, including education levels which were grouped into three categories. These independent variables were assessed with multivariate associations, and linear models were used in the estimation of associations. Choi and Forster (2014) found that 69.9% of respondents were aware of e-cigarettes, 7% had tried them, and 1.2% had used them in the last 30 days.

Like the study by Goniewicz and Zielinska-Danch (2012), this study provided important information regarding awareness among youth. Again, the researchers found that smokers are more likely to be aware of e-cigarettes than non-smokers, allowing the reader to conclude that smoking status relates to awareness of e-cigarettes. Understanding of how they function was not studied, suggesting respondents know they exist but may not know how they work. The implications of awareness among youth beckon researchers to better understand their perceptions and likelihood of use. Though this study was cross-sectional and did not reveal consequences of the recorded awareness, the results are indeed valuable. However, since this study did not focus exclusively on smokers’ awareness, more research is certainly warranted.

**Summary.** The aforementioned studies used survey techniques in different manners to research the awareness of e-cigarettes within their samples. Limitations for all included the generalizability of the information as well as response bias. Goniewicz and Zielinska-Danch (2012) and Choi and Forster (2014) designed their research to study
youth subpopulations, yielding valuable information for public health. However, more research on subgroups is necessary, and focusing exclusively on smokers and their awareness of e-cigarettes will provide regulators and public health personnel additional insight into their potential as cessation aids.

**Perceptions of E-cigarettes**

Perhaps more important than assessing smokers’ awareness of e-cigarettes is smokers’ perceptions of them. Since the Food and Drug Administration plans to regulate e-cigarettes (Pearson et al., 2012), public health must seriously consider them as a potentially valuable smoking cessation aid. Understanding smokers’ perceptions of e-cigarettes, including the barriers that may limit their use, will be increasingly valuable as the fight to reduce tobacco use continues. The following studies assessed both awareness and perceptions of e-cigarettes, but more research is needed to better understand why smokers do or do not use them.

**Perceptions in Great Britain.** The study conducted by Dockrell and colleagues (2013) was conducted to assess both awareness and perceptions of e-cigarettes. The survey used by the researchers identified smokers and asked them questions that related to the individuals’ perceptions and beliefs regarding e-cigarette use. The questions compared the safety of e-cigarettes to conventional cigarettes, explored the perceived advantages and disadvantages of their use and compared them to other available smoking cessation aids (nicotine gum, patch, etc.). The results were then analyzed and reported as percentages of the most common perceptions. The researchers found that the majority of respondents (60%) believed that e-cigarettes might reduce the desire to smoke by
satisfying cravings. They also found that 55% thought they could help cut down on smoking and 51% believed they could eliminate smoking entirely. Of smokers, 71% believed e-cigarettes were safer than cigarettes and only 6% considered them less safe. The main perceived disadvantage of e-cigarettes was the cost associated with their continued use.

These results were promising, revealing that the majority of respondents held positive perceptions of e-cigarettes as a quitting aid. The researchers explored the perceived disadvantages of e-cigarettes, which helps elucidate a probable barrier in their use as a cessation aid. However, the authors did not provide information regarding the list of disadvantages the respondents were asked to identify. Because of this, it cannot be known if the research included the accessibility of e-cigarettes in the survey. This is an important barrier, whether perceived or actual, that may deter smokers from using them. Further research studying the accessibility of these products is needed.

**Perceptions in Europe.** Etter and Bullen (2011) undertook research examining users’ satisfaction with e-cigarettes and their perceived effects. They posted a questionnaire on a smoking cessation website and published it through other websites, some of which were e-cigarette forums. Adults 18 years of age and older responded to the questionnaire, which included questions relating to the effect of e-cigarettes had on smoking cessation, withdrawal from nicotine, side effects, acceptability, and satisfaction.

Since the questionnaire was published on e-cigarette sites, there was concern for bias in their favor. To test this, the researchers compared respondents from pro-electronic cigarette forums to neutral sites using ANOVAs and Mann-Whitney $U$–tests.
Linear regressions models were used to test variable associations. The study found that 92% of smokers cited e-cigarette as successful in helping them reduce smoking, and 96% of former smokers reported e-cigarettes helped them quit. Eighty-nine percent claimed e-cigarettes helped them avoid smoking, 84% believed they are less toxic than smoking, and 94% would recommend them.

This study suggests that, like other studies, perceptions of e-cigarettes are favorable. However, response bias is a concern in this study, even after attempting to control for this possibility. Since most respondents were recruited from smoking cessation websites and e-cigarette forums, the possibility for pro-electronic cigarette responses was high. This may contribute to the high numbers of positive perceptions regarding e-cigarettes. The opportunity to examine barriers to their use does not exist in this study because it focuses on e-cigarette users, not smokers. Nevertheless, it suggests that e-cigarettes can be helpful in smoking cessation applications.

**Perceptions in the Mid-West U.S.** The previously mentioned study conducted by Choi and Forster (2014) also assessed awareness (discussed previously) and perceptions of respondents regarding e-cigarettes. The importance of perceptions in the age range 12–16, cannot be understated because this age group is often the initial stage in the development of smoking behavior (Choi & Forster, 2014). Using a five-point Likert-type scale, the researchers assessed questions of perception as independent variables and outcome measures. The three statements used in this section of the survey assessed whether respondents believed using e-cigarettes could help smokers quit, whether they believed e-cigarettes were safer than cigarettes, and whether they believed e-cigarettes
were less addictive than cigarettes. Associations among perception variables and the use of e-cigarettes were assessed using multivariate regression models using smoking status, demographics, peer smoking, and outcomes. The same was done when treating perception variables as outcomes. The results showed that ever using e-cigarettes was associated with positive perceptions of e-cigarettes, including the belief that they can help smokers quit. Of those aware of e-cigarettes, 44.5% believed they can help smokers quit, 52.9% believed they were less harmful than cigarettes, and 26.4% believed they were less addictive than cigarettes.

This research provides more valuable insight into the perceptions of e-cigarettes, but is limited in its generalizability. Choi and Forster (2014) explored the ramifications of e-cigarette use and presented arguments that supported claims against the effectiveness of e-cigarettes in quitting. However, the information gathered supports positive perceptions of those who had ever used e-cigarettes. These perceptions suggest that, though the product is not yet regulated, the attitudes of smokers who had used them could be advantageous in smoking cessation efforts. This will depend on perceived and actual barriers. The authors touch on the possibility that monetary barriers may be the cause for a low prevalence of electronic cigarette use in the region studied but no evidence is discussed supporting this. In fact, no barriers were addressed in this study at all, possibly due to the skeptical nature of the article relating to electronic cigarette effectiveness. The overall negative tone of the article may have limited the authors in collecting information that would benefit those who viewed e-cigarettes in a positive light.
Harm perceptions in U.S. adults. Pearson, Richardson, Niaura, Vallone, and Abrams (2012) sought to elucidate the awareness and harm perceptions of e-cigarettes in the U.S. citing a lack of reliable national information. American adults were the population of interest in this study, including never smokers, former smokers, and smokers. Awareness was highest in smokers, which supports the awareness studies mentioned previously. However, this study focused on harm perceptions.

The authors compiled data for their study from two national surveys. The first was a cross-sectional, nationally representative survey, and the second was a cross-sectional, longitudinal smoker cohort study. From the first survey, 2,649 of 10,547 participants were deemed eligible for study, and from the longitudinal study 4,067 completed the follow-up in 2008, while 3,658 completed the follow-up in 2010. Both studies included a five-point Likert scale question about e-cigarette perceptions, asking respondents if they believed e-cigarettes were much less harmful than cigarettes, a little less harmful, the same, a little more harmful, or a lot more harmful. Results were calculated by reducing the five-point Likert scale to a three-point scale. Statistical significance was measured with the Rao-Scott test, and estimations of odds ratios were calculated using a multivariable logistic regression. The results showed that 70.6% (95% CI = 65.0, 75.7) of respondents in the online survey felt e-cigarettes were less harmful than cigarettes. The longitudinal study showed that 84.7% (95% CI = 81.5, 87.4) of respondents believed e-cigarettes were less harmful than cigarettes.

The reader can conclude from the two nationally representative surveys in this study that overwhelmingly, respondents believed e-cigarettes are less harmful than
cigarettes. There is, however, no information on the perceived barriers prohibiting the use of e-cigarettes, which again highlights the need for research in this area. Pearson and colleagues (2012) admit that social factors like socioeconomic status may not be taken into account in the results. Response bias from the online survey may also exist.

**Summary.** Studies measuring the perceptions of e-cigarettes have shown favorable attitudes toward their use. Respondents believe they are less dangerous than cigarettes, they are beneficial in reducing smoking, and they can help satisfy cravings. Only one study identified a potential barrier to using them; this barrier was the cost of continued use. Another study hypothesized that the expense might be a cause of low prevalence, but did not conduct any research to test this hypothesis. Because of this, more research is needed regarding the barriers, perceived or real, to using e-cigarettes, which may be expense or accessibility. There exists a gap in research focused on awareness, and perceptions of e-cigarettes here in the U.S., and this study hopes to fill. Public health cannot ignore their possible role in smoking cessation. Once regulated, they may prove to be a formidable ally for smokers attempting to quit.

**Chapter Summary**

E-cigarettes are a new technology that have the potential to reduce smoking and improve smoking cessation success. Research has shown that e-cigarettes can help in smoking reduction and abstinence, and since they mimic the act of smoking, they may become a first step for some who are attempting to quit. Because of this, regulators and public health officials must begin to understand current awareness of e-cigarettes, as well as the attitudes and perceptions of the public and smokers. Research has shown that
SMOKERS’ AWARENESS AND PERCEPTIONS

Awareness is increasing, especially among smokers. This may be due to several factors including advertising and word of mouth. Awareness does not equal knowledge, however. It will be important to collect data relating to the functioning of e-cigarettes, as well as their designed uses to substitute for combustible cigarettes.

Perhaps more important than awareness is the perception people hold of these devices. Assessing perceptions will help regulators and public health officials understand what motivates people to use them, how they affect self-efficacy in smoking reduction, and what barriers may exist to limit access to them. The possibility that barriers such as the expense of e-cigarettes, which may be dissuading, must be examined. Research has shown favorable attitudes toward their use among smokers, ex-smokers, and non-smokers, but more investigation, especially in the U.S., is warranted. Since these products are still relatively new inventions, research must continue, especially regarding the public’s awareness and perceptions of e-cigarettes.
Chapter 3: Research Method

Research Design and Approach

Because e-cigarettes have the potential to become a valuable public health tool, it is necessary to continue studying them in order to establish the need for regulation. To support this need for regulation, research must be conducted on smokers’ awareness of e-cigarettes and perceptions of their efficacy. In attempting to elucidate these elements, this study asked the following questions: Do smokers know what e-cigarettes are? Have they used e-cigarettes? Do smokers view e-cigarettes in a positive light as a cessation aid? If they were to decide to quit smoking, would smokers try the e-cigarette to help them do so?

These questions were used to develop the three hypotheses the research tested. They were:

1. \( H_0 \): There is not a relationship between cigarettes smoked per day and awareness of e-cigarettes.
   
   \( H_1 \): There is a relationship between cigarettes smoked per day and awareness of e-cigarettes.

2. \( H_0 \): There is not a relationship between the desire to quit smoking and positive perceptions of e-cigarettes.
   
   \( H_1 \): There is a relationship between the desire to quit smoking and positive perceptions of e-cigarettes.

3. \( H_0 \): There is not a relationship between age and positive perceptions of e-cigarettes.
H1: There is a relationship between age and positive perceptions of e-cigarettes. Each of these questions was implemented and the hypothesis for each was either rejected or not rejected based on correlational significance.

This quantitative study was accomplished by sending the survey questionnaire in Appendix A to Facebook users with a goal of reaching smokers. The first section of the questionnaire moved respondents through a series of yes/no questions, some of which were designed to disqualify non-smokers or those who were not of legal U.S. smoking age. The second section used a five-point Likert-type scale to help gauge the perceptions of efficacy, safety, and availability of e-cigarettes. A chi-square test was used to analyze the results.

**Setting and Sample**

The sample was drawn from the population of smokers who use social media. Specifically, the website Facebook.com was used to disseminate the survey. The researcher sent the survey with instructions to friends and colleagues to help him disseminate the survey. They then distributed the survey via Facebook and email to friends and colleagues they knew to be smokers for completion. Respondents were asked to complete the survey, and to forward the survey with instructions to all people they knew on Facebook who smoked. The instructions told this contacted group to do the same. No information exists on the number of smokers who use Facebook, but it is this author’s personal experience that there are is a large population of smokers from which to be sampled.
Procedure

Data was collected by producing a survey questionnaire that was distributed electronically through Facebook and emails. Using the popular survey website SurveyMonkey.com, the questionnaire was developed to assess smokers’ awareness and perceptions of e-cigarettes. The researcher contacted friends and colleagues via email and Facebook and asked them to distribute the survey to their friends and colleagues. This created an initial group of Facebook profiles that were used to disseminate the survey to others. The questionnaire included a notice to respondents that, by voluntarily completing the survey, they were giving informed consent.

A pretest was administered using classmates of the researcher as evaluators of the validity of the survey. These classmates had nearly two years of study in a master’s of public health program, and they were from diverse backgrounds living in the United States and Nigeria. They were experienced using social media like the population of respondents from which data were collected. It was found that no survey questions needed to be changed or removed.

Also, a test and retest were administered. Hard copies of the electronic survey were distributed to five adult smokers. A week later the same survey was again given to the same five adult smokers. Reliability was determined by comparing the responses from each person’s two separate completed surveys. It was found that no questions presented unreliable results among the test, re-test group, and no questions were removed.
Data Collection and Analysis

The survey for this study collected categorical data regarding awareness and perceptions of e-cigarettes. Data from the questions were coded according to responses for questions about awareness, use, and perceptions of e-cigarettes. Much of the data analyzed was descriptive, and provided information on the percentages of respondents who were aware of e-cigarettes, used e-cigarettes, and had favorable/unfavorable perceptions of e-cigarettes as a quitting tool. However, in testing the hypotheses discussed above, a chi-square statistical analysis was employed.

Instrumentation and Materials

Data was collected with a two-part questionnaire. This questionnaire began by assessing respondents’ awareness of e-cigarettes and their function. This includes whether they had used e-cigarettes, and whether they had used them recently. This section also assessed whether respondents had any desire to quit smoking, whether they were trying to quit smoking at the time of the survey, and whether e-cigarettes were part of any quitting strategy. The second section used a 5-point Likert-type scale to measure perceptions of accessibility, safety, and efficacy of e-cigarettes.

Survey scores were calculated by assigning point values to the different answers prior to analysis. The survey’s validity was determined through face value; it effectively covers the areas that the research questions sought to answer. A pre-test with a small sample of five smokers was also conducted to ensure validity.
Protection of Human Participants (if applicable)

The Concordia University, Nebraska Institutional Review Board approved this study to ensure the ethical protection of respondents. All questionnaires were anonymous, and participants were notified of informed consent from an explanation that preceded the questionnaire. Their consent was signified by their voluntary completion of the questionnaire.
Chapter 4: Results

In an effort to gain a greater understanding of smokers’ awareness and perceptions of e-cigarettes, the survey in Appendix A was distributed to smokers via electronic mail and the social media site Facebook. Because social media was used for distribution, it was not possible to determine how many people the survey was distributed to, thus a response rate could not be calculated. However, 177 surveys were collected. Of these, 68 were disqualified, most for being incomplete. These 68 were excluded from the results, leaving a total of 109 for inclusion in the statistical analysis. Much of the information gained from the survey was descriptive, including location and demographics. Additional analysis was performed using chi-square tests; the level of statistical significance for the $p$ values was set at < .05 for the purpose of rejecting or confirming the null hypotheses that follow.

1. $H_0$: There is not a relationship between cigarettes smoked per day and awareness of e-cigarettes.

   $H_1$: There is a relationship between cigarettes smoked per day and awareness of e-cigarettes.

2. $H_0$: There is not a relationship between the desire to quit smoking and positive perceptions of e-cigarettes.

   $H_1$: There is a relationship between the desire to quit smoking and positive perceptions of e-cigarettes.

3. $H_0$: There is not a relationship between age and positive perceptions of e-cigarettes.
H₁: There is a relationship between age and positive perceptions of e-cigarettes.

**Descriptive Data**

There were more female respondents included in the analysis (60.6%) and most were Caucasian (89.9%). Almost two-thirds (58.7%) of the participants were between the ages of 25 and 34 and a large majority (81.5%) wanted to quit smoking traditional cigarettes. More than half (60.2%) of the respondents said that they were trying to quit smoking, and two-thirds of those (66%) were using e-cigarettes in their plan to quit. Interestingly, respondents were almost evenly divided when asked if they felt e-cigarettes had helped them reduce their consumption of traditional cigarettes; 54% said “yes” and 46% said “no.”

**Research Questions.**

The survey used in this study yielded much information on the respondents and their awareness and perceptions of e-cigarettes. In addressing the first research question outlined above, it was found that 108 of 109 respondents knew what e-cigarettes are. The second research question asked if respondents had used e-cigarettes. The survey results showed that 79.6% of respondents had used e-cigarettes. The third research question addressed whether the smoker had a positive perception of e-cigarettes as a smoking cessation aid. The survey was designed using two Likert-style (strongly disagree, disagree, neutral, agree, strongly agree) questions to answer the research question. The first question, regarding safety, showed that only 22 of 108 respondents agreed or strongly agreed that e-cigarettes were safe. The second question, regarding effectiveness as a cessation aid, showed that only 40 of 108 agreed or strongly agreed e-cigarettes were
effective as smoking cessation aids. However, it must be noted that neutral responses showed the highest percentages in both questions (44.4% and 32.4%, respectively), suggesting that the majority of respondents had neither positive nor negative perceptions of the safety and effectiveness of e-cigarettes. Therefore, it cannot be determined from this data whether respondents had positive or negative perceptions of e-cigarettes without conducting statistical testing. The results of the statistical tests are discussed below.

The researcher also wanted to know whether respondents would use e-cigarettes in their attempts to quit smoking. Those who responded that they were trying to quit smoking were then prompted to answer a follow-up question that asked if e-cigarettes were part of their quitting strategy. The results showed that 35 of the 53 who responded to this question were incorporating e-cigarettes into their quitting strategy. This suggests that there is a relationship between those trying to quit and the perceived efficacy of e-cigarettes as a smoking cessation aid. Again, however, this could not be verified without statistical testing. The results of this testing is discussed below.

**Quantitative Data**

The independent variables in this study were the number of cigarettes smoked per day, the desire to quit smoking, and age. Dependent variables included awareness and positive perceptions of e-cigarettes. A Chi-square test was used to determine if there was a relationship between each variable. This value was then used to determine whether or not to reject the hypotheses. The following sections are organized by each hypothesis that was tested. The results of the analyses are explained and contained therein.
Hypothesis 1. Null hypothesis: There is not a relationship between cigarettes smoked per day and awareness of e-cigarettes.

Hypothesis 1: There is a relationship between cigarettes smoked per day and awareness of e-cigarettes.

The first hypothesis was based on the assumption that there is a correlation between a higher number of cigarettes smoked per day and increased awareness and knowledge about e-cigarettes. The thought was that heavier smokers are more likely to have been exposed to e-cigarettes than light or occasional smokers. The results of the statistical analysis showed that there is not a statistically significant association between the number of cigarettes smoked per day and awareness of e-cigarettes. The overall results from testing this hypothesis are listed in Table 1.

Table 1

Cigarettes per Day and Awareness of E-cigarettes and their Function.

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>%</th>
<th>Number</th>
<th>%</th>
<th>n</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heard of e-cigarettes</td>
<td>108</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>108</td>
<td>Cannot calculate</td>
</tr>
<tr>
<td>Know how they work?</td>
<td>92</td>
<td>85.2</td>
<td>16</td>
<td>14.8</td>
<td>108</td>
<td>0.077</td>
</tr>
</tbody>
</table>

The statistical analysis was conducted using the Chi-square test in Microsoft Excel 2013 with the XLSTAT add-in available at http://xlstat.com. The test resulted in a p value of 0.077. An awareness score was calculated by averaging whether respondents had heard of e-cigarettes and knew how they worked. In testing for a relationship between the number of cigarettes smoked per day and the awareness score, the results did
not yield a statistically significant result ($p > 0.05$). Since both $p$ values are above the significance level of 0.05, there is a failure to reject the null hypothesis. The data collected in this survey did not show a statistically significant association between the number of cigarettes per day and respondents’ awareness of e-cigarettes.

**Hypothesis 2.** Hypothesis$^1$: There is a relationship between the desire to quit smoking and positive perceptions of e-cigarettes.

Null Hypothesis$^0$: There is not a relationship between the desire to quit smoking and positive perceptions of e-cigarettes.

The second hypothesis is based on the assumption that the desire to quit smoking may lead smokers to have a positive perception of e-cigarettes. To test this hypothesis, data from two survey questions were used, both of which were Likert-style questions. First, the desire to quit was tested to determine if a relationship with positive perceptions existed. The respondents completed questions about the safety, effectiveness, and affordability of e-cigarettes. The results are listed in Table 2.

**Table 2**

*Perceptions of E-cigarettes in Those Wanting to Quit*

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>% wanting to quit</th>
<th>n (total responses)</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-cigarettes safe</td>
<td>7</td>
<td>23</td>
<td>38</td>
<td>18</td>
<td>2</td>
<td>81.5</td>
<td>108</td>
<td>0.885</td>
</tr>
<tr>
<td>E-cigarettes are effective in quitting</td>
<td>0</td>
<td>23</td>
<td>28</td>
<td>31</td>
<td>6</td>
<td>81.5</td>
<td>108</td>
<td>0.009</td>
</tr>
<tr>
<td>E-cigarettes are affordable</td>
<td>1</td>
<td>11</td>
<td>27</td>
<td>39</td>
<td>10</td>
<td>81.5</td>
<td>108</td>
<td>0.131</td>
</tr>
</tbody>
</table>
The results of the analysis yielded statistically significant results in one of the three areas, the perceptions of the safety of e-cigarettes \((p = 0.009)\).

Second, data from respondents who reported they were trying to quit smoking were tested against positive perceptions of e-cigarettes. Again, the respondents completed questions about the safety, effectiveness, and affordability of e-cigarettes. The results are listed in Table 3.

Table 3

<table>
<thead>
<tr>
<th>Perceptions of Those Trying to Quit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>E-cigarettes safe</td>
</tr>
<tr>
<td>E-cigarettes are effective in quitting</td>
</tr>
<tr>
<td>E-cigarettes are affordable</td>
</tr>
</tbody>
</table>

The statistical analysis using the chi-square test yielded another statistically significant result. There is a relationship between trying to quit smoking and positive perceptions of the effectiveness of e-cigarettes \((p = .003)\). Because of the statistically significant relationship between wanting to quit smoking and positive perceptions of e-cigarettes, and the relationship between trying to quit smoking and e-cigarettes, the null hypothesis is rejected in favor of the alternative hypothesis.

**Hypothesis 3.** Hypothesis\(^1\): There is a relationship between age and positive perceptions of e-cigarettes.
Hypothesis$^0$: There is not a relationship between age and positive perceptions of e-cigarettes.

This hypothesis is based on the assumption that younger generations may be more inclined to have a favorable attitude toward this type of new technology. Using the same three Likert-style questions used to assess the desire to quit and its relationship to positive perceptions, age related to positive perceptions of e-cigarettes was analyzed. The statistical analysis used in testing for a relationship between respondents’ age and their perceptions of e-cigarette safety yielded a $p$ value $= 0.053$). Though this result was close to the desired statistical cut-off ($p$ value $\leq 0.05$), and suggests there may some sort of a relationship, this result cannot be considered to be statistically significant.

In testing for a relationship between age and the perceived effectiveness of e-cigarettes, the results were not found to be statistically significant ($p = 0.354$).

In testing for a relationship between age and the perceived affordability of e-cigarettes, the results were not found to be statistically significant ($p < 0.978$). A perception score was calculated by averaging the responses to the Likert-style questions of safety, effectiveness, and affordability of e-cigarettes. A relationship between age and the perception score were tested with using the chi-square. No statistically significant relationship was found ($p > 0.05$) using this testing. Altogether, there are no relationships regarding age and perceptions of e-cigarettes that are statistically significant. Therefore, the null hypothesis cannot be rejected in favor of the alternative hypothesis.
Reliability/Validity

Reliability in this study was determined by using a pretest. Hard copies of the electronic survey were distributed to five adult smokers. A week later the same survey was again given to the same five adult smokers. Reliability was determined by comparing the responses from each person’s two separate completed surveys. It was found that no questions presented unreliable results among the test, re-test group, and no questions were removed. Therefore, the survey and the data collected were determined to be reliable.

This research project claims good face validity in the elements it studied. A class of Master’s in Public Health students, a professor of public health knowledgeable in applied research and survey methodology, and a professor of public health with postdoctoral training in biostatistics reviewed the survey and determined that the survey had content and construct validity.

Summary

It is, and will continue to be, important to understand smokers’ awareness and perceptions of e-cigarettes, especially since they may be used as smoking cessation tools. The findings in this study did show that there exists statistically significant relationships between positive perceptions of e-cigarette and those who want to quit smoking or are trying to quit smoking. Because of this, the second null hypothesis was rejected in favor of the alternative hypothesis. There is a relationship between the desire to quit smoking and positive perceptions of the effectiveness of e-cigarettes. No associations were found between the number of cigarettes smoked per day and awareness of e-cigarettes. Nor
were there any statistically significant associations between age and perceptions of e-cigarettes. Because of this, the null hypotheses associated with each were not rejected in favor of the alternative hypotheses. There were some suggestions of an association between age and perceptions of e-cigarettes, and while the $p$ value was close to the cut-off ($p \leq 0.05$), these results cannot be considered statistically significant.
Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

To understand the public health implications of e-cigarettes as a potential tobacco cessation aid, policy makers and public health practitioners must understand smokers’ awareness and perceptions of e-cigarettes. This study sought to elucidate smokers’ awareness and perceptions of e-cigarettes by distributing an anonymous survey via Facebook and electronic mail. The survey sought to answer the following research questions: Do smokers know what e-cigarettes are? Have they used e-cigarettes? Do smokers view e-cigarettes in a positive light as a cessation aid? If they were to decide to quit smoking, would smokers try the e-cigarette to help them do so?

These questions led to the development of three hypotheses that were used in testing the statistical significance of the relationships they outline. The three hypotheses were:

1. $H_0$: There is not a relationship between cigarettes smoked per day and awareness of e-cigarettes.

   $H_1$: There is a relationship between cigarettes smoked per day and awareness of e-cigarettes.

2. $H_0$: There is not a relationship between the desire to quit smoking and positive perceptions of e-cigarettes.

   $H_1$: There is a relationship between the desire to quit smoking and positive perceptions of e-cigarettes.
3. \( H_0 \): There is not a relationship between age and positive perceptions of e-cigarettes.

\( H_1 \): There is a relationship between age and positive perceptions of e-cigarettes.

The following sections discuss the findings of the research and their implications, not only for smokers, but for public health policy relating to smoking cessation. The limitations of this study and recommendations for future research are also addressed.

**Discussion**

**Research Questions.** The survey used in this study yielded much information on the respondents and their awareness and perceptions of e-cigarettes. In addressing the first research question outlined above, all but one respondent knew what e-cigarettes were. This is likely due to the increased advertisement for e-cigarettes that have been seen at establishments that sell traditional cigarettes. It is also likely that smokers knew other smokers who have tried e-cigarettes, or used them regularly.

The second research question asked if respondents had used e-cigarettes. Because the majority had used them, it can be concluded that e-cigarettes are becoming more readily available, and this researcher believes that their position as a high-tech new device leads smokers to want to try them. Choi, Fabian, Mottey, Corbett, and Forster (2012) found that young adults especially believe that the high-tech nature of these devices makes them appealing. Increased awareness and availability seem to be contributing to their increased use. This is important as it relates to the Theory of Planned behavior and the Health Belief Model discussed earlier. Awareness and
availability can affect perceived barriers and social norms, which may make smokers more likely to try e-cigarettes as a quitting aid.

The third research question addressed whether smokers had positive perceptions of e-cigarettes as a smoking cessation aid. Few respondents believed e-cigarettes were safe, which supports the findings of Trumbo and Harper (2014). They found that young adults did not believe e-cigarettes were safe. This may be attributed to the unregulated nature of these products and the varying ingredients used in the different models, which again supports the call for the regulation of e-cigarettes. Lack of regulation may present a perceived barrier to those considering their use.

Finally, the researcher wanted to discern whether respondents would use e-cigarettes in their attempts to quit smoking. Those who responded that they were trying to quit smoking were prompted to answer a follow-up question that asked if e-cigarettes were part of their quitting strategy. The majority of respondents answered yes, suggesting that smokers perceive e-cigarettes in a positive light in as a cessation aid. This was not unexpected given that e-cigarettes mimic the act of smoking, which is appealing to smokers. Often it is a familiar action that is part of an addiction, so it is logical that the method of nicotine delivery in e-cigarettes would be easily embraced by smokers trying to quit. However, statistical testing had to be used to test for a relationship between the desire to quit and perceptions of e-cigarettes.

**Hypothesis Testing.** The hypotheses below were developed as a result of the research questions posed, and assumptions based on the Theory of Planned Behavior and the Health Belief Model.
**Hypothesis 1.** The first hypothesis tested whether there was a relationship found between the number of cigarettes each respondent smoked and their level of awareness of e-cigarettes. Unfortunately, this could not be tested. The statistical test was unable to be carried out because all but one respondent were aware of e-cigarettes. E-cigarettes are becoming more popular and more available. Therefore, it is believed that almost all smokers have at least heard of e-cigarettes. This conclusion is supported by Yamin, Bitton, and Bates (2010), who found an ever-increasing presence of information seekers and e-cigarette vendors on the internet.

**Hypothesis 2.** The second hypothesis involved testing whether there is a relationship between the desire to quit smoking and positive perceptions of e-cigarettes. The first analysis tested whether those desiring to quit smoking perceived e-cigarettes as safe. The results did not show a statistically significant relationship between the two. This may have been because the survey question designed to collect this data needed to be more specific. A better question would have asked respondents about the safety of e-cigarettes relative to normal cigarettes. There is not a lot of existing research on the safety of e-cigarettes, and given their lack of regulation, it is not surprising that smokers, who may perceive e-e-cigarettes as safer than regular cigarettes, may not view them as completely safe. This belief is supported by the study conducted by Trumbo and Harper (2014), which found that most young adults do not believe e-cigarettes are safe.

The second analysis tested for a relationship between the desire to quit and perceptions of e-cigarettes as effective cessation aids. This include a separate analysis of smokers who reported they were trying to quit. In both cases, it was found that there is a
relationship between the desire to quit smoking, or attempting to quit smoking, and positive perceptions of e-cigarettes. Again, since e-cigarettes mimic the action of smoking, it is logical that smokers would perceive them as an effective method to quit smoking. Caponnetto and colleagues (2013) concluded that for some smokers, the e-cigarettes was satisfying enough to reduce cravings for regular cigarettes. This perceived efficacy supports the findings in this study, and it can be concluded that smokers who have a desire to quit, view e-cigarettes in a positive light as a smoking cessation aid.

The significance of these findings and their relationship to health behavior theory is indeed important. A positive perception of e-cigarettes will increase the chances of their use as a smoking cessation aid. As long as these positive perceptions outweigh perceived barriers or social norms, smokers are likely to try them in attempts to quit. Here, again, the researcher concludes that regulation of these products in the near future is not only responsible, it is necessary.

**Hypothesis 3.** The third hypothesis examined whether there was a relationship between age and positive perceptions of e-cigarettes. The suggestion of a relationship between age and perceptions of e-cigarettes, although not statistically significant, leads the researcher to believe more research is warranted. E-cigarettes are a relatively new and hi-tech product that are likely to appeal with younger generations. This allure is especially strong among young adults as Choi and colleagues (2012) found. Trumbo and Harper (2014) found that awareness was correlated with positive perceptions of e-cigarettes among college students, which supports the suggestion seen in this study that young adults are likely to have positive perceptions of e-cigarettes.
Limitations

The completed surveys may have their own limitation due to response bias. It is possible that some respondents may have had strong feelings for or against e-cigarettes, which may not be indicative of the norm. This occurrence would be subverted with a larger sample size.

Another limitation that may affect the validity of results is the lack of racial variation in the respondents of the survey. The majority (89.9%) of respondents were self-reported to be non-Hispanic White individuals. To obtain a well-rounded analysis of smokers’ awareness and perceptions of e-cigarettes, greater demographic variation is preferable. The small number of minority respondents unfortunately leaves no room to apply weights to their responses to correct for a lack of minority representation in this study. Similarly, the majority of respondents (58.7%) were in the 25–34 age range. This may be due to the fact that this is the range in which the researcher falls, as do the contacts who were asked to help distribute the survey. A wider distribution of responses from persons in older age ranges could likely be obtained from using a different surveying method since older generations are less likely to use social networking websites like Facebook.

Recommendations for Action

This research presents several findings that the public health community cannot ignore. Since there is a statistically significant relationship between the desire to quit smoking and positive perceptions of e-cigarettes, regulation of these products must be expedited. It is clear that smokers plan to continue using these devices in their strategies
to quit smoking regular cigarettes. Therefore it will be the responsibility of regulatory bodies to ensure these products are safe to use. The FDA plans to regulate them in the future, but as of this research, no schedule has been identified. The research shows there is significant value in e-cigarettes as a smoking cessation aid, and therefore, they must be considered as a viable candidate for nicotine replacement.

This study also showed a possible relationship between age and positive perceptions of e-cigarettes. Though this study encompassed only respondents above age 18, it stands to reason that the allure of such a new technology could create nicotine addiction in users who don’t smoke. Instead of using these devices for smoking cessation, non-smokers could be enticed into using them by the variety of flavors and devices available. This is especially problematic if these devices result in nicotine dependency – a potential gateway to smoking regular cigarettes. Since there is a higher acceptance of e-cigarette use in social situations (Trumbo & Harper, 2014), increased nicotine addiction in young adults is a very real concern. This problem should spur regulators to act. If they do not do so for the sake of smoking cessation, they must do so to ensure that regulations for the public use of e-cigarettes mirrors public tobacco smoking policies.

**Recommendations for Further Study**

Further research on the accessibility of e-cigarettes and the barriers affecting their use will be necessary to assist public health campaigns in reducing tobacco consumption. The researcher suggests studying smokers’ perceptions of e-cigarette safety in relation to the safety of normal cigarettes. This study addressed overall perceptions of e-cigarette
safety and did not specifically study respondents’ view related to cigarette smoking. In doing this, research will gain a better understanding of smokers’ perceptions of e-cigarettes. Knowledge of these perceptions can be used with theoretical models like the Theory of Planned Behavior and the Health Belief Model in developing policy and interventions to help smokers find effective strategies to quit smoking.

The results of the statistical analysis point to the need for more research in this area. Improving upon this study design and improving the dissemination of the survey would likely yield more generalizable results. A larger sample size would provide an even better understanding of how smokers view e-cigarettes as potential tools for quitting smoking. It is recommended that future research take these two points into account to increase the diversity of responses, which will increase the study validity. Research should also seek to better understand the suggested relationship between age and perceptions of e-cigarettes. Though the data in this research in this area, in this study, did not yield statistically significant results, the ramifications of understanding how different age groups perceive e-cigarettes will be important, especially regarding future regulation and policy.

**Conclusion**

E-cigarettes have become a popular means of nicotine delivery, among both smokers and non-smokers. This study, in its attempts to better understand smokers’ awareness and perceptions of e-cigarettes has helped contribute to a limited body of knowledge gained from e-cigarette research. More research is needed to better understand the ramifications of e-cigarettes as a public health tool, and to help prompt
SMOKERS’ AWARENESS AND PERCEPTIONS

regulatory agencies to act quickly. Regulation is the key to developing e-cigarettes into effective, trusted smoking cessation aids. This study and others have found that smokers have favorable perceptions of e-cigarettes. Favorable perceptions combined with increased awareness and availability make now the time to move forward in standardizing their contents and regulating their use.
References


Appendix A

Electronic Cigarette Survey Questionnaire for Smokers

Are you 18 or older? No____ Yes____

Do you smoke? No____ Yes____
DESCRIPTION: You are invited to participate in a research study on the knowledge and attitudes of electronic nicotine delivery systems, more commonly known as electronic cigarettes. Questions will include your familiarity with electronic cigarettes and your beliefs about their use. You will be asked to anonymously complete a short survey; the results may be published in a scientific journal.

TIME INVOLVEMENT: Your participation will take approximately 5 to 10 minutes.

RISKS AND BENEFITS: The risks associated with this study are none. The benefit which may reasonably be expected to result from this study is the advancement of public health and regulators. We cannot and do not guarantee or promise that you will receive any benefits from this study.

PAYMENTS: You will receive no payment for your participation.

PARTICIPANT’S RIGHTS: If you have read this form and have decided to participate in this project, please understand your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled. The alternative is not to participate. You have the right to refuse to answer particular questions. The results of this research study may be presented at scientific or professional meetings or published in scientific journals.

CONTACT INFORMATION:

Questions: If you have any questions, concerns or complaints about this research, its procedures, risks and benefits, contact the Protocol Director, Mark Thompson, 1311 Wentbridge Rd. Richmond, VA 23227.
Independent Contact: If you are not satisfied with how this study is being conducted, or if you have any concerns, complaints, or general questions about the research or your rights as a participant, please contact the Stanford Institutional Review Board (IRB) to speak to someone independent of the research team at (650)-723-2480 or toll free at 1-866-680-2906. You can also write to the CUNE IRB, Concordia University Nebraska, 800 N. Columbia Ave. Seward, NE 68434.

Have you read the consent form above? No____ Yes____

Do you agree to voluntarily participate in this study by completing this survey? No____ Yes____

SIGNATURE _____________________________ DATE __________

Please select the appropriate information:

Gender: Male_____ Female_____ Age: 18-24____ 25-34____ 35-44____ 45-54____ 55+____
SMOKERS’ AWARENESS AND PERCEPTIONS

Race:  Asian ____  White, non-Hispanic____  Hispanic____  African-American____
Native American____  Pacific  Islander____  Other____

Cigarettes smoked per day:  1-4____  5-10____  11-20____  21-30____  30+____

1. Have you heard of devices used to deliver nicotine, called electronic cigarettes or e-cigarettes?  No_____  Yes_____

2. Do you know how electronic cigarettes work?  No____  Yes____

3. Have you used an electronic cigarette?  No_____  Yes_____  
   a. If so, how recently?  I have not used one ______  Within the last 7 days_____  Within the last 30 days_____  Within the last 6 months______  Within the last year______

4. If applicable, how frequently do you use one?  Not Applicable____  Several times daily____  Several times weekly____  Several times monthly____

5. Do you want to quit smoking?  No____  Yes____

6. Are you trying to quit smoking?  No____  Yes____
   a. If yes, are e-cigarettes a part of your quitting strategy?  
      Not Applicable_______  No____  Yes_____  
      i. If yes, do you feel e-cigarettes have helped you reduce the number of cigarettes you smoke?  No____  Yes____  
         a) If yes, how may cigarettes did you smoke before using the e-cigarette?  1-4____  5-10____  11-20____  21-30____  30+____
b) How many do you smoke while using the e-cigarette?

1-4  5-10  11-20  21-30  30+

7. Is your goal to switch completely to the e-cigarette? No Yes

On a scale of 1–5, please circle the number that best describes your attitudes toward electronic cigarettes

8. Electronic cigarettes are safe.

1  2  3  4  5
Strongly Disagree Neutral Strongly Agree

9. Electronic cigarettes are effective in quitting smoking.

1  2  3  4  5
Strongly Disagree Neutral Strongly Agree

10. Electronic cigarettes are easy to find.

1  2  3  4  5
Strongly Disagree Neutral Strongly Agree

11. Electronic cigarettes are affordable.

1  2  3  4  5
Strongly Disagree Neutral Strongly Agree
In what city and state do you currently live?