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# Electronic Cigarettes: Associated Beliefs and Reasons for Use among US Adults

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School of Public Health  
Georgia State University

ELECTRONIC CIGARETTES: ASSOCIATED BELIEFS AND REASONS FOR USE  
AMONG US ADULTS

A dissertation submitted in partial satisfaction of the requirements for the  
degree of Doctor in Philosophy  
in

Public Health (Epidemiology)  
By

Ban A Majeed

Committee in charge

Dr. Michael P Eriksen, chair  
Dr. Shanta R Dube  
Dr. Gregory B Lewis  
Dr. Kymberle Sterling

2014

DEDICATION

To Timothy

## TABLE OF CONTENTS

|  |      |
|--|------|
| Dedication   | II   |
| Table of contents  | III  |
| List of Abbreviations  | IV   |
| List of Figures  | V    |
| List of Tables   | VI   |
| Acknowledgements   | VII  |
| Abstract   | VIII |
| Chapter I: Literature Review   | 1    |
| Chapter II: Reasons for e-cigarette use among U.S. adults, 2012  | 27   |
| Chapter III: Reasons for e-cigarette use among current smokers: A focus group study using the Theory of Planned behavior | 46   |
| Chapter IV: Opinions about electronic cigarette use in smoke-free areas among U.S. adults, 2012                          | 48   |
| Chapter V: Discussion and Recommendations  | 79   |
| Appendix   | 88   |



## LIST OF ABBREVIATIONS

CDC, Centers for Disease Control and Prevention

CHART, Consortium of Hospitals Advancing Research on Tobacco

CTCP, California Tobacco Control Program

E-cigarettes, electronic cigarettes

FD&C Act, Food, Drug, & Cosmetic Act

FDA, Food and Drug Administration

HAVE, Host, Agent, Vector, & Environment

LLSC, Legacy Longitudinal Smoker Cohort

MHC, Mental Health Condition

NYTS, National Youth Tobacco Survey

TCA, Tobacco Control Act

TPB, Theory of Planned Behavior

## LIST OF FIGURES

|   |    |
|---|----|
| Figure 1.1. E-cigarette replacement parts   | 3  |
| Figure 1.2. Constructs of the Theory of Planned Behavior  | 16 |
| Figure 2.1. Reasons for (ever) e-cigarette use among U.S. adults,<br><i>HealthStyles</i> , 2012                                   | 39 |
| Figure 3.1. Conceptual framework to explain reasons and harm<br>perceptions associated with e-cigarette use among current smokers |    |
| Figure 3.2. Propose progression model among current smokers   |    |

## LIST OF TABLES

|   |    |
|---|----|
| Table 2.1. Reasons for (ever) e-cigarette use among U.S. adults (N= 307) by smoking status — <i>HealthStyles</i> , 2012   | 40 |
| Table 3.1. Opinions about allowing e-cigarette use in smoke-free public areas among U.S. adults by respondents' characteristics — <i>HealthStyles</i> , 2012  | 75 |
| Table 3.3. Adjusted Odds Ratios for the association of respondents' characteristics with their opinions about allowing e-cigarettes use in smoke-free public areas among U.S. adults — <i>HealthStyles</i> , 2012 | 77 |

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## ABSTRACT OF THE DISSERTATION

Electronic Cigarettes: Associated Beliefs and Reasons for Use among US Adults

By

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Doctor of philosophy in Public Health (Epidemiology)

Chair: Dr. Michael P Eriksen

Introduction: Electronic cigarettes (e-cigarettes), a type of novel tobacco products, deliver nicotine or flavored mist to the users in the form of a vapor or aerosol. E-cigarette awareness, and use continue to increase among U.S. adults. E-cigarettes are often used as a less harmful alternative to regular cigarettes, as a smoking cessation aid, or as a way to overcome smoking restrictions. Most research on reasons for e-cigarette use has been focused on use among committed e-cigarette users. The three research studies included in this dissertation aimed to examine the reasons for e-cigarette use among U.S. adults, and to examine the U.S. public opinion on allowing e-cigarette use where smoking is otherwise prohibited.

Methods: Mixed (quantitative and qualitative) research methods were used. Data from 2012 HealthStyle survey (an online survey among U.S. adults who are recruited from an online research panel to be representative of the U.S. population) on reasons for e-cigarette use and public opinion on allowing their use where smoking is prohibited.

Descriptive as well as logistic regression analyses were conducted. Textual data from two

focus groups among current smokers who also used e-cigarettes were deductively and inductively analyzed.

Results: Among 307 survey respondents who had ever used e-cigarettes, the three most common reasons for e-cigarette use were curiosity (40.8%), the belief that “it helps people quit smoking” (19.1%), and perceiving e-cigarettes “less harmful than regular cigarettes” (9.3%). About 40% of U.S. adults were uncertain whether e-cigarette use should be allowed in smoke-free public areas, 37% opposed, while 23% favored allowing their use in smoke-free environments. The majority of the focus group participants have used e-cigarettes to complement regular cigarette smoking and intake nicotine where smoking is restricted. E-cigarette use was viewed to be less harmful and more convenient than smoking regular cigarettes.

Conclusion and recommendations: The findings of the three studies suggest that curiosity about e-cigarettes lead to experimentation and the convenience to use e-cigarettes in smoke-free areas lead to continual use. Our results highlight the need for updating smoke-free policies to include explicit language about e-cigarette use. With impending regulation and the changing e-cigarette landscape, there is a need for continued monitoring and research on reasons for and attitudes about e-cigarette use, and on public opinion pertaining to e-cigarette use in smoke-free areas.

CHAPTER I  
INTRODUCTION AND LITERATURE REVIEW

## CHAPTER I

### INTRODUCTION AND LITERATURE REVIEW

What is an e-cigarette?

Electronic cigarettes (e-cigarettes), a type of novel tobacco products, deliver nicotine or flavored mist to the users in the form of a vapor or aerosol. Currently, there are more than 400 different models of e-cigarettes on the market, sold in stores and on the Internet (Zhu, et al., 2014). Unlike regular cigarettes, which could either be of tobacco or menthol flavor, e-cigarettes are available in a wide range of flavors, such as those characteristic of tobacco, mint, fruits, and beverages (Farsalinos, et al., 2013).

They vary in shape, size, and nicotine concentration. Some models are made to closely resemble regular cigarettes and others are pen- or syringe-like devices (Grana, et al., 2014). All e-cigarette models have the following parts in common (Figure 1.1):

1. A source of power, batteries, which can be disposable or rechargeable.
2. A cartridge, a plastic container for the e-cigarette solution. There are two types of cartridges: one-time-use pre-filled cartridges and re-usable ones that allow for re-fills. E-cigarettes using refillable cartridges are known as the “tank system.”
3. The nicotine solution, which is also known as e-juice. The key ingredients of the solution are propylene glycol, vegetable glycerine (glycerol), flavoring, water, and nicotine.
4. An atomizer to heat and vaporize the flavored nicotine solution that is in the cartridge.
5. A power switch or a flow sensor to activate the atomizer (Brown & Cheng, 2014).





**Cartridge Style  
E-Cigarette**



**Re-Fillable Tank  
Style E-Cigarette**

Figure 1.1: E-cigarette replacement parts.  
Adapted from FitVapes (2014).

## **Epidemiology of awareness and use**

Both the awareness of e-cigarettes and the prevalence of ever use of e-cigarettes have sharply increased over the past few years. In 2009, 16.4% of U.S. adults reported being aware of e-cigarettes (Regan, et al., 2011) by 2013 awareness had increased to 77.1% (Tan & Bigman, 2014). Being young adults (18-34 years), white, college educated, and current smokers, were independently associated with increased e-cigarette awareness (Tan & Bigman, 2014). The prevalence of ever using an e-cigarette also increased in U.S. adults in recent years. In 2010, 3.4% of adults indicated they had ever tried e-cigarettes, (Pearson, et al., 2012) while in 2012, 8.0% of U.S. adults reported ever trying them. Ever e-cigarette users are more likely to be young and current smokers (King, et al., 2013; Christensen, et al., 2014). Similarly, current e-cigarette use—defined as use during the past 30 days—is higher among current smokers (Pearson, et al., 2012). Increased awareness of e-cigarettes and prevalence of their use was also observed in Great Britain. Dockrell, et al. (2013) reported that ever use rose significantly, from 5.5% in 2010 to 15% in 2012; and that current use significantly increased from 2.7% in 2010 to 6.7% in 2012.

Though many researchers define *current use* as having used an e-cigarette in the past 30 days, Giovenco and group (2014) called for a new metric to distinguish current use from trial use in the past 30 days. In their study with a probability sample of 2,136 current and former adult smokers, Giovenco, et al. (2014) used the term established users to indicate e-cigarette use of 50 or more times during the previous 30 days and to differentiate this group of users from those who had tried e-cigarettes in the past 30 days. They found that white adults were more likely to ever use e-cigarettes than others, and

that former smokers were less likely to be ever users and more likely to be established users than current daily smokers (Giovenco, et al., 2014).

E-cigarette use is popular among people with mental health conditions and hospitalized smokers. Cummins, et al. (2014) reported that those with Mental Health Conditions (MHC), such as depression and anxiety, were more likely to have used e-cigarettes than adults with no MHC. A recent study among in-patient smokers, admitted to one of the nine Consortium of Hospitals Advancing Research on Tobacco (CHART) study sites, showed that the prevalence of current e-cigarette use increased over the three and a half period of the study (2010 to 2013). Current e-cigarette users were more likely to be young adults, more educated, white, and heavy smokers (10 or more cigarettes per day) (Rigotti, et al., 2014).

Chapman and Wu (2014) summarized findings of the available studies on e-cigarette awareness and use among adolescents and documented the rising popularity of e-cigarettes in this population. For example, data from the National Youth Tobacco Survey (NYTS) revealed an increase in both the lifetime use of e-cigarettes (from 3.3% in 2011 to 6.8% in 2012) and the current use of e-cigarettes (1.1% in 2011 to 2.1% in 2012) (CDC, 2013). Contrary to the characteristics of adult e-cigarette users, who are more likely to be current smokers, 7.2% of high school and 20.3% of middle school ever e-cigarette users (defined as those who used e-cigarettes one time or more) were never smokers (CDC, 2013). A recent study, analyzing data of NYTS 2011-2013, showed that ever e-cigarette users reported higher intentions to smoke than never e-cigarette users (Bunnell, et al., 2014). Bunnell, et al (2014) contend that e-cigarettes are potentially harmful to adolescents' health and brain development because they contain nicotine, and

this potential for harm does not depend on their intentions to smoke regular cigarettes. They concluded that e-cigarettes are harmful to teens regardless of whether their intentions to smoke regular cigarettes preceded or followed their e-cigarette use (Bunnell, et al., 2014).

## **Marketing**

National and international studies showed that adults use e-cigarettes to partially or completely substitute for regular cigarettes or to evade smoking restrictions. These reasons are consistent with the messages commonly used to market e-cigarettes; advertisements claim e-cigarettes are a less harmful alternative to regular cigarettes, as a more satisfying smoking cessation aid (than the FDA-approved Nicotine Replacement Therapies), and as a way to circumvent smoke-free laws and smoke “anywhere” (Grana & Ling, 2014).

Advertisements for e-cigarettes are widely seen on the Internet, TV, and in magazines. The overall expenditure on e-cigarette ads witnessed a sharp increase from \$6.4 million in 2011 to \$18.3 million in 2012 (Kim, et al., 2014). Because the regulation of e-cigarettes by the FDA is still pending, e-cigarette manufacturers are not currently mandated to report their expenditures on the ads to the U.S. Federal Trade Commission, which is the case for ads for tobacco products (Kim, et al., 2014).

Grana & Ling (2014) completed content analysis to determine the themes used to market e-cigarettes on retail websites. They found that health, smoking-cessation, and the ability to use the products anywhere were the messages most commonly used to sell e-cigarettes (Grana & Ling, 2014). E-cigarettes are also advertised on social media. Huang,

et al. (2014) examined e-cigarette marketing messages on one form of social media: Twitter. Two types of tweets were identified: organic, in which individuals' expressed their personal opinions and experiences and commercial, which linked to commercial sites selling e-cigarettes. They reported that among 73,672 tweets related to e-cigarettes, only 10% were organic tweets and the majority were commercial tweets. The commercial tweets were more likely than the organic ones to use price, discount, and cessation language (Huang, et al., 2014).

Pepper et al. (2014a) examined the effect of message type on motivation to try e-cigarettes among a random sample of U.S. adult smokers. Three message types were tested in this study: comparison ads, which demonstrated e-cigarettes' advantages over regular cigarettes in terms of cost, health effect, and convenience to "smoke" anywhere; similarity ads, which demonstrated comparability of e-cigarettes to regular cigarettes in terms of satisfaction; and control ads, which used no comparison to regular cigarettes. Results showed that comparison ads were more likely to yield interest in future use than control ads (Pepper et al., 2014a). Further research showed that U.S. adults hear about e-cigarettes through indirect marketing, word-of-mouth, store displays, and through commercial advertisements on TV and the Internet (Pepper, et al., 2014b).

## **Reasons for use**

E-cigarettes are often used as a less harmful alternative to regular cigarettes, as a smoking cessation aid, or as a way to overcome smoking restrictions. Recent studies exploring reasons for use vary in their design (quantitative versus qualitative), their sampling methodology (probability versus convenience), and in the respondents' characteristics in terms of smoking status and pattern of use. In a survey that used a probability sample of U.S. adults, Cummins, et al. (2014) found that 68.9% of participants tried e-cigarettes “just because”, 55.2% used because they wanted to quit smoking, 51.2% were seeking a safer alternative to regular cigarettes, and 46.7% wanted to be able to smoke anywhere. Separate yes or no questions were used to elicit this information and calculate the response percentages. Richardson, et al. (2014) surveyed a convenience sample of current and former smokers from eight designated market areas—Birmingham, AL; Columbus, OH; Fort Smith and Fayetteville, AR; Houston, TX; Kansas City, MO; Phoenix and Prescott, AZ; Pittsburgh, PA; and Portland, OR. This study revealed that 45.6% of e-cigarette ever users used e-cigarettes to quit smoking, 38% to overcome smoking restrictions, and 36% to reduce the number of cigarettes they regularly smoke. These findings were confirmed among current and former smokers who participated in the International Tobacco Control Four-Country survey (Adkison, et al. 2013).

Dawkins, et al. (2013) used an online survey to examine the reasons for e-cigarette use among a convenience sample of 1347 users from 33 countries of which 83% were former cigarette smokers and 16% were current smokers. The reasons for e-cigarette use were as follows: complete or partial alternative to regular cigarettes,

curiosity, friend suggestion, and other reasons that included smoking cessation, cost, health, and overcoming smoking restrictions (Dawkins, et al., 2013).

Goniewicz et al. (2012) documented how and why Polish adults used e-cigarettes (N=179). The online survey revealed that e-cigarettes were mainly used to reduce or quit smoking. Another online survey among e-cigarette users from France, Canada, Belgium, and Switzerland documented that e-cigarettes were used to reduce or quit smoking, to avoid bothering others with cigarette smoke, and to overcome smoking restrictions. In addition, participants reported that e-cigarettes helped them to breathe better and reduce their smoking-related cough (Etter, 2010).

A recent study on patterns of e-cigarette use utilized case reports. Weaver, et al. (2014) described three cases of e-cigarette use. Case 1: a heavy smoker who tried e-cigarettes in an attempt to quit smoking and the result was dual use of both regular and e-cigarettes. Case 2: a never smoker who experimented with e-cigarettes, enjoyed their effect and thus continued using them. Case 3: a social (occasional) smoker, whose tobacco smoking increased after he became a regular e-cigarette user (Weaver, et al. 2014). Motives for e-cigarette use vary by users' characteristics especially their cigarette smoking status.

### **Harm perception**

Consistent with some media messages, e-cigarettes are perceived as less harmful than regular cigarettes (Flouds, et al., 2011). Pearson, et al. (2012) analyzed data from two surveys conducted in 2010: a national online survey and the Legacy Longitudinal Smoker Cohort (LLSC). The study revealed that of participants who had heard of e-

cigarettes prior to the surveys (online survey: 70.6%, LLSC: 84.7%), the majority believed that e-cigarettes were less harmful than regular cigarettes. The investigators used multivariable regression models to examine the characteristics of smokers who believed e-cigarettes were less harmful. The model based on the online survey showed that being African American and perceiving one's health as poor were independently associated with lower odds of perceiving e-cigarettes as a less harmful alternative to regular cigarettes. The model based on the LLSC showed that smokers with some college education had significantly higher odds of believing e-cigarettes were less harmful than smokers with college degrees (Pearson, et al., 2012).

Tan and Bigman (2014) analyzed data from the 2012-2013 Health Information National Trends Survey and reported that half the sample believed that e-cigarettes were less harmful than regular cigarettes. The study revealed that— after adjusting for demographic factors, smoking status, and perceived health status—being young, holding a college degree or more (compared to high school or less), and being a current smoker (compared to non-smoker) were significantly associated with perceiving that e-cigarettes are less harmful than regular cigarettes (Tan & Bigman, 2014).

An international survey asked 26,566 participants aged 15 years and older to indicate their perception of harm from e-cigarettes using the following three categories: harmless, harmful, and don't know. Overall, 40.6% answered that they felt e-cigarette were "harmful", 28.5% responded "harmless", and the rest were unsure, responding "don't know." This study also showed that the perceived harmfulness of e-cigarettes predicts e-cigarette use; compared to respondents who believed e-cigarettes were "harmless," those who were uncertain of e-cigarette's harmfulness were less likely to use



them (Vardavas, et al., 2013). In another international survey, Farsalinos, et al. (2014) assessed perceptions of harm among 19,353 current and former adult smokers who were dedicated e-cigarette users using a four-point scale. The majority (88.2%) believed that cigarettes were less harmful than tobacco cigarettes and 11% thought e-cigarette were absolutely harmless (Farsalinos, et al., 2014).

### **Harm reduction**

The public health community is divided in their views on whether e-cigarettes represent a legitimate harm reduction tool (Breland, et al., 2014). Harm reduction aims at reducing, rather than eliminating, the negative health-related consequences associated with a harmful behavior such as smoking (Cahn & Siegel, 2010). According to the harm reduction notion (CTCP, 2005), individuals maintain their nicotine intake by using a potentially less harmful product than regular cigarettes. For e-cigarettes to be promoted as a harm reduction product, scientific evidence needs to show that they are safe to users and others around them, efficacious in smoking reduction and cessation, and unappealing to teens and long-term former smokers.

Thus far, it is unclear whether e-cigarettes would reduce the burden of death and disease caused by tobacco use or would merely introduce new users to nicotine addiction and ultimately to tobacco use (Henningfield & Zaatari, 2010). For example, in the United Kingdom an online survey among smoking cessation practitioners (N=675) showed that 42% were unsure and 18% were certain that e-cigarettes were not a “good thing” (Hiscock, et al., 2014). The survey respondents varied widely in their beliefs regarding

the usefulness of e-cigarette use as a harm reduction aid and called for more research and clear guidance on e-cigarettes role in smoking cessation (Hiscock, at al., 2014).

Both the medical and public health communities are split in their views regarding the legitimacy of e-cigarettes as a harm-reduction tool. This division is caused by the lack of sound scientific evidence on their effectiveness as smoking reduction and cessation tools and their long term unknown intended and unintended health consequences.

### **Current status of regulation**

E-cigarettes are not currently regulated at the federal level. In 2009, The Tobacco Control Act (TCA) brought “tobacco products” under the regulatory authorities of the Food and Cosmetics Act (FDA, 2014a). On September 22, 2009 the Food and Drug Administration (FDA) banned the manufacture, marketing, and distribution of tobacco cigarettes that contained any artificial or natural flavor. This rule allowed tobacco cigarettes to be one of two flavors: tobacco and menthol (FDA, 2009). A year later (June 2010), the FDA prohibited the sales of any type of tobacco products, including smokeless tobacco, to minors who were under 18 years old (FDA, 2014).

On April 25, 2014 the FDA filed a notice of proposed rulemaking, deeming e-cigarettes to be subject to the Federal Food, Drug, and Cosmetic Act (FD&C Act). Currently, the FDA is reviewing the public comments submitted in response to this deeming rule and the final action is expected June 2015.

Regulations have been implemented by state and local jurisdictions to control youth access to e-cigarettes and to restrict their use in smoke-free public areas. An increasing number of states are taking action to prohibit underage sales of e-cigarettes. As

of September 23, 2014, forty one states have banned e-cigarette sale to minors (NCSL, 2014). As of October 1<sup>st</sup> 2014, e-cigarette use has been banned in 100% smoke-free venues in three states (North Dakota, New Jersey, and Utah), and in other venues per state specifications. For example, Colorado, Arkansas, and Vermont prohibit e-cigarette use on school property; and Kansas, South Dakota, and Oklahoma prohibit e-cigarette use in correction facilities. Regulation of e-cigarette use varies by county. To date, e-cigarette use has been prohibited in smoke-free venues in 226 counties (ANRF, 2014).

## **Behavioral theory: The Theory of Planned Behavior**

According to the Theory of Planned Behavior (TPB), a person's behavior is directly determined by three main factors: attitude, subjective norms, and perceived control (Figure 1.1). These factors independently and collectively increase or decrease the perceived likelihood of performing the behavior, also called the behavioral intention.

A person's attitude toward performing a certain behavior is governed by the beliefs that he/she attaches to the potential outcomes of that behavior (also known as behavioral beliefs) and by the importance or value that one attaches to these possible outcomes (this is known as the evaluation of behavioral outcome). Attitudes toward performing a behavior are categorized as instrumental and experiential. *Instrumental* attitudes are based on the expected outcomes of the behavior, in other words, the possible advantages and disadvantages resulting from performing the behavior. A person who believes that performing the behavior would result in a beneficial outcome is more likely to perform the behavior. *Experiential* attitudes are based on feelings associated with the behavior. A person is more likely to conduct a behavior he/she associates with pleasant or enjoyable feelings.

Subjective norms around a certain behavior are shaped by the perceived approval or disapproval expressed by other people (also known as referents). An outside person's expression of support or discouragement is weighed against the person's motivation to comply with each person's expressed opinion; this is known as the motivation to comply. A positive subjective norm results from perceiving approval by others (especially people important to the individual) and the desire to comply with their viewpoints.

Perceived control construct is determined by the potential barriers and facilitators as well as the self-efficacy of the person to overcome the barriers. One cannot perform a behavior that is not under his/her own volition.

Different behaviors are affected differently by the influences of one's attitude, subjective norm, and perceived control over the behavior. For example, smoking where smoking is not allowed (behavior) is mainly controlled by the perceived control over the behavior. For example, smoking restrictions are a barrier that renders the behavior of smoking indoors outside the control of the individual. Other behaviors may be completely determined by the subjective norms or attitudes (Ajzen & Fishbein, 1980; Montano & Kasprzyk, 2008).

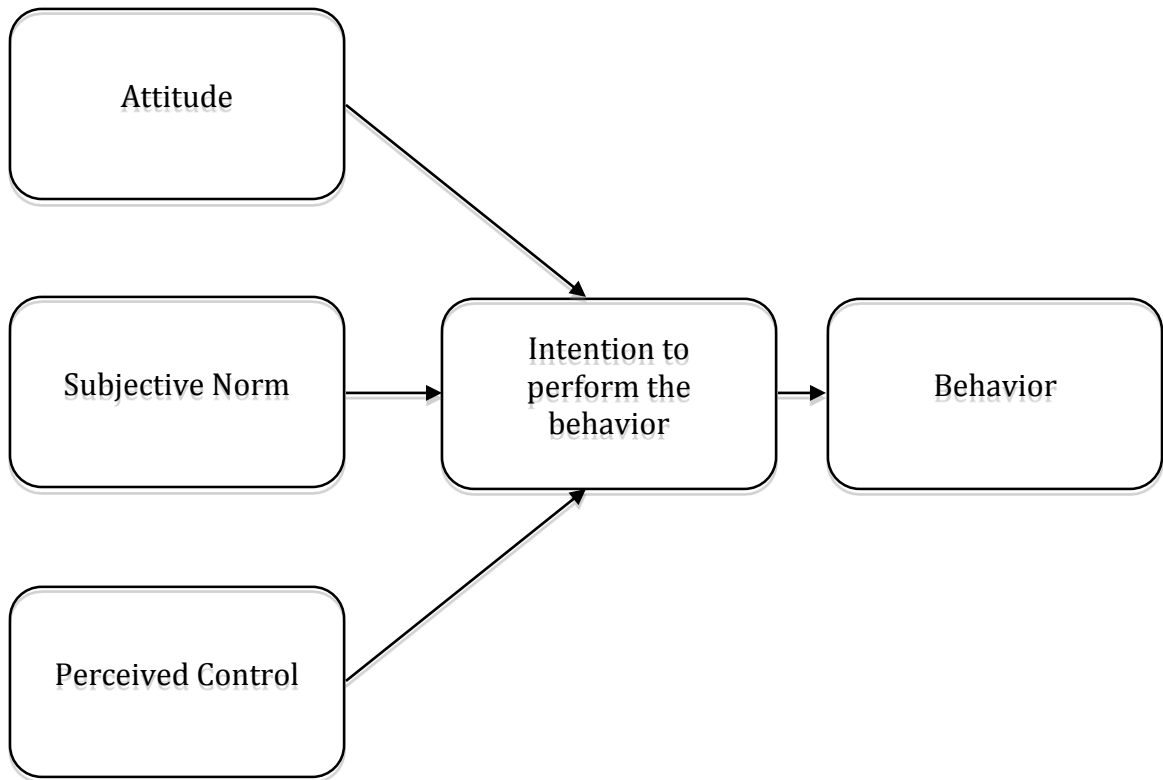


Figure1.2. Constructs of the Theory of Planned Behavior  
Source. Adapted from (Montano & Kasprzyk, 2008).

## **Knowledge gap in research**

The potential harms and benefits of e-cigarette use on public health depend on whether dual users use e-cigarettes as a harm reduction and smoking cessation aid or as a way to simply satisfy nicotine craving where smoking is restricted. The net impact of e-cigarette use on public health is still unknown and depends in part on the patterns of and reasons for e-cigarette use.

There are many unanswered questions about the safety of e-cigarettes, their effectiveness as a smoking cessation aid, as well as the effect of e-cigarette marketing on teen initiation and on renormalization of smoking. Epidemiologic evidence supporting or denying the potential dangers of second hand vaping is unavailable. However, e-cigarette use and popularity are increasing especially among current smokers. Though e-cigarettes are not an FDA-approved cessation tool, committed users believe that they are safe and effective smoking cessation aids (Sumner, et al., 2014). Furthermore, there is scarce data on the social acceptance of e-cigarette use and the public opinion regarding allowing e-cigarettes to be used in smoke-free public areas.

Most studies about the reasons for e-cigarette use have been focused on the self-perceived benefits of e-cigarettes among committed e-cigarette users. More research is needed to determine the patterns of e-cigarette use among adults who already smoke regular cigarettes.

### **The overall goals of this research were to:**

1. Examine the reasons for e-cigarette use among U.S. adults.
2. Examine U.S. public opinion on e-cigarette use in smoke-free public areas.

## **Study-specific objectives**

### Study I: Reasons for E-cigarette Use among U.S Adults, 2012

1. To explore the reasons for e-cigarette use among U.S. adults.
2. To examine ever use of e-cigarettes in situations where smoking is not allowed.
3. To investigate same day use of both regular and electronic cigarettes among adults who have ever used e-cigarettes.

### Study II: Reasons for E-cigarette Use among Current Smokers: A Focus Group Study using the Theory of Planned Behavior

1. To describe the scenarios of e-cigarette use among current smokers.
2. To explain the reasons for e-cigarette experimentation and initiation among current smokers.
3. To examine the current smokers' perceptions related to e-cigarettes' harms and benefits.
4. To describe the subjective norms around e-cigarette use.
5. To identify the trusted sources of information on e-cigarettes among e-cigarette users.

### Study III: Opinions about Electronic Cigarette Use in Smoke-Free Areas among U.S. Adults, 2012

1. To examine public opinion on whether e-cigarette use should be allowed in public areas where smoking is prohibited.
2. To describe the demographic characteristics of adults who support, oppose, or uncertain that e-cigarette use should be allowed in smoke-free public areas.



3. To investigate the effect of smoking cigarettes, awareness, and ever use of e-cigarettes on the individual's opinion regarding allowing e-cigarette use in smoke-free public areas.

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## CHAPTER II

### STUDY I: REASONS FOR E-CIGARETTE USE AMONG U.S. ADULTS, 2012

## **Title Page**

### **Reasons for E-cigarette Use among U.S Adults, 2012**

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## **Abstract**

Given the popularity of e-cigarettes and the uncertainty of their impact on public health, we sought to identify reasons for e-cigarette use among U.S. adults by smoking status. Data on e-cigarette use were obtained from the 2012 summer wave of the *HealthStyle* survey (an online survey among U.S. adults who are recruited from an online research panel to be representative of the U.S. population). Reasons for e-cigarette use were examined among ever users of e-cigarettes (N=307), using this question, “Which is the single most important reason you use or ever used e-cigarettes?” The three most common reasons for e-cigarette use were curiosity (40.8%), the belief that “it helps people quit smoking” (19.1%), and perceiving e-cigarettes “less harmful than regular cigarettes” (9.3%). Among e-cigarette users, 34.8% used them in situations where smoking was not allowed. Our findings suggest that curiosity and the perceived role of e-cigarettes in smoking cessation influenced adults to try them. Further research is needed to understand the mechanism of regular e-cigarette use and the progression from experimentation to addiction. Our results highlight the need for updating smoke-free policies to include explicit language about e-cigarette use.

**Keywords:** E-cigarettes, reasons, e-cigarette use, smoking

## 1. Introduction

Since their emergence in the U.S. market electronic cigarettes (e-cigarettes) continue to rise in popularity and use, particularly among current smokers (Pearson et al., 2012; King et al., 2013; Dockrell, Morison, Bauld, & McNeill, 2013; King, Patel, Nguyen, & Dube, 2014). Among U.S. adults, ever e-cigarette use was 0.9% in 2009 (Regan, Promoff, Dube, & Arrazola, 2011), and 6% in 2011 (King et al., 2013). A recent study of current and former smokers showed that about half had ever used e-cigarettes, 16% used them currently, and 3.8% used them on regular basis (Giovenco, Lewis, & Delnevo, 2014). Research shows that e-cigarette were used to partially or completely replace regular cigarettes, and to overcome smoking bans (Etter, 2010; Adkison, et al., 2013; Dockrell, Morison, Bauld, & McNeill, 2013; Dawkins, Turner, Roberts, & Soar, 2013; Goniewicz, Lingas, & Hajek, 2013; Richardson et al., 2014). Other motivations for e-cigarette use were curiosity (Dawkins, Turner, Roberts, & Soar, 2013; Berg et al., 2014) and the perception that they were less harmful and less toxic than regular cigarettes (Etter, 2010; Tan, & Bigman, 2014).

The impact of e-cigarette use on smoking initiation, smoking cessation, maintenance of nicotine addiction, and compliance with smoke-free policies is still unclear (Flouds, Veldheer, & Berg, 2011; King et al., 2013; Grana, Benowitz, & Glantz, 2014). Currently, the scientific evidence is lacking on whether e-cigarettes promote harm reduction and smoking cessation, or whether they just allow smokers to overcome smoking restrictions. Depending on users' smoking status and reasons for use, e-cigarettes could benefit or harm health (Chen & Husten, 2014). If current smokers completely switch from regular cigarettes, exclusive use of e-cigarettes could promote

harm reduction, but if they mainly use e-cigarettes to overcome smoking restriction, such use could undermine decades of efforts to de-normalize smoking behavior (Grana, Benowitz, & Glantz, 2014). E-cigarette use could lead never smokers to develop nicotine addiction and cause former smokers to relapse.

Available studies on reasons for e-cigarette use are mainly among non-U.S. samples and focus on experienced users and cigarette smokers. E-cigarette use among non-smokers, same-day use of both regular and electronic cigarettes, and use in situations where smoking is not allowed are still understudied areas that need further attention. In this study we report the reasons for e-cigarette use by smoking status; ever use and past 30-day use of e-cigarettes in situations where smoking was not allowed; and proportion and frequency of same day use of regular and electronic cigarettes.

## **2. Methods**

### *2.1. Participants and procedures*

Data on e-cigarette use among U.S. adults were obtained from the 2012 summer wave of *HealthStyle* survey, which is administered by a market research company, Porter Novelli. The survey was conducted online among U.S. adults randomly selected from an online research panel (KnowledgePanel<sup>®</sup>). This panel includes about 50,000 members recruited using a probability-based sampling to represent the U.S. population. Details about *HealthStyles* survey and sampling design of KnowledgePanel are described elsewhere (King, et al., 2013; GfK, 2013). In 2012, response rate to HealthStyles was 65% (N=4,170 U.S. adults). Ever e-cigarette users were adults who answered “yes” to the question: “Have you ever tried any of the following products, even just one time ...electronic cigarettes or E-cigarettes, such as Ruyan or NJOY?” A total of 317 (8.14%) adults were ever e-cigarette users. After excluding participants with missing information on variables of interest for this study, the final sample size was 307 adults.

The study protocol was approved by Georgia State University’s Institutional Review Board.

### *2.2. Measures*

#### *2.2.1. Cigarette smoking status*

Current smokers were defined as those who had smoked 100 cigarettes or more in their lifetime, and responded “everyday” or “some days” to this question: “Do you currently smoke cigarettes everyday, some days, or not at all?” Respondents who had smoked 100 cigarettes or more in their lifetime but selected “not at all” were considered former smokers. Never smokers when defined as those who had *not* smoked 100 cigarettes or more in their lifetime.

### *2.2.2. Reasons for e-cigarette use*

All ever users of e-cigarettes were asked, “Which is the single most important reason you use or ever used e-cigarettes?” Respondents could select any of these responses: 1) It could be used in places where smoking is prohibited; 2) It is less harmful than conventional cigarette; 3) It helps in smoking cessation; 4) It feels like cigarette smoking; 5) It is more acceptable to others”; 6) Curiosity; and 7) None of the above.

### *2.2.3. E-cigarette use in situations where smoking was not allowed*

All ever users of e-cigarettes were asked, “Have you ever used e-cigarettes in situations where you could not smoke?” Those who said “yes” were asked whether they had done so in the previous 30 days.

### *2.2.4. Same day use*

Use of both e-cigarettes and conventional cigarettes on the same day was assessed among current and former smokers who have ever tried e-cigarettes. Same day use was defined using this question: “Have you ever used regular cigarettes and e-cigarettes on the same day?” Those who said “yes”, were then asked: “How often do you use regular cigarettes and e-cigarettes on the same day?” Respondents could select everyday, some days, never, or don’t know.

### 2.3. *Data analysis*

2.3.1. We used Stata to analyze the data (Stata v.11.2). All estimates were weighted according to the U.S. Current Population Survey of 2012, using a study-specific weighting variable, computed by the company that conducted the survey. We computed the point prevalence and 95% Confidence Intervals. We used chi square tests to determine statistically significant difference. Statistical significance was set at  $p < 0.05$ .



### 3. Results

#### 3.1. Participants characteristics

E-cigarette users were more likely to be current smokers (n= 194, 66.7%) than former (n= 70, 23.0%), and never smokers (n=43, 16.3%) (Table 1).

Table 1: Reasons for (ever) e-cigarette use among U.S. adults (N= 307) by smoking status —*HealthStyles*, 2012

| Reasons for use                                      | Smoking Status               |                            |                            | Total                     |
|--|------------------------------|----------------------------|----------------------------|---------------------------|
|  | Current smoker               | Former smoker              | Never smoker               |                           |
|  | Weighted % (95% CI)          |                            |                            |                           |
| Overall  | 66.7 (59.6 – 73.2)<br>N= 194 | 17.0 (12.7 – 22.3)<br>N=70 | 16.3 (11.3 – 23.0)<br>N=43 | 100<br>N=307              |
| I was curious  | 42.1 (33.2 – 51.6)           | 40.1 (26.8 – 55.1)         | 36.0 (2.0 – 55.8)          | <b>40.8</b> (33.7 – 48.3) |
| It helps people quit smoking                         | 23.9 (16.8 – 32.9)           | 18.5 (9.5 – 33.1)          | 0 (0)                      | <b>19.1</b> (13.9 – 25.8) |
| It is less harmful than cigarettes                   | 10.0 (6.0 – 16.2)            | 10.5 (5.0 – 20.7)          | 5.5 (1.2 – 22.7)           | <b>9.3</b> (6.6 – 13.9)   |
| It can be used in places where smoking isn't allowed | 11.3 (6.8 – 18.3)            | 0.7 (0.2 – 3.0)            | 0 (0)                      | 7.7 (4.6–12.5)            |
| It feels like smoking regular cigarette              | 1.8 (0.7 – 4.3)              | 7.2 (2.8 – 17.5)           | 0 (0)                      | 2.4 (1.2 – 4.6)           |
| It is more acceptable to non-smokers                 | 1.2 (0.4 – 3.3)              | 0 (0)                      | 0 (0)                      | 0.8 (0.3 – 2.2)           |
| None of these  | 9.7 (5.2 – 17.3)             | 23.0 (12.1 – 39.2)         | 58.5 (38.9 – 75.7)         | 19.9 (14.4 – 26.9)        |
| Total  | 100                          | 100                        | 100                        | 100                       |

### 3.2. Reasons for ever e-cigarette use

The three most common reasons for using e-cigarettes were curiosity (40.8%); the belief that it helps people quit smoking (19.1%); and the perception that e-cigarettes are less harmful than regular cigarettes (9.3%) (Figure 1).

Among current smokers, 11.3% gave as their most important reason that e-cigarettes help them overcome smoking restrictions. Among never smokers, 58.5% did not mention any of the listed reasons for using e-cigarettes.

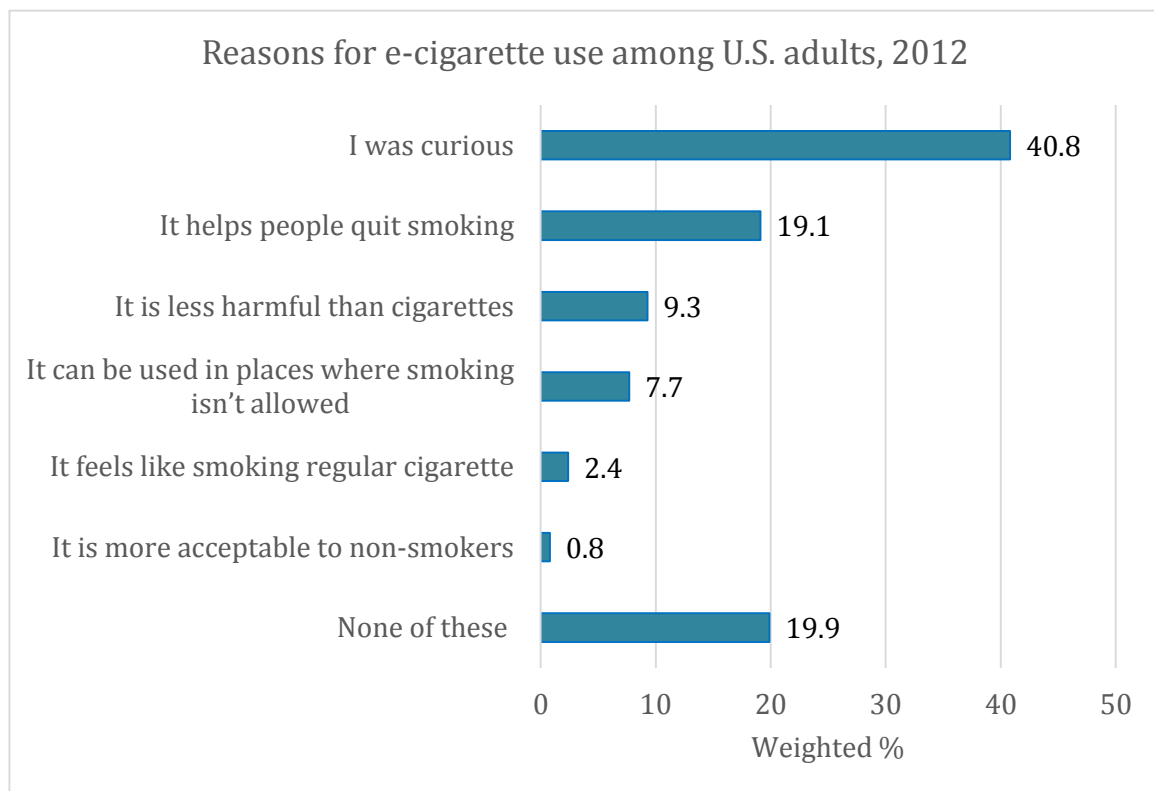


Figure 1: Reasons for (ever) e-cigarette use among U.S. adults, *HealthStyles*, 2012

### 3.3 *E-cigarette use in situations where smoking was not allowed*

A total of 118 (34.8%) current and former smokers had used e-cigarettes in situations where smoking was not allowed. Of those who used e-cigarettes where smoking was not allowed, 38% did so in that past 30 days.

### 3.3. *Same day use*

Among current smokers who had used e-cigarettes 68.8% had used them on the same day as regular cigarettes. Of the current smokers who had used both e-cigarettes and regular cigarettes, only 46.6% were able to recall frequency of same-day use as “everyday” (4.4%) or “someday” (42.2%).

## **4. Discussion**

Consistent with findings from previous studies (Dawkins, Turner, Roberts, & Soar, 2013; Cummins et al., 2014), we found that U.S. adults use e-cigarettes because they were curious, believed e-cigarettes could help in smoking cessation, and perceived them to be less harmful than regular cigarettes. The novelty of e-cigarettes invokes curiosity (Choi et al., 2012) and causes both smokers and non-smokers to experiment with them. Akin to reasons for smoking experimentation and initiation (Pierce, Distefan, Kaplan, & Gilpin, 2005), curiosity leads to initial e-cigarette use (experimentation), and nicotine addiction results in subsequent regular use (initiation). Though perceived as a less harmful alternative to regular cigarettes, experimentation with nicotine-containing e-cigarettes could lead to nicotine addiction among never smokers and cause relapse among former smokers. Further research is needed to understand the mechanisms underlying regular e-cigarette use and the progression from experimentation to addiction.

Consistent with previous studies (Adkison et al., 2013; Odum, O'Dell, & Schepers, 2012; Foulds, Veldheer, & Berg, 2011; Berg et al., 2014) and with the messages used to market e-cigarettes (Grana & Ling, 2014), our findings indicate that U.S. adults used e-cigarettes as a means to overcome smoking restrictions. Given the novelty and the recent introduction to the U.S. market, most states' smoke-free policies do not explicitly ban e-cigarette use where smoking was not allowed (Gourdet, Chriqui, & Chaloupka, 2014). This led users to believe that e-cigarettes were exempt from smoking bans. Allowing e-cigarette use in smoke-free environments could lead to the renormalization of smoking, the weakening of existing smoke-free policies (Grana, Benowitz, & Glantz, 2014), and the perpetuation of nicotine addiction. Recently, an increasing number of municipalities and companies have updated their smoke-free policies by clearly banning e-cigarette use in their smoke-free venues (ANRF, 2014). Future studies need to address social norms around e-cigarette use in smoke-free environments and whether the social stigma associated with smoking has been transferred to e-cigarette use.

Our study is not free of limitations. First, we used a close-ended question to elicit information on the reasons why adults use e-cigarettes; therefore we were unable to identify all possible reasons for e-cigarette use. Other possible reasons for e-cigarette use include enjoyment of the various flavors, relaxation, and stress reduction. We recommend using an open-ended question or qualitative research methodology to elicit all potential reasons underlying e-cigarette experimentation and initiation. Second, in 2012, the number of ever e-cigarette users was small, thereby decreasing the stability of the estimates. Third, we do not know whether former smokers have used e-cigarettes before

they successfully quit smoking or while trying to quit. Lastly, similar to previous studies on e-cigarette awareness and use (Regan, Promoff, Dube, Arrazolla, 2011; King, Patel, Nguyen, & Dube, 2014), we acknowledge that the survey is subject to biases. Because *HealthStyle* draws from an online research panel, the survey is potentially subject to selection bias. However, the research panel is representative of the U.S. population, and the data were weighted to provide national estimates. More details on computation of weighting variables and how it was designed to account for selection, and non-response biases can be found elsewhere (GfK, 2013; Regan, Promoff, Dube, Arrazolla, 2011).

Despite these potential limitations, the study sheds light on reasons underlying e-cigarette use among U.S. adults and contributes to the limited body of knowledge on reasons underlying e-cigarette use, and use in smoke-free environments. We recommend continuous monitoring of e-cigarette use among U.S. adults, as well as future research to answer the following questions: Do e-cigarettes assist current smokers in reducing the number of cigarettes they regularly smoke or merely enable them to satisfy their nicotine craving by allowing them to get around smoking restrictions; Do e-cigarettes cause relapse among former smokers; and do e-cigarettes lead to nicotine addiction among never smokers.

## **5. Conclusions**

Our findings suggest that curiosity and the perceived role of e-cigarettes in smoking cessation influenced adults to try them. Further studies are needed to investigate reasons for continued, subsequent e-cigarette use among those who were initially motivated by curiosity. Our results highlight the need for updating smoke-free policies to include explicit language restricting e-cigarette use.

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**Contributors**

The authors' contributions to the current manuscript are as follows: B. Majeed, S. R. Dube, M. Eriksen, and K. Sterling conceptualized the research questions for the study. B. Majeed analyzed the data, and S.R. Dube, K. Sterling, G.B. Lewis, and M. Eriksen provided input on analysis and interpretation. B. Majeed wrote the manuscript with input from all co-authors.

**Conflict of interest**

The authors have no competing interests pertaining to this research.

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## CHAPTER III

### STUDY II: REASONS FOR E-CIGARETTE USE AMONG CURRENT SMOKERS: A FOCUS GROUP STUDY USING THE THEORY OF PLANNED BEHAVIOR

## Title Page

Reasons for electronic cigarette use among current smokers: A focus group study using the

Theory of Planned Behavior

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### **Abstract [max 200 words one paragraph]**

The factors that determine e-cigarette experimentation and initiation among adult current smokers are still unknown. To have an in depth understanding of these factors and how they may be related, we conducted two focus groups among fourteen current smoker adults who had used e-cigarettes. Both deductive and inductive analytic techniques were used to interpret the textual data. The Theory of Planned Behavior provided the conceptual framework for the deductive analyses. The study revealed that current cigarette smokers used e-cigarettes to complement tobacco cigarettes; they had positive attitudes toward e-cigarette use and perceived them as healthier than regular cigarettes. Current smokers stated that families and friends perceived ecigarettes to be less harmful and approved of their use. Future research is needed to develop and validate measurements for e-cigarette use and its associated beliefs. Longitudinal studies are needed to investigate the natural progression of nicotine dependence and tobacco use.

Quantitative research is needed to test the strength and directionality of association of the factors identified in this study and e-cigarette use, especially use in smoke-free public areas.

## Introduction

National and international epidemiological studies reveal that adults use e-cigarettes to reduce the number of regular cigarettes they smoke, to quit smoking, or to evade smoking restrictions [1-7]. In addition, adults use e-cigarettes to satisfy their curiosity, manage nicotine cravings, comply with peer pressure, save money, and reduce the harm associated with smoking [4,7,8]. These reasons mirror the marketing messages that tobacco companies and e-cigarette manufacturers employ to sell their products to consumers. Currently, e-cigarettes are widely advertised — on television, in print media, and on the Internet— using unsupported smoking cessation and reduced-harm claims. E-cigarettes are also being marketed for use in situations where smoking is prohibited [9].

E-cigarettes are commonly perceived to be less harmful than regular cigarettes, with approximately half of U.S. adults who believe that they are less harmful than regular cigarettes [10,11]. Vardasa, Filippidis, & Agaku (2014) assessed harm perceptions of e-cigarettes in 27 European countries. They found that 28% of the survey participants believed that e-cigarettes were harmless, 40% believed that e-cigarettes were harmful, and the rest were uncertain of the harm from e-cigarette use [12].

We found a limited number of qualitative studies that examine reasons for e-cigarette use and harm perceptions among e-cigarette users in the U.S. For example, McQueen, et al (2011) interviewed fifteen e-cigarette users (“vapers”) and developed themes to describe a user’s progression from exposure to e-cigarette marketing to noticing health benefits from using only e-cigarettes in place of regular cigarettes. This study was exploratory and focused on the practicality of e-cigarette use rather than the individual’s attitudes and perceptions [13]. Barbeau, Burda, and Siegel (2013) conducted a focus group with eleven participants to investigate e-cigarettes’ effectiveness as a smoking cessation aid among adults who were using e-cigarettes to quit smoking [14]. The researchers identified five themes related to e-cigarette use: *biobehavioral feedback*, the ability of e-cigarette to satisfy the need for oral fixation; *social benefits*, the value of the support “vapers” receive from other “vapers”; *hobby element*, the enjoyment of assembling various e-cigarette parts and using e-cigarettes with various flavors; *personal identity*, the participants self-identified as “vapers” rather than smokers; and *difference between smoking cessation and nicotine cessation*, some participants replaced their regular cigarettes with e-cigarettes and expressed no intention to quit nicotine or e-cigarette use in the near future [14]. Both of these studies were focused on committed e-cigarette users; therefore, the results are not transferable to non-committed e-cigarette users. Further, we recognize the paucity of research on the perceptions of e-cigarettes

among former smokers, where e-cigarette use has significantly increased between 2010 and 2013 [15].

To fill the research gaps that currently exist, we conducted the present study to obtain in depth views of current smokers' experience with e-cigarette use. The Theory of Planned Behavior (TPB) was utilized as the conceptual framework to guide the analysis and to provide structure for the emerging themes and their relationships [16]. TPB postulates that there are three main constructs: attitudes, subjective norms, and perceived behavioral control that determine the occurrence of a particular behavior by influencing behavioral intention. First, attitudes toward performing the behavior are categorized as either experiential attitudes or instrumental attitudes. *Experiential attitudes*, also known as affect, refer to the feelings and emotions associated with performing the behavior of interest. *Instrumental attitudes* refer to the perceived advantages and disadvantages that result from performing the behavior. Second, the subjective norms around the behavior are determined by two underlying sub-constructs: the normative beliefs related to the behavior and the motivation to comply with these beliefs. Third, the perceived control over the behavior, which dictates whether the behavior is under the volition of the individual, describes the perceived level of ease or difficulty associated with performing the behavior [17,18]. The specific objectives of this study were to: 1) describe the various scenarios of e-cigarette use among current smokers; 2) explain reasons for ever trying and for continual e-cigarette use; 3) examine e-cigarette-associated perceptions of harm and their potential underlying factors; 4) assess perceived norms around e-cigarette use; and 5) identify where users look for information about e-cigarettes.

**Methods:**

**Study design:** We conducted a qualitative study in Atlanta, Georgia using focus group methodology to explain the reasons for e-cigarette use among current and to examine perceptions of the harms and benefits related to e-cigarette use. Focus groups provide an appropriate environment to understand the participants' perceptions of harm and benefits pertaining to ecigarette use from the participants' perspectives. The study protocol was approved by the Institutional Review Board (IRB) at Georgia State University (GSU).

**Recruitment:** The non-probability sample for the study was based on recruitment by Focus Pointe Global (FPG), a marketing research company. Eligible participants were purposively selected from a research panel maintained by the contracted company. FPG keeps a database of approximately 1.4 million opt-in potential participants for qualitative research. FPG's trained recruiters conducted phone interviews with potential participants to ensure their eligibility for the study. The inclusion criteria included participants who were aged 18 years and older; selfidentified as current smokers; had used e-cigarettes (even once); and had not been part of a focus group in the previous six months. The phone interviews were also used to screen for articulation and consistency of responses.

**Participants:** The study sample included 14 current smokers. In order to uncover variations in perspectives, experiences, and opinions related to e-cigarette use, we sought diversity in the focus groups composition. The age of the participants ranged from 21 to 59 years; half of the participants were males; and groups included primarily white and African American participants; and other demographic characteristics also varied (Table 1).

**Data collection:** Upon arrival to the focus group site, all participants completed the same intake screener questionnaire to validate the information gathered during phone interviews. All participants read and signed a written informed consent form prior to starting the focus group discussion.

We recruited eight participants per group (total recruitments of 16), two of them could not participate. The group sizes (seven participants per group) were ideal to have interactive discussion and to allow enough time for each participant to share his/her views.

All focus groups were facilitated by an experienced moderator. The research team observed the focus groups from adjacent observation room using a one-way glass. The moderator guided the focus groups using a discussion guide developed by the research team. The discussion guide included a set of open-ended questions and activities (e.g. word association) designed to answer the overall research questions. Topics covered in the discussion guide include: reasons for ecigarette use, harm perceptions, and e-cigarette use in smoke-free environments. Each focus group lasted for 90 minutes. Digital voice recording was used to capture the focus group data.

**Data analysis:** The digital voice records of the focus groups were transcribed verbatim by FPG. Our data analysis approach incorporated both deductive and inductive techniques. Deduction and induction were used to develop codes. Prior to reading the textual data, we developed deductive codes to represent the constructs

of the conceptual framework (TPB), and the topics that appeared on the moderator guides. After several readings of the data, we developed the inductive codes to represent the concepts that emerged from the discussion. A study-specific codebook was created to document code names, types, descriptions, and example from the data. Data coding was done line by line by iterative cyclical readings. While coding, new codes emerged and old codes were removed or refined. The coded texts were compiled in separate Microsoft® word documents so that coded texts for a specific code could be read at the same time. Saturation was reached and we stopped coding when no new issues emerged from the data for several cycles of reading. Initially, data were searched by code, and codes with similar attributes were categorized. Analytic search was also conducted to explore links among categories and fit categories into the conceptual framework used in this study. In this paper, we report the emergent themes to explain how and why e-cigarettes were used among current smokers. Deductive and inductive themes were organized into categories and were fit into each construct of the conceptual framework of the TPB.



Table 1: Characteristics of focus group participants

|   | Current Smokers |                |
|---|-----------------|----------------|
|   | Focus Group I   | Focus Group II |
|   | Frequency       | Frequency      |
| <b>Number of participants</b>                                 | 7               | 7              |
| <b>Sex Male</b>   |                 |                |
|   | 4               | 3              |
| Female  | 3               | 4              |
| <b>Race</b>   |                 |                |
| White   | 6               | 4              |
| African American  | 1               | 3              |
| <b>Education High School</b>                                  |                 |                |
|   | 0               | 3              |
| Some College  | 3               | 3              |
| College Graduate +  | 4               | 1              |
| <b>Age started smoking</b>                                    |                 |                |
| ≤17years  | 5               | 3              |
| 18-23 years   | 2               | 4              |
| <b>Smoking frequency</b>                                      |                 |                |
| Everyday  | 6               | 3              |
| Some days   | 1               | 4              |
| <b>Cigarettes smoked per day 1-10 cigarette</b>               |                 |                |
|   | 3               | 4              |
| 11-20 cigarette   | 4               | 3              |
| <b>Intention to quit smoking: Will quit in the next month</b> |                 |                |
|   | 1               | 2              |
| Will quit in the next 6 months                                | 1               | 2              |
| Will quit in the next year                                    | 5               | 3              |
| <b>Year first used e-cigarette</b>                            |                 |                |
| 2012  | 1               | 0              |
| 2013  | 3               | 7              |
| 2014  | 3               | 0              |
| <b>Average e-cigarette use</b>                                |                 |                |
| Everyday  | 2               | 1              |
| 2-5 times a week  | 3               | 2              |
| Once a week   | 2               | 1              |
| Once every 2 weeks  | 0               | 1              |
| Once a month  | 0               | 1              |
| Less than once a month  | 0               | 1              |
| <b>E-cigarette nicotine level 8 mg</b>                        |                 |                |
|   | 3               | 2              |
| 16 mg +   | 3               | 4              |
| Other/not sure  | 1               | 1              |

|                                     |   |   |
|-------------------------------------|---|---|
| Same-day dual use Yes,<br>some days | 6 | 6 |
| No, never                           | 1 | 1 |

## Results

### Themes that emerged about e-cigarette use:

## BEHAVIOR

Participants referred to e-cigarette use as “smoking e-cigarette.” One participant clarified “*I would still say smoking even though it’s not exactly a cigarette. It’s the action of it.*” Participants explained that “vaping” is more descriptive of smoking marijuana than “smoking e-cigarette.”

## ATTITUDE

We classified the themes around attitudes toward e-cigarettes use into two categories:

instrumental and experiential attitudes. Figure (1) shows the favorable attitudes toward smoking e-cigarettes that emerged from the focus group discussions.

*Instrumental attitudes:* are attitudes that develop in relation to the perceived advantages and disadvantages of e-cigarette use. The following are the favorable instrumental attitudes:

### 1. E-cigarettes were perceived as healthier than regular cigarettes

We found that current smokers strongly believed e-cigarettes were *less harmful* to users and to others, compared to smoking regular cigarettes, which is similar to previous research [10]. Participants believed that e-cigarettes were less harmful (or healthier) alternatives to regular cigarettes because they contain fewer chemicals than regular cigarettes, are fire-safe, and do not produce second hand smoke.

The advantages of using e-cigarettes mentioned by participants included improved breath, no smoking-related cough, pleasant (flavored) taste and smell instead of the harsh taste and foul smell associated with smoking regular cigarettes. One participant described the health gains associated with e-cigarette use relative to smoking regular cigarettes, “*It helps with the breathing techniques and everything, so I mean it’s not harder to breathe because you’re not breathing in*

*smoke. It’s [e-cigarette] not harming anything health wise.*”

### 2. E-cigarettes satisfy curiosity and satisfy nicotine cravings

With respect to reasons for trying e-cigarettes for the first time, two salient themes emerged: curiosity about the novel product and the immediate satisfaction of nicotine craving. For many the first experience using an e-cigarettes occurred in a social setting where an e-cigarette user offered the participant a taste (“puff”) to

satisfy curiosity or a nicotine craving, and sometimes both. This usually occurred in places where regular smoking was not allowed. Here is an example account of a first experience with e-cigarette: *“I had my last cigarette and on the way out, just lighting it up, it was pouring rain. It just came down and I couldn’t cover up the cigarette enough to keep it from getting soaked, and so I had an attitude, had nicotine craving [laughter] and my friend had electronic cigarette [...] he [said] “Here, you know, check this [ecigarette] out.” [...] I didn’t want to do it at first, but that craving was in high gear [...] so I took it and tried it [e-cigarette]. It was different but it was okay.”*

### **3. E-cigarettes are more satisfying than regular cigarettes**

E-cigarettes provide guilt-free pleasure, hence some considered them to be superior to regular cigarettes. One female participant concluded, *“For me I’m more satisfied with e-cigarettes because it’s taking away the guilt.”*

### **4. E-cigarettes can help reduce and quit smoking**

Few current smokers used e-cigarettes to replace regular cigarettes and felt that e-cigarettes could help them quit because they satisfied their need for nicotine and the oral fixation associated with smoking regular cigarettes. One participant elaborated on how she has used ecigarettes to quit smoking, *“It’s kind of a funny statement, but e-cigarette have helped me quit smoking three times [...] I have backslid a couple of times with parties and then gone back to traditional cigarettes for a little but then relied only on the e-cigarettes to give me the oral fixation and nicotine to quit traditional cigarettes.”*

Few participants had unfavorable instrumental attitudes toward smoking e-cigarettes.

### **1. Harmfulness of e-cigarettes is still unknown**

To some current smokers the level of harm from e-cigarettes was still *unknown*. E-cigarettes have been on the market a short-time, which evoked doubts and concerns among focus group participants about e-cigarettes’ potential long-term effects on health. This issue manifested in the form of statements describing the lack of knowledge among the participants and the lack of credible information. One participant claimed *“[e-cigarettes] haven’t been on the market long enough to truly know what the fallout is,”* and another participant added *“there’s not enough research done on it yet, it’s so new they [health authority] don’t know if it’s still safe [...] they just don’t know.”*

## 2. E-cigarettes are less satisfying than regular cigarettes

Regarding satisfaction with e-cigarettes, current smokers held different views. E-cigarettes were constantly compared to regular cigarettes, especially in terms of satisfaction to nicotine craving.

E-cigarettes were less satisfying than “*real*” (regular) cigarettes. However, the participants acknowledged that e-cigarettes have their own place, and using them is better than nothing. One participant elaborated, “*To me the satisfaction leans more towards traditional cigarettes than it does electronic cigarettes, but they each have their niche.*”

*Experiential attitudes*: are attitudes that reflect feelings and emotions associated with smoking e-cigarettes. Figure (1) shows the experiential attitudes associated with positive feelings.

### Participants like flavors of e-cigarettes

E-cigarettes come with different flavors. For some people, flavors foster positive attitudes toward e-cigarette use because of the pleasant tastes and smells. Most participants described enjoying various e-cigarette flavors such as cherry vanilla, root beer, chocolate, gummy bears, and menthol. One participant indicated how she liked a certain flavor, “*She [a friend] just hands it [e-cigarette] to me and is like ‘Cherry Vanilla’ [...] and I thought that it was delicious.*”

On the other hand, few participants expressed unfavorable (negative) emotions toward flavored e-cigarettes. One participant believed that only tobacco flavored e-cigarettes could be suitable as better alternatives to replace regular cigarette smoking. He argued, “*if I’m trying to replace my cigarettes, I’m not replacing it for Vanilla or Cherry Vanilla.*”

**SUBJECTIVE NORMS:** We inductively identified two types of subjective norms: direct and

indirect.

Direct subjective norms:

#### 1. Family approves of e-cigarette use

Participants’ families and friends believed e-cigarettes were less harmful and approved of their use, “*[...] my family, at least my dad’s side of the family because my dad [...] when I used to smoke cigarettes “Why are you smoking?” and then he saw me with an e-cigarette and he [said]*

*“That’s so much better for you,” so he had a more positive reaction to it than me smoking regular cigarette.*”

## 2. Peers approved of e-cigarette use

**A female participant used e-cigarette to avoid the negative social image attached to regular cigarettes, “I just don’t like to smoke cigarettes when I’m out [...] for some reason I just feel like it doesn’t make me girly.”**

Indirect subjective norms: Some bystanders expressed their approval of e-cigarette use by approaching the users and asking them questions.

### **Bystanders are intrigued by e-cigarettes**

E-cigarettes created curiosity especially among people who smoke regular cigarettes. One participant described how others reacted to his smoking e-cigarettes in a public place where smoking was prohibited, “*I got a lot of questions, ‘what is it?’, ‘does it really taste like a cigarette?’*” Previous research linked curiosity to smoking initiation [19] and trying e-cigarette [20].

On the other hand, some participants described how they had experienced disapproving

(“dirty”) looks and remarks, sometimes even after explaining that they were “smoking” an e-cigarette and not a regular cigarette. One participant described bystanders’ reaction to his smoking e-cigarettes in smoke-free public areas “*they [bystanders] give you looks [...] they freak out.*” Another participant added “*people look at you [participant using e-cigarettes] like you’re doing something wrong.*”

## **PERCEIVED BEHAVIORAL CONTROL**

### **E-cigarettes are readily accessible for use in smoke-free environments**

All participants disclosed that they had “smoked” e-cigarettes in public and private places in which smoking was not allowed, such as public transportation, workplaces, homes, and movie theaters. However, sometimes participants experienced guilt because they were breaking the rules. Most participants enjoyed smoking e-cigarettes in smoke-free areas because could use them discretely. One participant described the convenience of having e-cigarette in the library,

*“We were studying at the library [...] I really needed a cigarette and I did not want to*

*have to get dressed to go outside and put on all the layers [in winter], put on my hat and*

*deal with all of that stuff. So one of my friends offered me [...] [e-cigarette brand name]. I*

*ended up picking up one the next day just to have for the convenience aspect of it.”*

## **Bystanders are confused by e-cigarettes**

Confusion emerged as the most salient reaction to noticing someone using an e-cigarette in smoke-free public places. Use in smoke-free venues was difficult because the rules, and stigma associated with smoking were readily transferred to e-cigarette use. E-cigarette vapor was easily mistaken for smoke from regular cigarettes. One participant discussed *“I did have the manager come over to ask me to either smoke it [e-cigarette] discretely or to go outside with everybody else because he wasn’t worried about me smoking it [e-cigarette], but he was worried that some other people – inebriated person may see me smoking and think it’s okay for them to light up a cigarette.”*

## **Themes around direct marketing for e-cigarette**

### **Marketing message: Convenience and social acceptance**

The “welcome back” theme, used to promote a particular brand of e-cigarettes, resonated among current smokers. Examples of interpretations of this ad were *“Like nowadays, everybody smokes everywhere”* and *“Whenever, wherever [...] we’ve all lived through this part where we’ve become second class citizens because of smoking.”* The ad portrays e-cigarette as the way to bring smokers back inside, and promised them convenience, social inclusion, and acceptance.

*Marketing message: Satisfaction*

Current smokers were attracted to an ad that promised satisfaction with “smoking” e-cigarettes,

*“you’re going to get a real nicotine draw.”*

*Marketing message: Healthy*

Participants also liked ads that highlighted the health benefit of e-cigarettes,

*“flowers, and it’s green and it [e-cigarette] looks like, it [e-cigarette] might be healthy.”*

## **Themes related to sources of information on e-cigarettes**

### **First source of awareness of e-cigarettes**

We found that the participants had heard of e-cigarettes by indirect marketing (seeing another person using them), or by direct marketing (e.g. seeing them for sale in mall kiosks, seeing televised or print advertisements), which was similar to previous studies on sources of awareness of e-cigarettes [21].

### **Trusted sources of information on e-cigarettes**

Current smokers identified three sources of information on e-cigarettes: manufacturers, health authorities, and other people. They stated that information from manufacturers is biased because its goal is marketing rather than providing accurate information. Information from health agencies (e.g. American Cancer Society) was also viewed with skepticism.

Trustworthy sources of information on e-cigarettes were stories of (“real”) people who used e-cigarettes, consumer reviews, and online (“intelligent conversations”) blogs.

## **Discussion**

Two types of e-cigarette use emerged in this study: experimentation, i.e. first time use, and initiation or continual use. Our results indicate that curiosity motivates current smokers to try e-cigarettes for the first time and the perceived advantages of e-cigarettes motivate smokers to continue using e-cigarettes. Consistent with previous research [e.g. 1-3,10], we found that curiosity, the reduced-harm perception, the ability to use them indoors, and their perceived effectiveness to reduce or quit smoking lead individuals to try or to use e-cigarettes.

The Theory of Planned Behavior allowed us to group the study themes around the theoretical constructs: attitudes, subjective norms, and perceived behavioral control. It also provided a useful way to present the underlying reasons for e-cigarette use [17, 18]. Positive attitudes toward e-cigarette use could be explained by the belief that they could reduce the harm associated with smoking and combat nicotine cravings. Negative attitudes toward e-cigarette use were also expressed by the participants who expressed uncertainty and lack of knowledge on the long term health effects of e-cigarette use. Due to the newness of e-cigarettes on the market, the scientific data regarding the toxicity, potential health effects of e-cigarette use on the users and those caused by secondhand “vaping” are still lacking and warrant extensive research [22].

In this study, we also found that the majority of participants were dual users of both regular and electronic cigarettes, they used e-cigarettes to complement their regular cigarette smoking, especially in smoke-free environments. Dual use sustains nicotine intake and may even increase total nicotine intake thus potentially complicating the picture of nicotine dependence and reducing the ability to quit the use of nicotine containing products [23]. E-cigarette use in smoke-free environments could also undermine the smoke-free laws by introducing aerosolized vapor that has unknown health effects [22], reversing social norms around smoking, and reducing compliance with smoke-free policies [24,25].

In the present study, few current smokers used e-cigarettes to replace regular cigarettes. Under the replacement scenario, current smokers, who are interested in smoking reduction or cessation, use e-cigarettes in place of their regular cigarettes to manage their craving for nicotine and oral fixation. Smokers who replace cigarette use with e-cigarette use are able to maintain nicotine dependence and reduce the harm associated with smoking regular cigarettes.

However, indefinite use of e-cigarettes rather than complete smoking cessation may actually lead to unintentional negative physical, social, or financial consequences. Understanding how and why the products are being used require continuous monitoring so that the impact of e-cigarette use at the population-level can be ascertained [22,26].

While the TPB represents the intricate relationships of among the emergent themes, it does not allow for the differentiation among behaviors, particularly experimentation and initiation, and the factors influencing each. Therefore, we propose the use of the classic epidemiologic model, Host, Agent, Vector, and Environment (HAVE) as way to understand progression from awareness to e-cigarette initiation. The HAVE model has conventionally been use in infectious disease epidemiology, but has also been proposed for use in tobacco control to understand what influences the host (tobacco user) to experiment, initiate, and continue use [27,28]. By understanding the interplay between the host with agents (the products and their configuration), vectors (marketing and industry tactics), and environment (point of sales, smokefree venues, legislation, regulatory actions), we can begin to have a better understanding of how the evolving e-cigarette landscape will impact the host. We specifically used the HAVE model to identify the themes that emerged and the directionality of their relationships (Figure 2).

By applying the HAVE model in the present study, the focus group findings indicate that at the vector level, direct and indirect forms of marketing create curiosity (host factor), which in turn motivates individuals to experiment with e-cigarettes. At the host level, first time use was also precipitated by the urge to smoke (i.e. craving for nicotine). Reasons for continual use included the need for nicotine and oral fixation. The host-agent interaction suggests that reasons for continued use have to do with beliefs that e-cigarettes are less harmful than regular cigarettes, and the social acceptability of e-cigarettes, because of how they are configured (do not create smoke). Future studies are needed to monitor whether the stigma associated with regular cigarette smoking is transferred to e-cigarette use. If e-cigarettes are not prohibited from use in public places, additional studies will also be needed to examine if the denormalization of smoking regular cigarettes begins to wane among future generations.

Our study is not free of limitations. First, we could not distinguish words spoken by different participants. The moderator speech was appropriately labeled and distinguished from that of the participants in the transcripts. However, no labeling was used to differentiate between participants' contributions to the group discussion. Second, the focus group participants were purposively recruited from one city (Atlanta, Georgia); therefore, transferability of the results to the wider US adult population f current smokers is limited.

Despite these limitations, the current study adds to the limited body of research that may inform the tobacco regulatory policy regarding e-cigarette use. The study also highlights types of attitudes, subjective norms and perceived control that may explain e-cigarette use among current smokers. Longitudinal researchs are needed to further understand the progression of use of ecigarettes. In addition, studies are needed to inform the development of new measures that are critical to assessing e-cigarette use, attitudes, subjective norms, and perceived control over



ecigarette use. Future studies utilizing quantitative research study designs are needed to test the findings of our focus group study, with respect to reasons for experimenting with and initiating e-cigarette use. Research on reasons for e-cigarette use should distinguish between factors that prompt current smokers to try e-cigarettes for the first time and those factors that cause them to use e-cigarettes on a regular basis.

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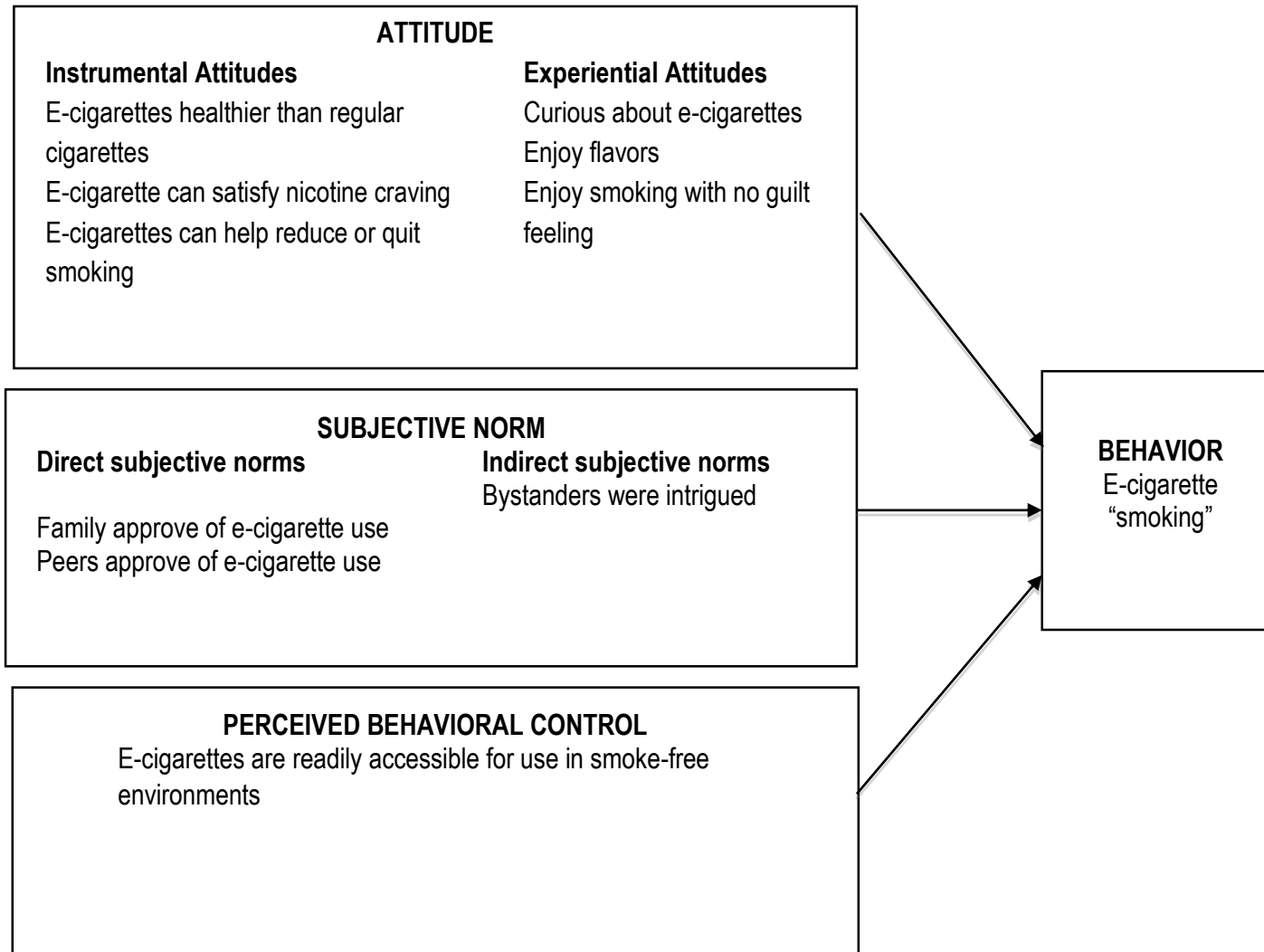


Figure 1: Conceptual framework to explain reasons and harm perceptions associated with e-cigarette use among current smokers

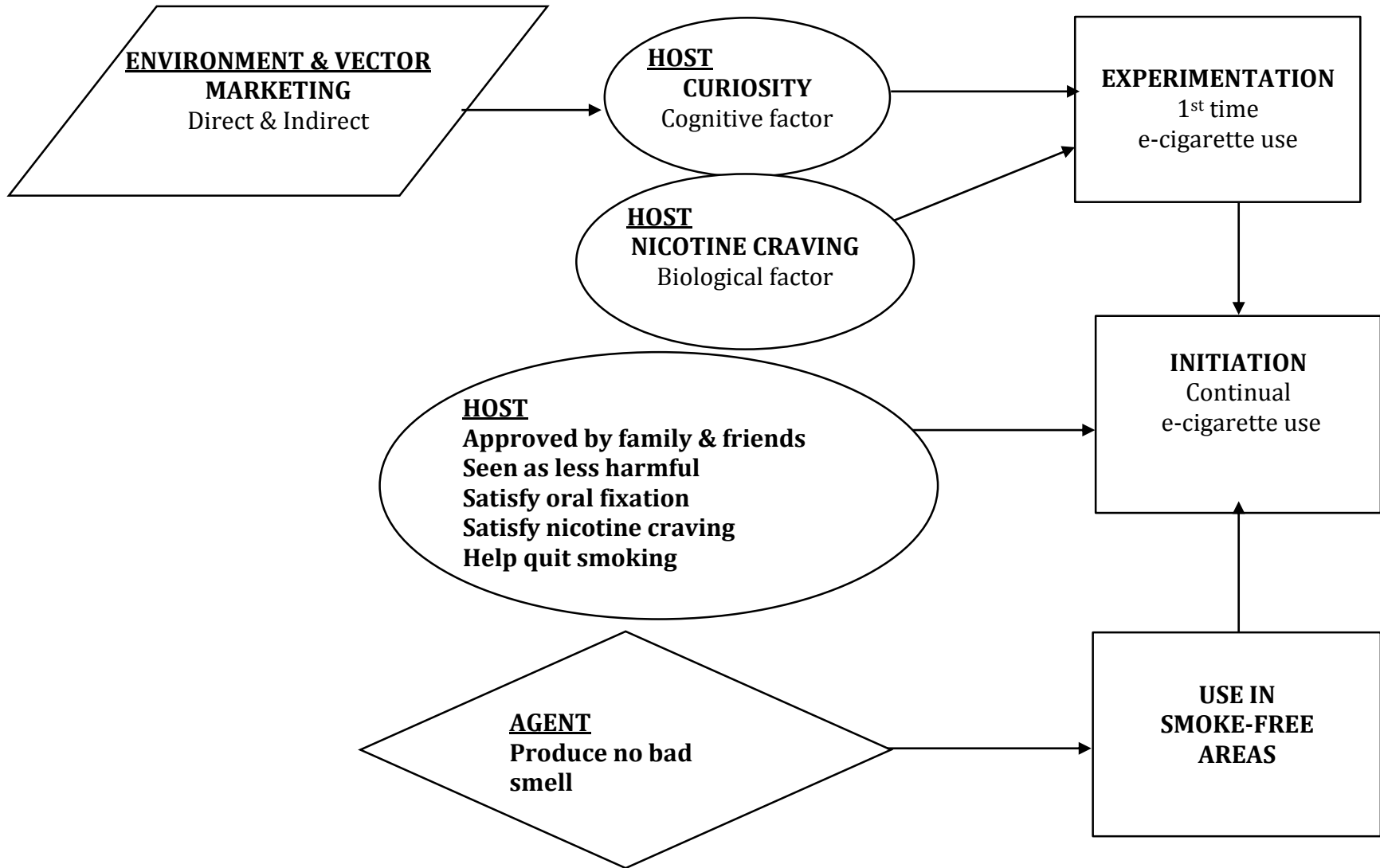




Figure 2: Proposed progression model among current smokers using HAVE model

CHAPTER IV

STUDY III: OPINIONS ABOUT ELECTRONIC CIGARETTE USE IN SMOKE-FREE  
AREAS AMONG U.S. ADULTS, 2012

Nicotine Tob Res (2014)

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**Opinions about Electronic Cigarette Use in Smoke-Free Areas among U.S. Adults, 2012**

|                               |   |
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## Title Page

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## ABSTRACT

**Introduction** In the U.S., electronic cigarettes (e-cigarettes) are currently unregulated, extensively marketed, and experiencing a rapid increase in use. The purpose of this study was to examine the opinions of U.S. adults about e-cigarette use in smoke-free public areas.

**Methods** Data were obtained from the online HealthStyle survey administered to a probability sample of a nationally representative online panel. The study included 4043 U.S. adults, aged 18 years or older who responded to this question, “Do you think e-cigarette should be allowed to be used in public areas where tobacco smoking is prohibited?” Multinomial logistic regression analyses were used to examine opinions on e-cigarette use in smoke-free areas by sex, age, race/ethnicity, household income, education, census region, and cigarette smoking status and e-cigarette awareness and ever use.

**Results** Overall, about 40% of adults were uncertain whether e-cigarettes should be allowed in smoke-free areas, 37% opposed, while 23% favored their use in smoke-free public places. Multinomial logistic regression analyses showed that adults who were aware, ever used e-cigarettes, and current cigarette smokers were more likely to express an *in favor* opinion than adults who expressed an *uncertain* opinion (don’t know).

**Conclusion** Over 75% of U.S. adults reported uncertainty or disapproval of the use of e-cigarettes in smoke-free areas. Current cigarette smokers, adults aware or have ever used e-cigarettes were more supportive to exempting e-cigarettes from smoking restrictions. With impending regulation and the changing e-cigarette landscape, continued monitoring and research on public opinions about e-cigarette use in smoke-free places are needed.



## INTRODUCTION

The use of electronic cigarettes (e-cigarettes), also known as Electronic Nicotine Delivery Systems (ENDS), has increased in popularity within the United States. E-cigarettes are battery-operated devices that heat a liquid containing nicotine and other ingredients, such as water, propylene glycol, vegetable glycerin, citric acid, natural flavors and artificial flavors in a cartridge (McQueen, Tower & Summer, 2011). When the liquid ingredients are heated, a vapor is created and the nicotine is delivered to the user through the inhalation of vapor. E-cigarettes were originally designed to closely resemble regular cigarettes (O'Connor, 2012). They now vary in design, shape, ingredients, (Cobb, Byron, Abrams, & Shields, 2010; FDA, 2011), as well as the amounts of nicotine in a cartridge and that delivered per puff (Goniewicz, Kuma Gawron, Knysak, & Kosmider, 2012). E-cigarettes are a class of products that come in three main models: cigarette-like e-cigarettes that mimic regular cigarettes in shape and size and can either have a disposable (e.g. NJOY) or a rechargeable power source (e.g. Blu, GreenSmoke); pen-like, medium-sized rechargeable e-cigarettes (e.g. Vapor King); and tank-style vaporizers, also known as 'mods,' which contain a large cartridge and an efficient battery (e.g. Volcano) (Grana, Benowitz, & Glantz, 2014).

E-cigarettes are marketed to consumers as a healthier alternative to regular cigarettes (Cobb, Brookover, & Cobb, 2013) that can be used anywhere (Grana, and Ling, 2014), although restrictions on e-cigarette use in public places are beginning to be seen in local jurisdictions (Grana, Benowitz, & Glantz, 2014).

E-cigarettes were originally created and manufactured by entrepreneurs in China in 2006, and they became widely available in the global market in 2007. In April 2014 the Food and Drug Administration (FDA) released proposed rules to extend their existing regulatory authority over tobacco products to include e-cigarettes and other tobacco products (FDA, 2014). Currently, e-



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4 cigarette marketing strategies resemble those used by conventional tobacco cigarette  
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6 manufacturers 50 years ago including glamorous images, portraying smokers as carefree,  
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8 popular, and independent (Benowitz & Goniewicz, 2013). Additionally, specific marketing  
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10 messages, such as “freedom to use anywhere” promote the use of e-cigarettes as an alternative or  
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12 supplement to smoking regular cigarettes (Grana & Ling, 2014).  
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16 The prevalence rates of e-cigarette awareness, ever use, and current use are on the rise in  
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18 the United States (King, Alam, Promoff, Arrazola, & Dube, 2013; Tan & Bigman, 2014). The  
19  
20 Centers for Disease Control and Prevention (CDC) reported in 2009 only 0.6% of U.S. adults  
21  
22 had ever used e-cigarettes (Regan, Promoff, Dube, & Arrazola, 2011). According to the CDC the  
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24 prevalence of ever use was 6.2% in 2011 (King, Alam, Promoff, Arrazola, & Dube, 2013).  
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26 Furthermore, approximately one in five current smokers indicated that they had ever tried e-  
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28 cigarettes in 2011 (King, Alam, Promoff, Arrazola, & Dube, 2013). Between 2011 and 2012, the  
29  
30 CDC observed an increase in ever use (3.3% to 6.8%) and in current use (1.1% to 2.1%) of e-  
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32 cigarettes among youth (CDC, 2013).  
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37 Over the last two decades, smoke-free policies have been implemented widely across the  
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39 U.S., gained public support, and proven to be effective in protecting public health (Eriksen &  
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41 Chaloupka, 2007). As of July 2014, 26 states and 646 municipalities have adopted 100% smoke-  
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43 free laws in non-hospitality workplaces, restaurants and bars (ANRF, 2014a). The benefits of  
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45 smoke-free laws have surpassed their original purpose of protecting non-smokers from  
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47 environmental second-hand smoke. The additional benefits recognized include: reducing  
48  
49 smoking rates, increasing quit attempts, reducing the number of cigarettes smoked by current  
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51 smokers, and lowering initiation rates among young people (Guide to Community Preventive  
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53 Services, 2012). Smoke-free laws have also been instrumental in reducing social acceptability of  
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55 smoking (Guide to Community Preventive Services, 2012). Smoking denormalization has been  
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3 effective in increasing smoking cessation and reducing initiation (Hammond, Fong, Zanna,  
4 Thrasher, & Borland, 2006). If e-cigarette use in smoke-free areas reverse the social norms and  
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6 undermine the benefits of smoking restrictions, then they would be harmful at the population  
7  
8 level (Grana, Benowitz, & Glantz, 2014). Alternatively, permitting e-cigarette use in smoke-free  
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10 areas could have the potential to motivate current smokers to shift from smoking regular  
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12 cigarettes to using e-cigarettes, resulting in some possible harm reduction at the individual and  
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14 the public health levels.  
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20 Furthermore, public opinion is an important indicator for the development,  
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22 implementation, and evaluation of public policies because public opinion reflects social norms  
23  
24 and demonstrates the level of societal support for new and existing tobacco control policies  
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26 (Farley, et al., 2014; FDA, 2014). Given the rapid increase in e-cigarette use and the differing  
27  
28 perspectives of whether e-cigarette use should be encouraged or discouraged, there is a pressing  
29  
30 need to examine public attitudes about allowing the use of e-cigarettes in currently smoke-free  
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32 areas. The objectives of the current study were to examine public opinion on whether e-cigarette  
33  
34 use should be allowed in public areas where smoking is currently prohibited and to examine  
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36 these opinions by socio-demographic characteristics, cigarette smoking status, e-cigarette  
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38 awareness, and ever use of e-cigarettes.  
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## 45 46 **METHODS**

### 47 48 **Sampling**

49  
50 Porter Novelli, a for profit communications consulting firm, administers a series of  
51  
52 national consumer surveys known as Styles. The surveys are conducted by Knowledge Networks  
53  
54 which maintains an online research panel (KnowledgePanel®). This panel is nationally  
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56 representative of the U.S. adult population and maintains approximately 50,000 members (GfK,  
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2013). The panel members are randomly recruited by a probability-based sampling (random-digit-dialing and address-based) to reach people with and without landline phones and Internet access. If needed, survey respondents are provided with laptop computers and Internet access (GfK, 2013, GfK, 2014).

One of the consumer surveys, *HealthStyles* measures health-related information, opinions, and behaviors among U.S. adults. To examine behaviors and opinions regarding e-cigarettes among U.S. adults, we included e-cigarette questions in the *HealthStyles* survey. The survey was fielded in June through July 2012. A random sample of 6402 adults from KnowledgePanel was invited to participate in the *HealthStyles* survey. Of these, 4170 adults completed the survey (response rate: 65%). All information was collected online with a median survey completion duration of 38 minutes. Participants who completed the survey were eligible to receive 10000 reward points (equivalent to \$10) and enter a sweepstake and to win an in-kind prize. More information on the recruitment, participation incentives, and statistical weighting procedures are found on the company's website (GfK, 2013).

After excluding respondents with missing information for the dependent and independent variables of interest, the final sample size for this study was 4043 adults. The study has been approved by the Institutional Review Board at Georgia State University.

## Measures

### *Socio-demographic characteristics*

Socio-demographic characteristics of the respondents included sex, age, race/ethnicity, annual household income, education level, and U.S. census region of residence.

### *Awareness of E-cigarette*

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3 Awareness was measured using this question, “Have you heard of electronic cigarettes or E-  
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Awareness was measured using this question, “Have you heard of electronic cigarettes or E-cigarettes, such as Ruyan or NJOY?” Response categories included *Yes*, and *No*. Participants who answered *Yes* were considered aware of e-cigarettes.

#### *Ever use of E-cigarette*

Ever use of e-cigarettes was defined by selecting “Electronic Cigarettes or E-cigarettes, such as Ruyan or NJOY” in response to this question, “Have you ever tried any of the following products, even just one time?”

#### *Cigarette smoking status*

Current smokers were defined as those who had smoked 100 cigarettes or more in their lifetime, and responded “everyday” or “some days” to this follow up question: “Do you currently smoke cigarettes every day, some days, or not at all?” Respondents who had smoked 100 cigarettes or more in their lifetime but selected “not at all” were considered former smokers. Never-smokers were defined as those who had *not* smoked 100 cigarettes or more in their lifetime.

#### *Opinions about E-cigarette Use in Smoke-Free Public Areas*

All survey participants were asked to indicate their opinions about whether e-cigarette use should be permitted where tobacco smoking is not allowed, using this question, “Do you think e-cigarette should be allowed to be used in public areas where tobacco smoking is prohibited?”

There were three responses to this question *Yes*, *No*, and *Don't know*.

#### **Analysis**

Data were analyzed using Stata (v. 11.2) SVY program and weighted according to 2012 U.S. Current Population Survey proportions. The study-specific weighting variable is computed in stages. The survey company computed a “base weight” to adjust for any selection deviations associated with recruitment to the research panel. Further, panel post-stratification weight is computed using nine demographic factors: gender, age, race/ethnicity, household income,



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3 education, census region, metro status, and Internet access. Finally, a study-specific post-  
4 stratification weighting variable was employed to adjust for potential biases related to sampling,  
5 and non-response.  
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10 We calculated weighted point prevalence and 95% confidence intervals. Opinions about  
11 e-cigarette use in smoke-free public places among U.S. adults were assessed by demographic  
12 characteristics: sex, age (18-24, 25-34, 35-44, 45-54, 55-64, and  $\geq 65$  years), race/ethnicity (non-  
13 Hispanic White, non-Hispanic African Americans and Hispanic), education levels (< high  
14 school, high school graduate, some college, and  $\geq$  college graduate), household income (<\$15K,  
15 \$15K - \$24.9K, \$25K - \$39.9K, \$40K - \$59.9K, and  $\geq$  \$60K ), and census region (Northeast,  
16 Midwest, South, and West); cigarette smoking status (current, former, and never smokers); and  
17 awareness and ever use of e-cigarettes. Chi square analyses of two-way tables were conducted to  
18 examine associations among opinions about e-cigarette use in public areas with respondents'  
19 characteristics ( $\alpha = .05$ ). We calculated the relative standard errors (RSE) for all estimates, and  
20 all reported estimates had RSE < 20%, which is within the accepted range—national health  
21 surveys consistently use 30% as their maximum acceptable RSE (30%) (Klein, Proctor,  
22 Boudreault, & Turczyn, 2002; NEPHTN, 2008).  
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41 Since the opinion outcome variable has three discrete categories: “yes”, “no”, and “don’t  
42 know”, we used a weighted multinomial logistic regression to model the probabilities of stating a  
43 particular opinion as to whether e-cigarette use should be allowed where smoking is prohibited  
44 as a function of e-cigarette awareness, ever use, cigarette smoking status, and demographic  
45 variables. In order to compare the characteristics of respondents who were in favor of permitting  
46 e-cigarette use in smoke-free areas, to the characteristics of those who did not have enough  
47 information and did not form an opinion, we specified the reference group in the model to be  
48 those who replied “don’t know. Adjusted odds ratios and their 95% confidence intervals were  
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3 calculated to characterize the relationship between the predictors and opinions about e-cigarette  
4 use in smoke-free areas.  
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## 7 8 **RESULTS**

### 9 10 **Sample Characteristics**

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12 In 2012, among the 4043 adult respondents aged 18 years and older, 51.8 % were  
13 females; the mean age was 46.5 years ( $\pm 17.5$ ) (Table 1). The majority were non-Hispanic White  
14 (68.0%), followed by Hispanic (13.7%), non-Hispanic African Americans (11.3%) and other  
15 race (7.0%). Levels of annual household income were: 50.1% ( $\geq$  \$60,000), 16.9% (\$40,000 –  
16 \$59,000.9), 14.4% (\$25,000 - \$39,000.9), 9.3% (\$15,000-\$24,000.9); and 9.3% ( $<$  \$15,000).  
17  
18 About 12.6% of adults reported having less than a high school diploma; 29.8% reported  
19 graduating from high school; and about 57.6% reported having some college education or being  
20 a college graduate. More than one-third of adults resided in the South (37.1%); followed by West  
21 (22.9%); Midwest (21.8%); and Northeast (18.3%). Among respondents, 68.0% were aware of e-  
22 cigarettes and 8.1% were ever e-cigarette users. More than half of adults (58.1%) were never-  
23 smokers; 24.7% were former smokers; and 17.2% were current smokers.  
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### 40 **Opinions about E-cigarette use in smoke-free public areas**

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42 Overall, 22.6% of respondents reported that e-cigarette use should be allowed in areas  
43 where tobacco smoking is currently prohibited; 37.5% stated that e-cigarette use should not be  
44 allowed in smoke-free areas, and 39.8% stated they did not know (Table 1). Bivariate analysis  
45 using chi square testing showed that adults who were males (25.3%), aged 25-34 years (30.2%),  
46 had less than a high school education (27.2%), were aware of e-cigarettes (30.0%), ever used e-  
47 cigarettes (64.1%), and were current cigarette smokers (51%) were more likely ( $p < 0.05$ ) to report  
48 that e-cigarettes should be allowed where tobacco smoking is prohibited (Table 1). No  
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3 statistically significant relationships were observed between opinions and race/ ethnicity,  
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5 household income, or U.S. census region.  
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### 8 **Multiple multinomial regression analyses**

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10 In the multinomial logistic regression model, compared to adults not aware of e-  
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12 cigarettes, those aware of e-cigarettes had a more than five times greater odds (Adjusted Odds  
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14 Ratio or AOR=5.5, 95% CI 3.9 – 7.8) of expressing an opinion *in favor of* allowing e-cigarette  
15  
16 use in smoke-free areas to expressing an *uncertain* i.e. a “don’t know” opinion, after controlling  
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18 for the other predictors (Table 2). The odds of being *in favor of* allowing e-cigarette use in  
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20 smoke-free areas versus being uncertain (i.e. reporting “don’t know”) was almost four times  
21  
22 greater for ever e-cigarette users, than for never users (AOR=3.8, 95% CI 2.4 – 6.0). Compared  
23  
24 with respondents who expressed an uncertain “don’t know” opinion, for current cigarette  
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26 smokers, the odds of expressing an opinion *in favor* were twice as large as the odds for never  
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28 smokers (AOR= 2.3, 95% CI 1.6 – 3.3).  
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34 Compared to young adults (18-24), older adults aged (45 – 54), (55 – 64), and (65 +) were  
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36 significantly less likely to express, an opinion *in favor* (AOR= 0.5, 95% CI 0.3 – 0.9), (AOR=  
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38 0.5, 95% CI 0.3 – 0.9), (AOR= 0.3, 95% CI 0.1 – 0.4) than to report, “don’t know.” Compared to  
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40 the reference group, individuals who expressed either a supportive or opposing opinion did not  
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42 significantly differ by gender, race/ethnicity, household income, education level, or U.S. census  
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44 region (Table 2).  
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## DISCUSSION

To our knowledge, this is one of the first studies to examine public opinion about e-cigarette use in areas where smoking is prohibited. While the majority of respondents either report, “don’t know” or oppose allowing e-cigarette use in smoke-free areas, about one in five adults support e-cigarette use in smoke-free areas. It should be noted that adults who responded, “don’t know” were also more likely to lack awareness about e-cigarettes compared to adults who had an opinion, suggesting that their lack of opinion could be due to the novelty of the device on the market. E-cigarette awareness, ever use of e-cigarettes, and being a current cigarette smoker were independently associated with expressing supportive opinion to allowing e-cigarette use in smoke-free areas compared to reporting, “don’t know.”

E-cigarettes are widely available (Ayers, Ribisl, & Brownstein, 2011) and marketed through multiple channels, including the Internet and television (Kim, Lee, Shafer, Nonnemaker, & Makarenko, 2013; Hodge, Collmer, Orenstein, Millea, & Buren, 2013). From 2008 to 2010, the relative Internet search volume for the topic of e-cigarettes, using the Google search engine, sharply increased, suggesting the rapid rise in its popularity, especially in states where strict tobacco control laws were implemented (Ayers, Ribisl, & Brownstein, 2011).

In 2009, the Family Smoking Prevention and Tobacco Control Act (FSPTCA) granted the FDA the power to regulate the manufacturing, marketing and distribution of tobacco products (Ashley, & Backinger, 2012). Because e-cigarettes deliver a drug (nicotine), the FDA attempted to regulate them as drug delivery devices in 2010. Sottera Inc. (the maker of a popular e-cigarette brand: NJOY) took the matter to court. In December 2010, the U.S. Court of Appeals for the D.C. circuit ruled in favor of Soterra, declaring that e-cigarettes should be regulated as tobacco products rather than drug delivery or therapeutic devices (Deyton & Woodcock, 2011). Most recently, in 2014, the FDA proposed rules to regulate e-cigarettes (FDA, 2014). However, this



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4 proposed rulemaking does not include flavored e-cigarette products, marketing practices, or  
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6 online sales.

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8 E-cigarettes have existed in a regulatory vacuum (Cobb, Byron, Abrams, & Shields,  
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10 2010). Recently, an increasing number of states and local governments are adopting legislation  
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12 to control youth access to e-cigarettes and to restrict where e-cigarette could be used. As of April  
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14 2014, three states (New Jersey, North Dakota, and Utah) banned the use of e-cigarettes in 100%  
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16 smoke-free venues: non-hospitality work places, restaurants, and bars. Ten states prohibited e-  
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18 cigarette use in certain facilities such as school and state workplace properties. In addition, 172  
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20 municipalities including New York, Los Angeles, and Chicago restricted e-cigarette use in work  
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22 places and other venues (ANRF, 2014b).  
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28 Some public health officials argue that e-cigarette use should be allowed in smoke-free  
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30 environments to encourage smokers to switch from combustible cigarettes (Saitta, Ferro, &  
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32 Polosa, 2014). Other argue that introducing e-cigarettes to smoke-free environments could  
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34 undermine smoking restrictions (Etter, Bullen, Flouris, Laugesen, & Essenberg, 2011). Smoking  
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36 restrictions have resulted in protecting non-smokers from second hand smoke, reducing overall  
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38 cigarette consumption (Hopkins, et al., 2010), and de-normalizing smoking behavior that in turn  
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40 led to increased cessation (Hammond, Fong, Zanna, Thrasher, & Borland, 2006) and to reduction  
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42 in initiation (Wechsler, Lee, & Rigotti, 2001).  
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47 Potential unintended consequences of allowing e-cigarettes to be used freely in smoke-  
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49 free areas include: undermining tobacco control efforts, and re-normalizing smoking,  
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51 encouraging dual use —the use of both regular and electronic cigarettes, and subjecting non-  
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53 smokers and non-e-cigarette users to second-hand vapor which could contain nicotine. E-  
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55 cigarette emissions are not “harmless water vapor” (Grana, Benowitz, & Glantz, 2014), but  
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57 contain nicotine, volatile organic compounds, and ultrafine particles (Schripp, Markewitz, Uhde,  
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3 & Salthammer, 2013; Schober, et al., 2013). Further studies are urgently needed to ascertain the  
4 safety of secondhand vapor, including its potential effect on people who have not used nicotine  
5 products, as well as whether it could be a vehicle for infectious agents. Understanding these  
6 issues will help determine the need for restrictions on e-cigarette use in public areas.  
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12 The industry markets e-cigarettes as a product to regain freedom from smoking bans  
13 (Grana, & Ling, 2014), by allowing smokers to administer nicotine in smoke-free environments,  
14 which may lead to dual use and perpetuation of nicotine dependency. This marketing could  
15 explain our finding that current smokers favor allowing e-cigarette use in smoke-free areas.  
16  
17 Previous research has shown that current smokers do indeed use e-cigarettes in situations where  
18 they cannot smoke cigarettes (Adkison, et al., 2013; Dawkins, Turner, Roberts, & Soar, 2013;  
19 Vickerman, Carpenter, Altman, Nash, & Zbikowski, 2013).  
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23 If permitted in smoke-free areas, e-cigarettes could be used to subvert smoking  
24 restrictions and re-normalize smoking (Grana, Benowitz, & Glantz, 2014). Social  
25 denormalization of smoking played a critical role in reducing smoking prevalence and youth  
26 initiation (Hopkins, et al., 2010). It is plausible that introducing a smoking-like behavior and a  
27 cigarette-like product to smoke-free areas could undo decades of work, renormalize smoking,  
28 and reverse youth initiation. A recent study among children aged 6-10 years showed that they  
29 could mistake e-cigarette vapor for cigarette smoke (Faletau, Glover, Nosa, & Pienaar, 2013).  
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33 Exempting e-cigarettes from smoking bans could undermine compliance with anti-  
34 smoking laws and their enforcement. The strong resemblance of e-cigarette-produced vapor and  
35 cigarette-produced smoke could potentially confuse bystanders, leading them to conclude that  
36 smoking is permitted in the facility. The difficulty of distinguishing clouds of vapor from clouds  
37 of smoke could impede efforts to enforce smoking bans (Kurutz, 2013). Future studies need to  
38 focus on understanding whether people recognize vapor from smoke or confuse the two.  
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## Limitations

The current study is not free of limitations. First, the data are self-reported. Thus, data are subject to recall bias, and underreporting of socially unfavorable behaviors. Second, a small proportion of respondents (3.0%) did not respond to the question on opinions about e-cigarette use in smoke-free public areas, which could lead to item non-response bias. Third, the regression model did not include all potential confounding variables that could affect the public opinion regarding use of e-cigarette in smoke-free areas; e.g. political ideology, and state, and local smoke-free laws for the survey participants (Tung, Stuart, & Webster, 2014; Huang, Tauras, & Chaloupka, 2014). Fourth, the study sample was recruited from an online research panel (KnowledgePanel). However, this online research panel is a representative sample of the U.S. population (GfK, 2013), and the data were weighted to be nationally representative. The weights were computed in stages to account for biases that could originate from non-coverage and non-response. Further, tobacco-related indicators based on *HealthStyles* are comparable with those of national surveys (Regan, Promoff, Dube, & Arrazola, 2011). Using the 2012 *HealthStyles*, we obtained a current smoking prevalence of 17.2 (95% CI 15.6 – 18.9), and the prevalence of current smoking was 18.1 (95% CI 17.5 – 18.7) using the 2012 National Health Interview Survey data (CDC, 2014), supporting that the estimates obtained in our study are consistent with NHIS (Regan, Promoff, Dube, & Arrazola, 2011).

## Conclusion

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3 The study revealed that a substantial proportion of U.S. adults did not know whether e-cigarettes  
4 should be banned in smoke-free public places. This might be explained by the lack of awareness  
5 of the existence of e-cigarettes. As e-cigarette awareness and popularity continue to increase and  
6 the diversity of the product continues to expand, we anticipate the proportion of adults with a  
7 “don’t know” response to decrease. Current smokers favored allowing e-cigarette use in smoke-  
8 free areas and opposed bans, which is consistent with previous findings of e-cigarette use to  
9 circumvent smoking bans. As e-cigarette popularity and use continue to rise, along with ensuing  
10 efforts to regulate its use, it will be important to continue to monitor public opinion regarding  
11 allowing e-cigarette use in smoke-free areas. Qualitative studies, especially among non-smokers,  
12 are also needed to explore the reasons behind favoring or opposing e-cigarette use in public  
13 areas. In addition, the potential effects of e-cigarette use on social norms, youth smoking  
14 initiation, and compliance with smoke-free laws warrant future research.  
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Table 1: Opinions about allowing e-cigarette use in smoke-free public areas among U.S. adults by respondents' characteristics — *HealthStyles*, 2012

| "Do you think e-cigarettes should be allowed to be used in public areas where tobacco smoking is prohibited?" |                           |                         |                              |                         |
|---|---------------------------|-------------------------|------------------------------|-------------------------|
| Characteristics   | All (N=4043) <sup>a</sup> | Yes, allow <sup>b</sup> | No, don't allow <sup>b</sup> | Don't know <sup>b</sup> |
| Weighted % (95% CI)   |                           |                         |                              |                         |
| Overall   |                           | 22.6 (20.9 – 24.5)      | 37.5 (35.5 – 39.6)           | 39.8 (37.8 – 42.0)      |
| Sex   |                           |                         |                              |                         |
| Male  | 48.2 (46.1 – 50.3)        | 25.3 (22.7 – 28.2)*     | 36.4 (33.5 – 39.3)           | 38.3 (35.4 – 41.3)      |
| Female  | 51.8 (49.7 – 53.9)        | 20.2 (17.9 – 22.7)      | 38.6 (35.8 – 41.4)           | 41.2 (38.4 – 44.1)      |
| Age group (year)  |                           |                         |                              |                         |
| 18-24   | 12.5 (11.0 – 14.1)        | 25.8 (20.2 – 32.4)*     | 40.8 (34.5 – 47.5)           | 33.3 (27.3 – 40.0)      |
| 25-34   | 17.4 (15.7 – 19.2)        | 30.2 (25.2 – 35.6)      | 36.9 (31.6 – 42.6)           | 33.0 (27.8 – 38.5)      |
| 35-44   | 16.8 (15.3 – 18.4)        | 23.3 (19.3 – 27.7)      | 39.3 (34.6 – 44.3)           | 37.5 (32.7 – 42.4)      |
| 45-54   | 19.0 (17.5 – 20.6)        | 24.6 (20.9 – 28.7)      | 33.7 (29.8 – 37.8)           | 41.8 (37.5 – 46.2)      |
| 55-64   | 16.4 (14.9 – 17.9)        | 21.6 (17.7 – 26.2)      | 37.7 (33.0 – 42.5)           | 40.7 (36.1 – 45.5)      |
| 65 +  | 18.0 (16.5 – 19.6)        | 11.6 (9.0 – 14.9)       | 38.1 (33.7 – 42.6)           | 50.3 (45.8 – 54.9)      |
| Race/ Ethnicity   |                           |                         |                              |                         |
| White, NH   | 68.0 (65.9 – 70.1)        | 23.1 (21.1 – 25.2)      | 38.2 (35.9 – 40.5)           | 38.7 (36.5 – 41.1)      |
| African American, NH  | 11.3 (9.9 – 12.8)         | 21.4 (16.3 – 27.7)      | 37.3 (30.8 – 44.2)           | 41.3 (34.9 – 48.1)      |
| Hispanic  | 13.7 (12.2 – 15.4)        | 19.8 (15.0 – 25.7)      | 36.6 (30.6 – 42.9)           | 43.7 (37.3 – 50.2)      |
| Other   | 7.0 (5.9 – 8.4)           | 26.0 (18.4 – 35.3)      | 33.6 (25.7 – 42.6)           | 40.5 (32.0 – 49.6)      |
| Household Income  |                           |                         |                              |                         |
| <\$15K  | 9.3 (8.0 – 10.7)          | 28.0 (21.5 – 35.6)      | 30.0 (23.6 – 37.2)           | 42.0 (34.7 – 49.7)      |
| \$15K-\$24.9K   | 9.3 (8.1 – 10.7)          | 24.5 (18.6 – 31.5)      | 35.4 (28.8 – 42.8)           | 40.1 (33.2 – 47.4)      |
| \$25K-\$39.9K   | 14.4 (13.0 – 16.0)        | 25.8 (21.2 – 31.0)      | 38.3 (33.1 – 43.8)           | 35.9 (30.8 – 41.2)      |
| \$40K-\$59.9K   | 16.9 (15.4 – 18.5)        | 23.6 (19.5 – 28.3)      | 37.5 (32.8 – 42.5)           | 38.9 (34.1 – 43.8)      |
| \$60K +   | 50.1 (48.0 – 52.2)        | 20.1 (17.9 – 22.6)      | 39.1 (36.3 – 41.9)           | 40.8 (38.0 – 43.7)      |
| Education level   |                           |                         |                              |                         |
| < HS  | 12.6 (11.0 – 14.4)        | 27.2 (21.0 – 34.4)*     | 34.5 (27.9 – 41.7)           | 38.4 (31.5 – 45.8)      |
| HS Graduate   | 29.8 (27.9 – 31.8)        | 23.3 (20.1 – 26.9)      | 36.9 (33.1 – 40.8)           | 39.8 (36.0 – 43.8)      |
| Some College  | 29.0 (27.2 – 30.8)        | 25.0 (22.0 – 28.3)      | 38.1 (34.7 – 41.7)           | 36.9 (33.5 – 40.4)      |
| College Graduate+   | 28.6 (26.9 – 30.5)        | 17.7 (15.1 – 20.7)      | 38.9 (35.5 – 42.4)           | 43.4 (40.0 – 46.9)      |
| U.S. Census Region  |                           |                         |                              |                         |
| Northeast   | 18.3 (16.7 – 19.9)        | 21.6 (17.8 – 25.9)      | 36.9 (32.4 – 41.6)           | 41.6 (36.9 – 46.4)      |
| Midwest   | 21.8 (20.2 – 23.5)        | 24.5 (20.9 – 28.5)      | 37.5 (33.4 – 41.7)           | 38.1 (34.1 – 42.1)      |
| South   | 37.1 (35.1 – 39.2)        | 22.4 (19.5 – 25.5)      | 37.4 (34.1 – 40.8)           | 40.3 (36.9 – 43.7)      |
| West  | 22.9 (21.2 – 24.8)        | 22.2 (18.6 – 26.4)      | 38.3 (34.0 – 42.8)           | 39.4 (35.1 – 44.0)      |
| E-cigarette Awareness   |                           |                         |                              |                         |
| Aware   | 68.0 (66.0 – 69.9)        | 30.0 (27.6 – 32.4)*     | 37.3 (34.9 – 39.8)           | 32.7 (30.4 – 35.1)      |
| Unaware   | 32.0 (30.1 – 34.0)        | 7.2 (5.4 – 9.5)         | 37.9 (34.3 – 41.6)           | 54.9 (51.2 – 58.6)      |
| E-cigarette ever use  |                           |                         |                              |                         |
| Ever user   | 8.1 (7.0 – 9.4)           | 64.1 (56.5 – 70.9)*     | 18.8 (13.4 – 25.7)           | 17.1 (12.2 – 23.5)      |
| Never user  | 91.9 (90.7 – 93.0)        | 19.0 (17.3 – 20.9)      | 39.2 (37.1 – 41.3)           | 41.8 (39.7 – 44.0)      |
| Cigarette Smoking Status  |                           |                         |                              |                         |
| Current smoker  | 17.2 (15.6 – 18.9)        | 51.0 (45.6 – 56.3)*     | 17.6 (13.9 – 21.9)           | 31.5 (26.6 – 36.7)      |
| Former smoker   | 24.7 (23.0 – 26.5)        | 18.3 (15.4 – 21.6)      | 37.0 (33.2 – 41.0)           | 44.7 (40.8 – 48.7)      |
| Never-smoker  | 58.1 (55.0 – 60.2)        | 16.2 (14.1 – 18.4)      | 43.6 (40.9 – 46.4)           | 40.2 (37.6 – 43.0)      |

1 \* Statistically significant by chi square test for bivariate analysis

2 <sup>a</sup>For each variable, total sums vertically to 100%

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Table 2: Adjusted Odds Ratios for the association of respondents' characteristics with their opinions about allowing e-cigarettes use in smoke-free public areas among U.S. adults —*HealthStyles*, 2012  
 "Do you think e-cigarettes should be allowed to be used in public areas where tobacco smoking is prohibited?"

| Predictors                     | Yes, allow (vs. Don't know)<br>Adjusted OR (95% CI) <sup>a</sup> | No, don't allow (vs. Don't know)<br>Adjusted OR (95% CI) <sup>a</sup> |
|--------------------------------|--|---|
| Sex                            |  |   |
| Male                           | 0.8 (0.6 – 1.0)  | 1.0 (0.8 – 1.0)   |
| Female (referent)              | 1.0  | 1.0   |
| Age group (year)               |  |   |
| 18-24 (referent)               | 1.0  | 1.0   |
| 25-34                          | 1.0 (0.6 – 1.6)  | 1.0 (0.7 – 1.6)   |
| 35-44                          | 0.7 (0.4 – 1.1)  | 1.0 (0.7 – 1.5)   |
| 45-54                          | 0.5 (0.3 – 0.9)  | 0.8 (0.5 – 1.1)   |
| 55-64                          | 0.5 (0.3 – 0.9)  | 0.9 (0.6 – 1.3)   |
| 65 +                           | 0.3 (0.1 – 0.4)  | 0.7 (0.5 – 1.0)   |
| Race/ Ethnicity                |  |   |
| African American, non-Hispanic | 0.8 (0.5 – 1.3)  | 1.0 (0.7 – 1.4)   |
| Hispanic                       | 0.9 (0.6 – 1.4)  | 0.9 (0.6 – 1.2)   |
| Other                          | 1.2 (0.7 – 2.2)  | 0.9 (0.6 – 1.3)   |
| White, non-Hispanic (referent) | 1.0  | 1.0   |
| Household Income               |  |   |
| <\$15K                         | 1.0 (0.6 – 1.7)  | 0.8 (0.5 – 1.2)   |
| \$15K-\$24.9K                  | 1.1 (0.7 – 1.7)  | 1.0 (0.7 – 1.4)   |
| \$25K-\$39.9K                  | 1.4 (1.0 – 2.1)  | 1.2 (0.9 – 1.6)   |
| \$40K-\$59.9K                  | 1.1 (0.8 – 1.6)  | 1.0 (0.8 – 1.3)   |
| \$60K + (referent)             | 1.0  | 1.0   |
| Education level                |  |   |
| < HS                           | 1.4 (0.8 – 2.3)  | 1.3 (0.9 – 2.0)   |
| HS Graduate                    | 1.3 (0.9 – 1.8)  | 1.2 (0.9 – 1.5)   |
| Some College                   | 1.4 (1.0 – 1.9)  | 1.2 (0.9 – 1.5)   |
| College Graduate+ (referent)   | 1.0  | 1.0   |
| U.S. Census Region             |  |   |
| Northeast                      | 1.0 (0.7 – 1.5)  | 0.9 (0.7 – 1.3)   |
| Midwest                        | 1.0 (0.7 – 1.4)  | 1.0 (0.7 – 1.3)   |
| South                          | 0.9 (0.6 – 1.3)  | 1.0 (0.8 – 1.3)   |
| West (referent)                | 1.0  | 1.0   |
| Awareness status               |  |   |
| Aware                          | 5.5 (3.9 – 7.8)*   | 1.8 (1.4 – 2.2)   |
| Unaware (referent)             | 1.0  | 1.0   |
| E-cigarette ever use           |  |   |
| Ever user                      | 3.8 (2.4 – 6.0)*   | 1.3 (0.8 – 2.3)   |
| Never user (referent)          | 1.0  | 1.0   |
| Cigarette Smoking Status       |  |   |
| Current smoker                 | 2.3 (1.6 – 3.3)*   | 0.4 (0.3 – 0.6)   |
| Former smoker                  | 1.0 (0.7 – 1.4)  | 0.8 (0.6 – 0.9)   |



|                         |     |     |
|-------------------------|-----|-----|
| Never-smoker (referent) | 1.0 | 1.0 |
|-------------------------|-----|-----|

\* Statistically significant ( $p=0.000$ ), compared to the reference group, by multinomial logistic regression

<sup>a</sup>Adjusted OR (95% CI): Adjusted Odds Ratio (95% Confidence Interval)

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## CHAPTER V

### DISCUSSION AND RECOMMENDATIONS



## DISCUSSION AND RECOMMENDATIONS

### **Summary of findings**

#### Study I: Reasons for E-cigarette Use among U.S. Adults, 2012

This study shows that adults try e-cigarettes because of the curiosity and the belief that they could help in smoking cessation. Current smokers often use e-cigarettes in places in which smoking is not allowed. The study underscores the need for continuous monitoring of e-cigarette uptake and for documentation of the underlying reasons for e-cigarette use. Further, it highlights the need to update and clarify the smoke-free laws to avoid confusion and promote compliance.

#### Study II: Reasons for e-cigarette use among current smokers: A focus group study using the Theory of Planned behavior

This study shows that curiosity, created by direct and indirect marketing, motivates adults to try e-cigarettes. Current smokers used e-cigarettes to complement regular cigarette smoking, especially in places where they could not smoke regular cigarettes. Current smokers who use e-cigarettes on a regular basis do, because they believe e-cigarettes are 1) less harmful than regular cigarettes, 2) helpful to satisfy cravings for nicotine and for an oral fixation, and 3) convenient to use even in smoke-free areas. Furthermore, this study revealed that the majority of adults have heard about e-cigarettes through indirect marketing such as word-of-mouth and seeing someone use e-cigarettes.

Study III: Opinions about electronic cigarette use in smoke-free areas among U.S. adults, 2012

A substantial proportion of the U.S. adults were unsure whether e-cigarette use should be allowed in smoke-free public areas. Adults in favor of a policy permitting e-cigarette use where smoking is prohibited tended to be young (aged 18-24), aware of e-cigarettes, ever users of e-cigarettes, and current smoker.

### **Why do adults use e-cigarettes?**

Adults use e-cigarettes for several reasons, mainly to satisfy curiosity, quit smoking, administer nicotine by a reduced harm product, and overcome smoking restrictions. These reasons have been demonstrated in both quantitative and qualitative studies included in this dissertation.

Curiosity, which is created by both direct and indirect marketing of e-cigarettes, motivates adults (irrespective of their smoking status) to try e-cigarettes. This motive was also evident in previous research on smoking initiation (Pierce, et al., 2005). E-cigarettes are currently manufactured and heavily marketed by entrepreneurs as well as big tobacco companies; examples of popular e-cigarette brands include NJOY of Sottera Inc., Blu of Lorillard, and VUSE of R.J. Reynolds. Television and print e-cigarette advertisements contribute to the increasing awareness and use of e-cigarettes. Consistent with previous studies (Pepper, et al., 2014), the findings in this dissertation indicate that indirect marketing, such as word-of-mouth and seeing others use e-cigarettes, especially in smoke-free environments, are instrumental in disseminating information about e-

cigarettes. Furthermore, the newness of the e-cigarettes and the multitude of flavorings elicit curiosity and encourage individuals to try e-cigarettes.

Scientific evidence on whether e-cigarettes assist in smoking reduction and cessation is still lacking (McRobbie, et al., 2012; Odum, et al., 2012; Breland, et al., 2014; Orr, et al., 2014). Current smokers do use e-cigarettes in place of regular cigarettes to satisfy nicotine craving because they believe them to be less harmful. However, recommending e-cigarettes as a “safer” alternative to FDA-approved nicotine replacement therapy is premature. Proponents of e-cigarettes as a harm-reduction tool view them as a superior way to alleviate the withdrawal symptoms especially those caused by nicotine craving and the need for oral fixation (Barbeau, et al., 2013). The act of using e-cigarettes closely mimics smoking regular cigarettes. This similarity was evident in the findings of the qualitative study included in this dissertation. Participants in the focus group study referred to the use of e-cigarettes as “smoking e-cigarettes.” Substituting regular cigarettes with a very similar product and maintaining the same behavior (of smoking) might increase nicotine dependence and hinder the efforts to break the addictive behavior of smoking especially in the absence of supportive behavioral therapy. Integrating behavioral therapy with pharmacotherapy is important for a successful quitting attempt (Weaver, et al., 2014).

Another reason for e-cigarette use among current smokers (dual users) is to satisfy the urge to smoke while in smoke-free venues. Dual users tend to smoke regular cigarettes in places where smoking is allowed such as in their cars, and outside. This was shown in results of results of both qualitative and quantitative studies, and confirmed those of prior studies on reasons for e-cigarettes use (Adkison, et al., 2013). A key

finding of the qualitative study was that current smokers viewed e-cigarettes convenient to use in smoke-free areas because they do not produce smoke nor the distinctive odor associated with smoking regular cigarettes, and therefore they could be used discretely. Smoke-free policies make smoking inconvenient, because smokers have to step outside the building even in uncomfortable weather to satisfy their urge for smoking and their nicotine addiction (Stuber, et al., 2008). The resonant e-cigarettes' marketing messages are focused on bringing smokers back inside and making smoking convenient again. One advertising campaign, used to promote e-cigarettes for use in situations where smoking is not allowed, generated positive reactions among current smokers (see Appendix A). E-cigarettes allow smokers to intake nicotine discretely and conveniently in areas that are traditionally smoke-free.

### **What do U.S. adults think about allowing e-cigarette use in smoke-free public areas?**

Overall, U.S. adults are not supportive of allowing e-cigarette use in smoke-free environments. Our findings show that less than a quarter of adults approve of permitting e-cigarette use in smoke-free venues, and that ever use of e-cigarettes could predict the public opinion toward allowing e-cigarette use in smoke-free venues. Results of the qualitative study included in the dissertation, "Reasons for E-cigarette Use among Current Smokers: A Focus Group Study using the Theory of Planned Behavior," explain and confirm our findings from the quantitative study, "Opinions about Electronic Cigarette Use in Smoke-Free Areas among U.S. Adults, 2012," regarding the public opinions on e-cigarette use in smoke-free areas. Another key finding of this study is that

two in five U.S. adults responded “don’t know” to the question on whether e-cigarette use should be allowed in smoke-free areas. This response mirrored the uncertainty with which individuals perceived the harms and benefits of e-cigarettes. Unlike the case of regular cigarettes, the long-term health effects of e-cigarette use on the user and bystanders are still unknown (Walton, et al., 2014). The “don’t know” responses to the online survey (in paper III) could be explained by the mixed attitudes, in terms of harm perceptions, toward e-cigarette use that emerged in the focus group study. The effects of environmental smoke on health are well established and smoking bans are designed and implemented to protect people from second hand smoke (Hopkins, et al, 2010). Research shows that the level of public support for smoking bans is positively related to the knowledge of the dangers of second hand smoke (Li, et al., 2010; Hyland, et al., 2012). By the same token, the lack of definitive evidence regarding the safety of second hand vapor (exhaled vapor) (Grana, et al., 2014) might explain why 40% of U.S. adults expressed uncertainty. As new scientific information becomes available, opinions concerning e-cigarette use in smoke-free areas may change, and these changes in opinions warrant close monitoring.

E-cigarette use in smoke-free areas raises public health concerns. Allowing e-cigarette use in smoke-free areas could undermine comprehensive tobacco control strategies. Smoke-free policies protect non-smokers from the harmful effects of secondhand smoke, and change attitudes toward smoking, which in turn contribute to the reduction in smoking initiation and to the increase in smoking cessation (Hopkins, et al., 2010; Hyland, et al., 2012). Current smokers might use e-cigarettes because their families and friends approve of them. This approval was manifest in the quantitative study on

reasons for e-cigarette use, which showed that a small number of current smokers indicated ever using e-cigarettes because they were more acceptable to non-smokers. Furthermore, the qualitative study showed that current smokers were influenced by positive subjective norms about e-cigarette use. This suggests that e-cigarettes could be evading the stigma attached to regular cigarettes. Stigma is defined “as the negative labels, pejorative assessments, social distancing and discrimination that can occur to individuals who lack power deviate from group norms” (Stuber, et al., 2008, p421). Social norms regarding smoking can be seen as stigmatizing smoking, and in turn influencing an individual’s decision to smoke. Smoke-free policies have contributed to the denormalization of smoking by creating a disapproving social environment and removing social desirability of smoking (Hammond, et al., 2006). Some current e-cigarette marketing campaigns are specifically designed to reverse these social norms and embrace e-cigarette use “everywhere” as the new norm. An example of this theme has been used to market Fin e-cigarettes for use indoors. Future research needs to focus on understanding whether the stigma associated with tobacco use would extend to e-cigarette use and whether social approval of e-cigarettes would re-normalize tobacco smoking.

### **Strengths and limitations**

This dissertation adds to the limited body of knowledge available on e-cigarette use, and the associated beliefs and attitudes among U.S. adults. The use of mixed (qualitative and quantitative) research methods allowed for better understanding of the reasons for e-cigarette use and the U.S. adults’ beliefs and attitudes regarding e-cigarette use in smoke-free areas.

However, the dissertation was not free of limitations. First, the data used in this dissertation did not allow for ascertaining whether those who ever tried e-cigarettes became current e-cigarette users. Second, because the study was cross-section, it was difficult to determine whether former smokers tried e-cigarettes before or after quitting smoking regular cigarettes. Third, the participants in the qualitative study were not among the sample of U.S. adults who responded to the survey used in the two quantitative studies. In addition to these limitations, study specific limitations were described in detail in the discussion sections of each paper.

### **Directions for future research**

The current findings suggest the need for further studies to explore the patterns of e-cigarette use among current (dual users), former, and never smokers. Future research is needed to describe the scenarios of e-cigarette use, its social acceptability, and public opinion about whether e-cigarette should be exempt from smoking restrictions in public areas. Research should also focus on developing and testing urgently needed definitions and measures used to estimate the prevalence of dual use, current e-cigarette use, and the attitudes of U.S. adults about their use in smoke-free areas.

In this research, e-cigarette use was perceived as less harmful than smoking regular cigarettes. This finding merits further research to define and standardize the harm perception measures to estimate both the perceived absolute and relative harms of e-cigarette use on users and bystanders. Furthermore, future studies need to address the impact of marketing claims related to e-cigarettes' usefulness to quit smoking and reduce

harm on the social acceptability of their use and public opinion about allowing their use where smoking is currently prohibited.



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## APPENDICES

APPENDIX A: E-Cigarette Advertisement



**APPENDIX B: Screener for eligibility to enroll in the focus group study**

## Focus Groups Screener Questions for GSU E-cigarette Focus Group – Current Smokers

1. What is your current age? **[Do not read list]**

- |          |                          |                  |
|----------|--------------------------|------------------|
| Under 18 | <input type="checkbox"/> | <b>Terminate</b> |
| 18-24    | <input type="checkbox"/> | <b>Record</b>    |
| 25-34    | <input type="checkbox"/> | <b>Record</b>    |
| 35-49    | <input type="checkbox"/> | <b>Record</b>    |
| 50 +     | <input type="checkbox"/> | <b>Record</b>    |

2. Have you ever used an e-cigarette even once?

- |          |                          |                  |
|----------|--------------------------|------------------|
| Yes..... | <input type="checkbox"/> | <b>Continue</b>  |
| No.....  | <input type="checkbox"/> | <b>Terminate</b> |

3. Have you smoked at least 100 cigarettes in your entire life?

- |          |                          |                  |
|----------|--------------------------|------------------|
| Yes..... | <input type="checkbox"/> | <b>Continue</b>  |
| No.....  | <input type="checkbox"/> | <b>Terminate</b> |

4. What is your total annual household income? **[Do not read list] Recruit a mix**

- |                          |                          |                  |
|--------------------------|--------------------------|------------------|
| Less than \$20,000.....  | <input type="checkbox"/> |                  |
| \$20,000 - \$50,000..... | <input type="checkbox"/> |                  |
| \$61,001 - \$80,000..... | <input type="checkbox"/> |                  |
| \$81,000- \$100,000..... | <input type="checkbox"/> |                  |
| \$100,000+.....          | <input type="checkbox"/> |                  |
| Don't know/Refused ..... | <input type="checkbox"/> | <b>Terminate</b> |

5. Have you ever participated in a focus group or been paid to be part of a discussion group?

- |          |                          |                   |
|----------|--------------------------|-------------------|
| Yes..... | <input type="checkbox"/> | <b>Continue</b>   |
| No.....  | <input type="checkbox"/> | <b>Skip to Q7</b> |

6. How recently did you participate in a focus group?

- Less than 6 months ago     [ ]     **Terminate**
- 6 months ago or longer     [ ]     **Continue**

7. Record Gender—DO NOT ASK UNLESS UNABLE TO TELL.

- Female.....     [ ]     **Continue**
- Male .....     [ ]     **Continue**

8. What is your race?     **(READ LIST. ACCEPT MULTIPLE ANSWERS.)**

- Black or African American .....     [ ]     **Recruit a mix**
- White.....     [ ]
- Hispanic.....     [ ]
- Other .....     [ ]

9. What is the highest level of education you have completed? **[Do not read list]**

- High school graduate or less.....     [ ]     **Recruit a mix**
- Some vocational or technical school.....     [ ]
- Some college .....     [ ]
- College graduate, Post graduate education (e.g., Master’s degree, MBA, law degree, PhD).....     [ ]

10. Do you now smoke cigarettes, every day, some days, or not at all?

- Every day     [ ]     **Continue ... include in current smoker focus group**
- Some days     [ ]     **Continue... include in current smoker focus group**
- Not at all     [ ]     **Skip to Former smokers screener**

**Cigarette and E-Cigarette Background Questions (to be asked of participants prior to the focus groups)**

11. How old were you when you started smoking?

12. Do you now smoke cigarettes every day or some days?     Everyday [ ]

Some days [ ]



13. On the days you smoke, what is the average number of cigarettes you smoke a day?

14. Do you want to quit smoking? Yes [ ] No [ ]

15. Have you tried to quit smoking before? Yes [ ] No [ ]

a. If answer is yes, how many times have you tried to quit smoking?

16. During the past 12 months, have you stopped smoking for one day or longer because you were trying to quit smoking? Yes [ ] No [ ]

17. What best describes your intentions regarding quitting smoking? Would you say you...?

a. Never plan to quit [ ]

b. Will quit in the next 7 days [ ]

c. Will quit in the next month [ ]

d. Will quit in the next 6 months [ ]

e. Will quit in the next year [ ]

18. When did you first try an e-cigarette? Month \_\_\_\_\_ Year \_\_\_\_\_

19. Have you used e-cigarettes in the past 30 days? Yes [ ] No [ ]

20. On average, how often do you use e-cigarettes?

a. Every day [ ]

b. 2-5 times a week [ ]

c. Once a week [ ]

d. Once every two weeks [ ]

e. Once a month [ ]

21. During the past 30 days, have you used e-cigarettes, in situations where you could not smoke? Yes [ ] No [ ]

22. What nicotine level cartridges do you usually use? 0mg 8mg 16mg 24 mg other?

23. Have you ever used regular cigarettes and e-cigarettes on the same day? Yes [ ] No [ ]

a. If the answer is yes, how often do you use regular cigarettes and e-cigarettes on the same day?

Every day [ ] some days [ ] never [ ] don't know [ ]

## **APPENDIX C: Moderator guide**

## **Moderator guide**

### **E-cigarette Focus Group: Current smokers (12:00, 2:00)**

#### **Introduction to Group Process and Procedures (5 Minutes)**

Thank you very much for agreeing to participate in this focus group. My name is \_\_\_\_\_ and I will guide us through the conversation. Before I get us started by having you introduce yourselves, I'd like to go over just a couple of things with you.

I'm here on behalf of a group that is interested in learning about your opinions and experiences with e-cigarettes. In the next hour and a half, I am going to ask you a variety of questions. We are interested in all of your opinions. We also have a lot of questions, so I may need to move us along occasionally. Please don't take this personally; it's just part of the process.

#### ***Review and discuss ground rules:***

- A. You have been asked here to offer your views and opinions; participation from everyone is important
- B. We will record the groups so we don't miss what is said
- C. There will be observers watching the discussion from behind the one-way mirror in order not to disturb the conversation. They are members of our team helping with the research
- D. Please speak one at a time
- E. No side conversations
- F. There are no right or wrong answers. It is OK to be critical. If you dislike something or disagree with something that is said, I want to hear about it – you won't hurt my feelings or get me fired from my job
- G. All answers are kept private, so feel free to speak your mind
- H. The group does not need to agree on everything – you can voice a different opinion
- I. Your comments and information will be kept completely private and your name will not be associated with the focus group or research in any way
- J. To complete our session in a timely manner, we ask that you please turn off your cell phone.

[ANSWER ANY QUESTIONS FROM PARTICIPANTS AT THIS POINT]

**Opening question/ ice breaker** (is not a discussion question, but to encourage everyone to talk early in the group): e.g. Tell us how long you have lived in Atlanta and your favorite leisure time activity in the metro area

**Introductory question** (introduce the topic and get people thinking about it): e.g.

- *Moderator Note: Use word association to elicit gut-level responses to the following questions. On one blank sheet of flip chart write the word “cigarette”. Direct the group to say the first things that come to their minds when they see the word on the page, then remove the cover sheet and show the word. Moderator should write all of the words/phrases shared during this free flowing conversation. Repeat on a new page using the term “e-cigarette”. What is the first thing that comes to your mind when you hear the term e-cigarette?*

**Transition question** (moves the conversation into key questions that derives the study, i.e. study objectives):

*Moderator Note: Provide each participant with a notepad of paper. Instruct them in the following: Imagine Hollywood was going to make a movie about the first time you tried an e-cigarette. Please take a few minutes to write the story on the pad in front of you. Allow 5-10 minutes for this activity, when it appears all are complete, ask for volunteers to share their story. Use the following questions to probe and learn more about their first experience using e-cigarettes.*

- Tell me about your first experience using e-cigarettes (Probe: where were you? Who were you with? What prompted you to try? etc)?
- Probing question: Do you remember how you first heard about or became aware of e-cigarettes?

### **Key questions**

#### **Reasons for use of e-cigarette among current smokers**

- Why did you use e-cigarettes?
- Where and when do you typically use e-cigarettes (e.g., work? home? social settings?)
- Are there times or places that you are more likely to use e-cigarettes?
- How do your e-cigarette and traditional cigarette choices interact?
- Have you been asked about e-cigarettes? What do people typically ask? How do you respond?
- What do you see as the benefits of e-cigarettes?
- What are the down sides to e-cigarettes?
- What do you think of e-cigarettes' cost compared to traditional cigarettes?
- What are your plans for continuing or ending your e-cigarette use? Why?
- What words do you use to describe your cigarette use? E-cigarette use?  
(Probe: smoking? Vaping?)

**Probe:** If dual use did not come up in the discussion, ask if participants have used e-cigarettes and regular cigarettes on the same day? Why did they use both on the same day?

### **Beliefs about e-cigarette and harm perception among current smokers**

- What role does health play in your decision to smoke traditional cigarettes? e-cigarettes? If yes, how?
- How do you compare the potential harm of e-cigarettes to traditional cigarettes? (Probe: can you tell me what in a word or two what does the term “harm” mean to you?)
- Have you sought information about the health effects of e-cigarettes?  
**Probe:** Where did you get this information?
- What sources do you trust for information about health?

### **Views on using e-cigarette in areas where smoking is prohibited**

- How do you feel about e-cigarette use in public areas where smoking is prohibited?
- Do you use e-cigarettes in areas where traditional cigarette smoking is prohibited? What were the reactions of others?

### **Additional areas of interest: effect of marketing and pricing on decision to use**

- Have you seen advertisements for e-cigarettes? Where? What can you tell me about them? What was your first reaction to these advertisements?
- I’m going to show you some e-cigarette advertisements. I’d like you to put them in order from most interesting to least interesting to you. *Once*

*participants have completed this ranking activity, will ask each to share the order then ask the following questions:*

- Why did you select the one as most interesting? What stood out most to you? What grabbed your attention?
- Is this the advertisement that would also be the most compelling for trying an e-cigarette? If not, which one and why?
- Have you seen traditional cigarettes' ads? How do e-cigarette' ads differ from the traditional cigarettes' ads?

**Ending questions** (ask about views regarding e-cigarette):

- Anything else you'd like to say?
  - Questions that you don't have answers for?

Additional areas of interest if time permits

- Compare mental satisfaction and physical satisfaction you get from vaping to smoking.
- Explore concept of "how tense or relaxed does e-cigarette use make you feel." Are those the best terms to use or best way to conceptualize feelings evoked by e-cig use?
- Relatedly, what terms do they use for ENDS? Do they use e-cigs or some other term How harmful do you think nicotine is?
- Explore thoughts on liquid nicotine and nicotine tanks: awareness, use, perceptions of risk/dangers.



## **APPENDIX D**

### **Focus Group Study: IRB approval**



INSTITUTIONAL REVIEW BOARD

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February 10, 2014

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Co-Investigators: Michael Eriksen, Melissa Taylor, Carrie Whitney

Student PI: Ban Marjeed

Protocol Department: Public Health

Protocol Title: Reasons for use and harm perceptions of electronic cigarette: qualitative study

Submission Type: H14189

Review Type: Expedited, Category 6, 7

Approval Date: February 10, 2014

Expiration Date: February 9, 2015

The Georgia State University Institutional Review Board (IRB) reviewed and approved the above referenced study in accordance with 45 CFR 46.111. The IRB has reviewed and approved the research protocol and any informed consent forms, recruitment materials, and other research materials that are marked as approved in the application. The approval period is listed above. Research that has been approved by the IRB may be subject to further appropriate review and approval or disapproval by officials of the Institution.

Federal regulations require researchers to follow specific procedures in a timely manner. For the protection of all concerned, the IRB calls your attention to the following obligations that you have as Principal Investigator of this study.

1. For any changes to the study (except to protect the safety of participants), an Amendment Application must be submitted to the IRB. The Amendment Application must be reviewed and approved before any changes can take place
2. Any unanticipated/adverse events or problems occurring as a result of participation in this study must be reported immediately to the IRB using the Unanticipated/Adverse Event Form.
3. Principal investigators are responsible for ensuring that informed consent is properly documented in accordance with 45 CFR 46.116.