

ABSTRACT

Title of dissertation: AN INVESTIGATION OF THE PREDICTORS AND PERCEPTIONS OF FLAVORED E-CIGARETTE USE AND LOCAL FLAVORED E-CIGARETTE SALES RESTRICTIONS IN THE UNITED STATES

Cen Chen, Doctor of Philosophy, 2018

Dissertation directed by: Research Professor, Dina L.G. Borzekowski, Department of Behavioral and Community Health

Electronic cigarettes, or e-cigarettes, with appealing flavors are extremely attractive to youth and young adults, and an increase in the prevalence of flavored e-cigarette use among these groups has been observed in recent years. Much remains to be learned about the personal characteristics and individual perceptions of flavored e-cigarette use among young adults, as well as the potential influence of existing flavored e-cigarette sales restrictions on preventing youth use of e-cigarettes. Based on the Social Ecological Model, this study investigated the intrapersonal, community, and public policy factors that play a role in flavored e-cigarette use among youth and young adults in the U.S. This dissertation (1) analyzed secondary data of 12,383 U.S. young adults using the wave 1 and 2 surveys (2013–2014 and 2014–2015) of the Population Assessment of Tobacco and Health (PATH) Study; (2) analyzed in-depth interview data collected from 25 young adult cigarette smokers; and (3) examined the content of 121 local flavored e-cigarette sales restrictions. In Study 1, the results show that younger age, female gender, education attainment of high school and above, non-cigarette smoking, and diminished harm perception about e-cigarettes were the prospective predictors of non-tobacco and non-menthol flavored e-cigarette use among young adults. In Study 2, qualitative findings suggest

that many young adult cigarette smokers held positive attitudes and beliefs about the role of e-cigarette flavors in smoking reduction. In Study 3, content coding results showed that among all the localities with flavored e-cigarette sales restrictions, 117 (96.7%) applied the restriction to the entire jurisdiction, 11 (9.1%) restricted the sale of menthol flavors, and 16 (13.2%) restricted the sale of flavored e-cigarettes in retail tobacco stores. Compared to the localities that enacted lax restrictions, those with strict or moderate restrictions were more likely to have low adult cigarette smoking prevalence. Findings from this study can help develop interventions and campaign messages to prevent and reduce e-cigarette use among youth and young adults. This study can also be used to inform public health practitioners regarding the strategies to strengthen and expand flavored e-cigarette sales restrictions to curb e-cigarette use among younger generations.

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IN THE UNITED STATES

by

Cen Chen

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Advisory Committee:

Research Professor Dina L.G. Borzekowski, Co-Chair
Associate Professor Kerry M. Green, Co-Chair
Associate Professor Amelia M. Arria
Associate Professor Craig S. Fryer
Associate Professor Jie Chen

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Dedication

This dissertation is dedicated first and foremost to the participants who shared their opinions and candid thoughts during the in-depth interview study. Also, to my loving husband, Will Sankey, who inspired and encouraged me to pursue my dreams.

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CHAPTER ONE: INTRODUCTION

1.1. Background

In recent years, non-cigarette tobacco products (NCTPs), especially electronic cigarettes (e-cigarettes), have become increasingly popular among youth and young adults. By 2015, about 16% of youth in the U.S. were current users of e-cigarettes (Singh, 2016), and from 2013 to 2014, e-cigarettes were the second and first most commonly used NCTPs by young adults aged 18–24 (13.1%) and 25–29 years old (11.1%), respectively (Bonhomme et al., 2016). One of the most important attributes of e-cigarettes is their flavor variety, which usually includes candy, fruit, wine, dessert, tobacco, and mint. Youth and young adults are attracted to e-cigarettes with various sweet flavors that taste like fruit, candy, and desserts. By 2013–2014, about 85% of youth e-cigarette users had adopted e-cigarettes that taste like flavors other than tobacco (Ambrose et al., 2015). One recent study showed that the majority (73%–85%) of young adult e-cigarette users aged between 18–29 years had used flavored e-cigarettes (Bonhomme et al., 2016).

Historically, the tobacco industry has offered flavor additives to enhance the palatability and attractiveness of various types of tobacco products to young people, and thus flavored tobacco products are widely considered to be “starter” products for young users (Stanton et al., 2016). Appealing e-cigarette flavors were found to increase e-cigarette initiation among youth (Kong et al., 2015; Patel et al., 2016) and lead to a higher level of cigarette smoking susceptibility among this group (Chen et al., 2017). Flavors in e-cigarettes were also perceived to maintain e-cigarette use over time. One recent study confirmed that e-cigarette flavorings might contribute to the continued use of e-cigarettes through increasing rewarding and addictive effects of vaping

(Soule et al., 2016). Some researchers even stated their concerns regarding the longitudinal effect of flavored e-cigarette use on prolonging tobacco dual use and increasing nicotine dependence among young adult users (Audrain-McGovern, Strasser, & Wileyto, 2016). Evidence also suggested that flavorings added to tobacco products may reduce “harshness” associated with tobacco use and thus are endorsed by young people who prefer sweet tastes (Stanton et al., 2016). Research further speculated that e-cigarette use, especially with fruity and sweet flavors, might cause nicotine overdose or poisoning when used inappropriately (Chatham-Stephens et al., 2014). Furthermore, e-cigarette flavoring ingredients may potentially have adverse effects on human health such as causing harm to one’s lungs and respiratory systems (Allen et al., 2016; Barrington-Trimis, Samet, & McConnell, 2014; Behar et al., 2013), as well as inducing inhalation toxicity (Leigh et al., 2016).

In order to regulate the ever-changing e-cigarette market, the U.S. Food and Drug Administration (FDA) in 2016 issued a final rule regulating the manufacture, marketing, and sale of e-cigarette products, within the scope of the 2009 Family Smoking Prevention and Tobacco Control Act (the Tobacco Control Act) (U.S. Food and Drug Administration [FDA], 2016). However, unlike the 2009 Tobacco Control Act that banned the sales of flavored cigarettes (except for menthol cigarettes), the new FDA’s rule did not restrict e-cigarettes with characterizing flavors (FDA, 2016). Given that flavored e-cigarette use may result in numerous adverse health consequences to users, especially young people, some researchers and policymakers proposed that e-cigarettes with characterizing flavors should be restricted in the U.S. (Chen et al., 2017; Choi et al., 2012; Harrell et al., 2017a). Thus, in the absence of the federal regulation, many local jurisdictions, such as Chicago and San Francisco, have enacted

flavored e-cigarette sales restriction to limit youth exposure to flavored e-cigarette products with the primary purpose of preventing youth initiation and regular use of e-cigarette products.

1.2. Statement of the Problem

E-cigarettes with appealing flavors, such as fruit and candy flavors, are attractive to youth and young adults, and an increased prevalence of using of flavored e-cigarettes among young people was observed in recent years. Flavored e-cigarette use may pose a wide range of health problems among youth and young adults. For youth, appealing flavors in e-cigarettes invite youth to use e-cigarettes and thus put them at risks of initiating cigarette smoking and developing nicotine addiction. For young adults, flavored e-cigarettes increased the chance of cigarette and e-cigarette dual use and facilitate the establishment of their life-long tobacco use behavior. Thus, timely and effective public health prevention and intervention initiatives to curb the use of flavored e-cigarettes among these groups are highly needed. In order to inform the development of such programs and public health messages, however, we first need to know the factors and characteristics associated with flavored e-cigarette use among the target population. Important information such as which groups of young adults are more likely to use flavored e-cigarettes and what perceptions propel their use of the product are extremely helpful. In the absence of the federal law restricting flavored e-cigarette products, research is also needed to examine existing local flavored e-cigarette sales restrictions in order to inform the advances of flavored e-cigarette-related public policies which may most effectively prevent and reduce flavored e-cigarette use among the vulnerable population.

1.3. Study Overview and Conceptual Framework

This dissertation study addressed the above-mentioned research gaps through (1) identifying the predictors of flavored e-cigarette use among young adults; (2) exploring the

attitudes, beliefs of flavored e-cigarette use and intentions of using flavored e-cigarettes given an e-cigarette flavor ban among young adult smokers; and (3) investigating the strictness of local flavored e-cigarette sales restrictions in preventing youth use of e-cigarettes as well as the community characteristics that predict strictness.

The Social Ecological Model was used to conceptualize the study design (Figure 1). The Social Ecological Model of health behavior change emphasized that health behavior has multiple levels of influences, which often include intrapersonal, interpersonal, organizational, community, and public policy influences (Bronfenbrenner, 1979). One advantage of the Social Ecological Model is that it informs multi-level interventions that should be most effective in changing health behavior. Specifically, the model posits that behavior change can be maximized when environments and policies support healthful choices, when social norms and social support for healthful choices are strong, and when individuals are motivated and educated to make these choices (Glanz et al., 2008).

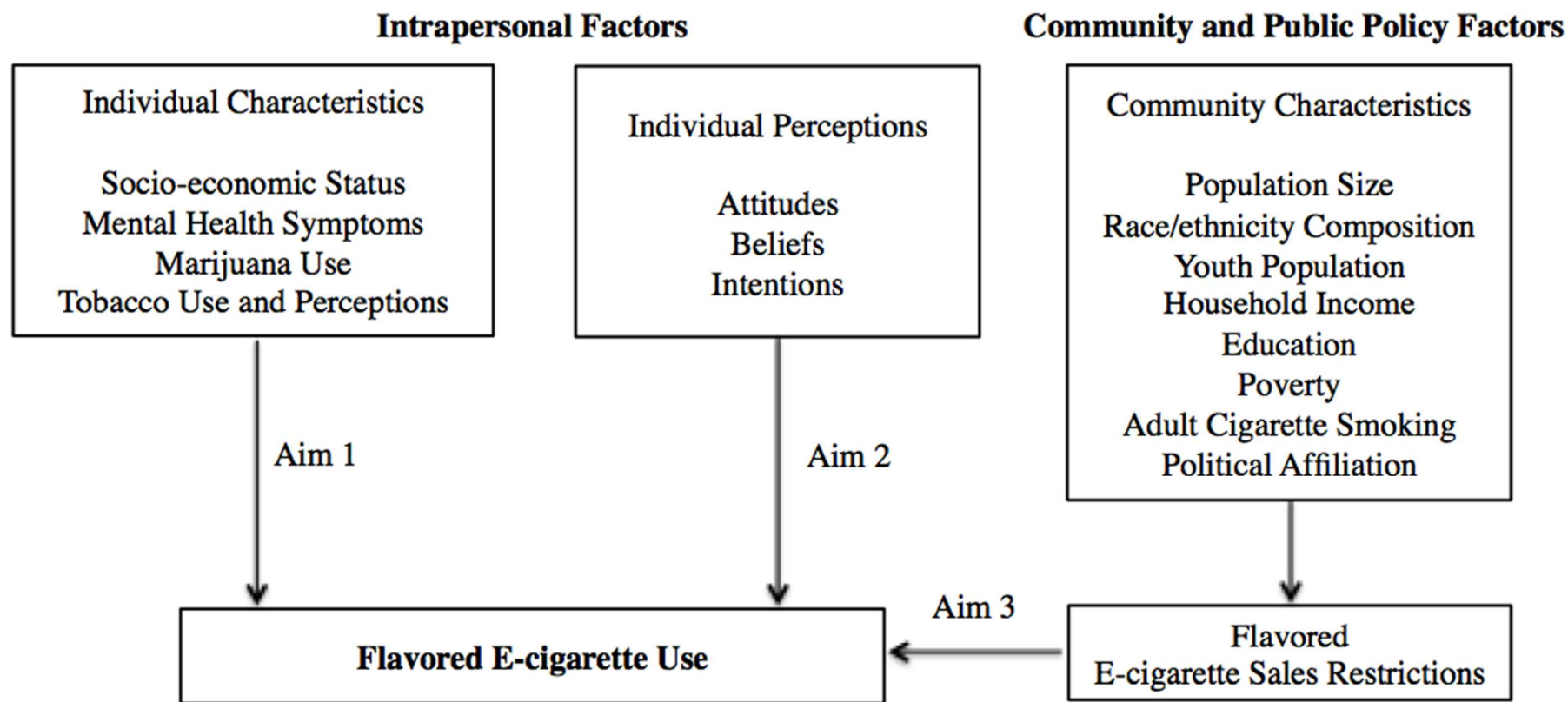


Figure 1. Conceptual Framework

Aim 1 of the study focused on intrapersonal factors related to flavored e-cigarette use. This aim investigated the prospective predictors of flavored e-cigarette use among young adults (n=12,383) over a one-year period using data from waves 1 and 2 surveys of the Population Assessment of Tobacco and Health (PATH) Study. The PATH study involves a nationally representative longitudinal cohort of U.S. youth and adults. Specifically, the study investigated the association between theoretically important predictors at wave 1 (i.e., socio-economic characteristics, mental health symptoms, marijuana use, and tobacco use and perceptions) for flavored e-cigarette use at wave 2 among a nationally representative sample of young adults aged between 18 and 34.

Aim 2 also focused on the intrapersonal level of flavored e-cigarette use. This aim explored the psychological constructs related to young adult cigarette smokers' attitudes and beliefs about flavored e-cigarettes use and their intentions of using flavored e-cigarettes given an e-cigarette flavor ban. A purposive sample of study participants (n=25) living in the Washington D.C. metropolitan area was recruited from a classified advertisement website. The author conducted in-depth interviews to explore the topics related to the above-mentioned perceptions.

Aim 3 focused on the community and public policy levels by: (1) assessing existing local flavored e-cigarette sales restrictions across the U.S. (n=121), (2) classifying the restrictions according to their potential effectiveness in preventing youth use of e-cigarettes, and (3) examining the community characteristics that determine the strictness. The method of classifying the strictness of the restrictions was based on three policy provisions. They relate to whether the restrictions: (1) only targeted retailers within a certain radius of youth-populated areas such as schools, libraries, and parks (i.e., have a "restriction zone"); (2) banned menthol flavors; and (3) banned the sales in retail tobacco stores and/or smoking bars. This aim also investigated the

community characteristics of the localities that have implemented such restrictions to determine which characteristics predicted the strictness of the restrictions.

1.4. Specific Aims and Research Questions

In conjunction with the three research aims, this dissertation addresses seven research questions. Research Aim 1 (research question 1) used quantitative analytical methods and was based on the wave 1 and 2 survey data of the PATH Study. Research Aim 2 (research questions 2–4) was addressed using qualitative data gathered from in-depth interviews among 25 young adult cigarette smokers. Research Aim 3 (research questions 5–7) was addressed by coding the content of existing local flavored e-cigarette sales restrictions and using community characteristics to predict the strictness of the restrictions in preventing youth use of e-cigarettes.

Aim 1: To investigate the prospective predictors (e.g., socio-economics, mental health symptoms, marijuana use, and tobacco use and perceptions) of flavored e-cigarette use among young adults.

Research Question 1: What individual characteristics at wave 1 predict young adults' flavored e-cigarettes use at wave 2?

Hypothesis 1.1: The individual characteristics including socio-demographics, mental health symptoms, marijuana use, and tobacco use and perceptions at wave 1 are associated with increased odds of using e-cigarette use with tobacco and menthol (TM) flavors and non-tobacco and non-menthol (NTM) flavors compared to non-e-cigarette use at wave 2 among young adults.

Hypothesis 1.2: The individual characteristics including socio-demographics, mental health symptoms, marijuana use, and tobacco use and perceptions at wave

1 are associated with increased odds of e-cigarette use with NTM flavors compared to TM flavors at wave 2 among young adults.

Aim 2. To describe young adult smokers' attitudes and beliefs about flavored e-cigarettes and their intention to use flavored e-cigarettes given an e-cigarette flavor ban.

Research Question 2: How do young adult smokers perceive flavored e-cigarettes?

RQ 2.1: What are young adult smokers' positive attitudes and beliefs towards flavored e-cigarettes?

RQ 2.2: What are young adult smokers' negative attitudes and beliefs towards flavored e-cigarettes?

Research Question 3: What are young adult smokers' intentions of using flavored e-cigarettes given an e-cigarette flavor ban?

RQ 3.1: What are young adult smokers' intentions of using e-cigarettes if all e-cigarette flavors except for tobacco flavors are banned?

RQ 3.2: What are young adult smokers' intentions of using e-cigarettes if all e-cigarette flavors except for menthol flavors are banned?

RQ 3.3: What are young adult smokers' intentions of using e-cigarettes if all e-cigarette flavors are banned?

Research Question 4: How do young adult smokers perceive using flavored e-cigarettes to cut down cigarette smoking?

RQ 4.1: What are the positive roles of flavored e-cigarette use in cutting down cigarette smoking?

RQ 4.2: What are the negative roles of flavored e-cigarette use in cutting down cigarette smoking?

Aim 3: To investigate local flavored e-cigarette sales restrictions in the U.S., understand their potential strictness in preventing youth use of e-cigarettes, and investigate the community characteristics that determine the strictness.

Research Question 5: Which U.S. states and localities have enacted sales restrictions on flavored e-cigarettes as of October 1, 2017?

Research Question 6: How are flavored e-cigarette sales restrictions classified according to their strictness in preventing youth use of e-cigarettes?

Research Question 7: Which community socio-economic and tobacco use characteristics predict the strictness of the restrictions?

Hypothesis 7.1: Community characteristics including population size, race/minority composition, and adult cigarette smoking prevalence predict the strictness of local flavored e-cigarette sales restrictions in preventing youth use of e-cigarettes.

1.5. Summary

The adverse health impact of flavored e-cigarette use among youth and young adults has raised tremendous concerns among public health practitioners and researchers. In order to develop evidence-based messages, interventions, and regulations to prevent and reduce the use of flavored e-cigarettes among young people, more information regarding the factors associated with flavored e-cigarettes and how flavored e-cigarettes are perceived and used among this vulnerable group is needed. Additionally, little is known about the potential strictness of local flavored e-cigarette regulations in preventing youth use of e-cigarettes and how young adult smokers perceive the restriction in regards to their future use of e-cigarettes. This dissertation study fills these research gaps by providing important results on intrapersonal factors associated

with flavored e-cigarette use among young adults, their perceptions of flavored e-cigarettes and intentions of using flavored e-cigarettes given an e-cigarette flavor ban, as well as the potential strictness of local flavored e-cigarette sales restrictions for preventing youth use of e-cigarettes.

1.6. Definition of Terms

Attitudes: An individual's positive or negative evaluation of self-performance of the particular behavior (Ajzen, 1991).

Behavioral Intentions: Behavioral intention is defined as a person's perceived likelihood or subjective probability that the person will engage in a given behavior (Ajzen, 1991).

Beliefs: An individual's perceptions about the outcomes or attributes of performing the behavior (Glanz et al., 2008).

Characterizing Flavors: Characterizing flavors are a distinguishable taste or aroma, other than the taste or aroma of tobacco, imparted either prior to or during consumption of a tobacco product, including, but not limited to, taste or aromas of menthol, mint, wintergreen, chocolate, vanilla, honey, cocoa, any candy, any dessert, any alcoholic beverage, any fruit, any herb, and any spice (Tobacco Control Legal Consortium [TCLC], 2017a).

E-liquid or E-juice: Liquid solution vaporized by e-cigarettes that generally consists of water, propylene glycol and vegetable glycerin, nicotine, and flavorings (McQueen, Tower, & Sumner, 2011).

Electronic Cigarettes or E-cigarettes: Electronic cigarettes or e-cigarettes are battery-powered devices that provide doses of nicotine and other additives to the user in an aerosol form (Etter et al., 2011). E-cigarettes are also called e-hookah, hookah pens, vape pens, tanks, mods, and vapes.

Flavored E-cigarettes: E-cigarettes with characterizing flavors that do not taste or smell like traditional tobacco but menthol/mint, fruit, candy, beverages, and other sweet flavors (TCLC, 2017a).

Flavored Tobacco: Tobacco products (including cigarettes, cigars, smokeless tobacco, Hookah, etc.) with characterizing flavors that do not taste or smell like traditional tobacco but menthol/mint, fruit, candy, beverages, and other sweet flavors (TCLC, 2017a).

Nicotine Dependence: A maladaptive pattern of nicotine use that leads to clinically significant impairment or distress (American Psychiatric Association [APA], 1994). It is recognized as a medical condition in the Diagnostic and Statistical Manual (SDM) of the American Psychiatric Association (APA, 1994).

Non-cigarette Tobacco Products (NCTPs): NCTPs also called non-traditional tobacco products or novel tobacco products, are tobacco products other than cigarettes that contain tobacco and/or nicotine concentration (Bonhomme et al., 2016). These tobacco products come in many different forms such as cigars, little cigars, cigarillos, e-cigarettes, Hookah, smokeless tobacco, and pipes.

Non-tobacco and Non-menthol (NTM) Flavored E-cigarettes: E-cigarettes that taste like candy, fruit, desserts, beverage, etc., and do not taste like regular cigarettes (tobacco flavors) or menthol cigarettes (mint flavors).

Social Ecological Model (SEM): Bronfenbrenner's socio-ecological framework illustrates the intersecting systemic influences that affect human behavior (Bronfenbrenner, 1979). The elements of the ecological environment comprise Microsystem (e.g., socio-demographic characteristics, and individual attitudes, knowledge, and beliefs), Mesosystem (e.g., social support, and interpersonal relationships), Exosystem (e.g., organizational and community

resources, and media), and Macrosystem (e.g., cultural values, customs, and laws) (Bronfenbrenner, 1979).

Tobacco and Menthol (TM) Flavored E-cigarettes: E-cigarettes that taste like regular cigarettes/tobacco or menthol cigarettes/mint.

Vaping: A behavior defined by inhaling the vaporized solution from an e-cigarette. Thus, a vaper is one who vapes (McQueen et al., 2011).

Young Adults: The term “young adult” in this study reflects non-institutionalized adults between the ages of 18–34 years residing in the U.S. This age group definition has been used in previous studies investigating tobacco use and e-cigarette use (Cantrell et al., 2016; Green et al., 2007; Rath et al., 2015).

Youth: The term “youth” in this study refers to individuals between the ages of 11–17.

CHAPTER TWO: LITERATURE REVIEW

This chapter describes what is currently known about the use and perceptions of flavored e-cigarettes among youth and young adults, the factors associated with flavored e-cigarette and tobacco use, the relationship between flavored e-cigarette use and cigarette smoking, as well as the rationale for flavored e-cigarette sales regulations in the U.S. This chapter also identifies the gaps in the literature concerning each relevant topic. The first section describes flavored e-cigarette use and perceptions among youth and young adults in the U.S.; the second section discusses the factors and predictors of flavored e-cigarette and tobacco use among young adults; the third section provides an overview of the research on the relationship between flavored e-cigarette use and cigarette smoking behaviors; the fourth section summarizes the literature on risks and harm associated with flavored e-cigarette use; and the final section introduces the rationale for flavored e-cigarette sales restrictions in the U.S. and the community characteristics that predict the enactment of local tobacco regulations. The conclusion highlights literature gaps related to the topics discussed in this chapter.

2.1. Flavored E-cigarette Use and Perceptions Among Youth and Young Adults

2.1.1. Flavored E-cigarette Marketplace in the U.S.

One of the most important attributes of e-cigarettes is their flavor variety, which includes candy, fruit, wine, dessert, tobacco, and mint, etc. The advancement of different e-cigarette types has facilitated the spread of flavored e-cigarettes. In the tobacco industry, nowhere is the use of flavorings more prevalent than in the production and marketing of e-cigarettes. Numerous studies have observed a large and increasing number of e-cigarette flavors available in the U.S. market. Since e-cigarettes were introduced into the U.S. market in 2006, the product has developed from disposables to pre-filled cartridges and from unmodified to modified refillable

tanks. The advances make flavor mixing and switching between different flavors easy. Studies found that e-cigarette users who used the newer forms of e-cigarettes were more likely to either consider flavor variety an important product feature (Patel et al., 2016; Yingst et al., 2015) or use flavors that did not taste like tobacco (Chen, Zhuang, & Zhu, 2016). Specifically, a 2012–2014 Internet survey found that, in order to obtain a better taste, 91% of adult users modified their liquids by adding flavors (Etter, 2016). These results indicated that as e-cigarette products become more personalized, users might experiment with and/or regularly use a greater number and variety of flavors over years.

The popularity of flavored e-cigarettes in the U.S. marketplace has grown in recent years. One study, which looked at flavors sold on e-cigarette brand websites from 2012 to 2014, found that almost 8,000 e-cigarette flavors were available, with 241 new flavors being introduced each month (Zhu et al., 2014). The study also found that newer brands were more likely than older brands to offer many flavors. Additionally, a study identified a total of 27,638 unique flavor-related posts on a popular forum website (Reddit) and found that “fruit-flavors” were mentioned most often (N=15,720) compared to other flavors (Wang et al., 2015). This study also observed that from 2012 to 2015, the number of posts about fruit-flavored e-cigarettes on Reddit grew six-fold. E-cigarette sales data also offer important information regarding the popularity of flavored e-cigarettes. Giovenco and colleagues (2015) examined data from e-cigarette sales in convenience stores, drug stores, grocery stores, and mass merchandisers in the U.S., and found that fruit and candy-flavored products experienced substantial growth from 2012 to 2013. Altogether, these studies do not simply confirm that e-cigarettes are growing in popularity, but also suggest that any attempt to understand their use must recognize the integral market appeal of added flavors.

2.1.2. E-cigarette Use Prevalence among Youth and Young Adults

E-cigarettes are popular among youth and young adults, and the prevalence of e-cigarette use among these groups has increased considerably over the past five years. By 2015, about 16% of youth in the U.S. currently used e-cigarettes (Singh, 2016), and from 2013 to 2014, e-cigarettes were the second and first most commonly used NCTPs by young adults in the 18–24 (13.1%) and 25–29 (11.1%) age groups (Bonhomme et al., 2016). In 2013, a U.S. nationally representative survey estimated that the prevalence of “every day” and “some days” e-cigarette use among adults aged 18–24 and 25–44 ranges from 5.5% to 8.6% and 4.4% to 5.5%, respectively (Hu, 2016; McMillen et al., 2015).

E-cigarettes also gained increased popularity among adult smokers since entering the market. Several nationally representative surveys have estimated the prevalence of e-cigarette use among adult cigarette smokers in the U.S. From 2013–2014, about 51% of current adult smokers had tried e-cigarettes (Weaver et al., 2016), and about 21.0% to 25.7% of smokers concurrently used e-cigarettes (Bonhomme et al., 2016; Weaver et al., 2016). E-cigarette use prevalence is even higher among young adult smokers. A cross-sectional study examined e-cigarette use prevalence using a convenience sample (N=1,142 in 2011, N=1,149 in 2013) of young adult bar patrons (ages 18–26) from Albuquerque, New Mexico between 2011 and 2013. The study found that e-cigarettes were the most popular form of tobacco product used by young adult cigarette smokers between 2012 and 2013 (Kalkhoran et al., 2015). The study also found that, from 2011 to 2013, among young adult smokers and non-smokers, the prevalence of past-30-day e-cigarette use increased from 20% to 49% and 2% to 11%, respectively.

2.1.3. Attractiveness of E-cigarette Flavors to Youth and Young Adults

Existing literature suggests that flavors play an integral role in the growing appeal of e-cigarettes among youth and young adults. Empirical evidence shows that young people have a strong preference towards sugar (Desor & Beauchamp, 1987), and flavored e-cigarettes usually taste and smell like sweet fruits, candies, and desserts. Non-cigarette flavored tobacco product, including flavored e-cigarettes, are usually packaged in bright colors to look like candy (Villanti et al., 2013). Furthermore, youth and young adults often perceive “candy and sweet-flavored” e-cigarettes as being less harmful than “tobacco-flavored” or “non-flavored” e-cigarettes (Cooper et al., 2016; Czoli et al., 2015). For example, an online discrete choice experiment conducted among 915 Canadians showed that youth and young adults considered “cherry, coffee, and menthol-flavored” e-cigarettes to be less harmful than “tobacco-flavored” e-cigarettes, while on the other hand, older adults perceived “tobacco-flavored” e-cigarettes to be less dangerous (Czoli et al., 2015). A crossover experiment was conducted among 20 young adult vapers to determine whether sweet flavorings affect e-cigarette appeal (Goldenson et al., 2016). The study found that e-cigarettes with sweet flavorings enhanced product appeal compared to those that were non-sweet and non-flavored. Another discrete choice experimental study found that young adult smokers were significantly more likely to purchase e-cigarettes when multiple flavors were available compared to older adult smokers (Pesko et al., 2015).

2.1.4. Flavored E-cigarette Use Prevalence Among Youth and Young Adults

By 2013–2014, about 85% of youth e-cigarette users had adopted e-cigarettes that taste like flavors other than tobacco (Ambrose et al., 2015). One recent study showed that 68% of adult, past-30-day e-cigarette users had used flavored e-cigarettes, while about 85% and 73% of young adult users aged between 18–24 and 25–29 years, respectively, had used flavored e-

cigarettes (Bonhomme et al., 2016). The researchers of this study found that “Fruit” and “candy, chocolate, and other sweet” flavors are especially popular among young adult e-cigarette users, and compared to older adults, young adults are more likely to use flavored e-cigarettes. One online survey conducted by Shiplo and colleagues (2015) examined flavors used by older youth and adults (aged 16–24) in Canada. The study found that the prevalence of flavored e-cigarette experimentation (ever use) was significantly higher for younger adult smokers (84.6%) than older adult smokers (64.2%).

2.2. Factors Associated with Flavored Tobacco and Flavored E-cigarette Use

2.2.1. Factors Associated with Flavored Tobacco Use

A great amount of research has focused on exploring the predictors of using flavored tobacco in general. These tobacco products may include cigarettes, cigars, smokeless tobacco, and Hookah, etc. Mainly, these studies suggest that young age (King et al., 2016; Rath et al., 2016; Smith et al., 2016; Villanti et al., 2013), female gender (Delnevo et al., 2015; King et al., 2013; Kostygina et al., 2016; Smith et al., 2016; Villanti et al., 2013), African American race (Delnevo et al., 2015; Kostygina et al., 2016; Smith et al., 2016; Sterling et al., 2016; Villanti et al., 2013), LGBT sexual identity (Rath et al., 2016), and low income (King et al., 2013; Sterling et al., 2016) predicted flavored tobacco use among adults. Mixed evidence was found regarding education levels as a predictor of flavored tobacco use. One study found that lower educated adults were more likely to use flavored tobacco (Smith et al., 2016), whereas another study showed the opposite trend (Villanti et al., 2013). One study using a national representative sample of young adults also found that mental health status predicted flavored tobacco use. Specifically, young adults with anxiety symptoms were more likely to use flavored tobacco than those without the symptoms (Rath et al., 2016). It is speculated that these differences have

resulted from the tobacco industry's tactics of selling flavored tobacco products to specific population groups (e.g., young people, female, racial/ethnic minorities, etc.).

Research also found that harm perceptions of tobacco products may also influence consumers' choice towards tobacco flavors: non-tobacco flavored tobacco were more likely to be used by those who considered tobacco use as less harmful or with more beneficial outcomes than those who perceived tobacco use more negatively (Ashare et al., 2007; Czoli et al., 2015; Thrasher et al., 2015). Finally, marijuana use status also predicted flavored tobacco use in young adults. One study found that young adults who used marijuana were more likely to use non-tobacco flavored tobacco products than those who did not marijuana (Rath et al., 2016).

2.2.2. Factors Associated with Flavored E-cigarette Use

Research examining the specific predictors of flavored e-cigarette use has mainly focused on the history of smoking cigarettes and cigarette use as predictors of flavored e-cigarette use. Specifically, these studies found that flavored e-cigarette use differs among adults of various smoking status. Evidence consistently suggests that current smokers are more likely to use "tobacco-flavored" or "non-flavored" e-cigarettes, while former and never smokers tend to use "sweet-flavored" or "non-tobacco flavored" e-cigarettes (Dawkins et al., 2013; Farsalinos et al., 2013; Shiffman et al., 2015; Tackett et al., 2015). Some researchers found that cigarette smokers are more likely to use tobacco-flavored e-cigarettes due to the similarity in taste between these two products (Tackett et al., 2015). Additionally, studies found that "former smokers" were more likely to switch between flavors daily and had more positive expectancies towards the "taste" of e-cigarettes than did "current smokers" (Farsalinos et al., 2013; Harrell et al., 2015). One study investigated the association between the use of flavored e-cigarettes and the purpose of e-cigarette use among 189 youth and young adult "established smokers" who were also "ever

users” of e-cigarettes (Camenga et al., 2016). The study found that those who reported the preference of using a combination of two or more flavors had a higher probability of using e-cigarettes for the purpose of smoking cessation even after controlling for e-cigarette use frequencies. Furthermore, one study found that long-time e-cigarette users were more likely to use fruity and candy flavored e-cigarettes than novice e-cigarette users (Tackett et al., 2015). Given the narrow focus of the evidence on the predictors of flavored e-cigarette use, further research is needed to explore the influence of other predictors (e.g., socio-economic characteristics, mental health symptoms, and substance use status) on flavored e-cigarette use in order to inform the e-cigarette use prevention efforts among young people.

2.3. Flavored E-cigarette Use and Cigarette Smoking Behaviors

2.3.1. The Perceptions of Using E-cigarettes for Smoking Cessation

E-cigarettes are often perceived as being a smoking cessation tool, and smokers who intend to quit smoking are likely to turn to e-cigarettes for the purpose of quitting smoking. A national representative survey among current adult cigarette smokers (N=2,254) in the U.S. found that the primary reasons for using e-cigarettes were quitting smoking (58.4%), reducing smoking (57.9%), and reducing health risks (51.9%) (Rutten et al., 2015). Regardless of smoking status, youth and young adults also perceive e-cigarettes as a smoking cessation tool. In multiple studies among youth and young adults, 23%–55% believed that e-cigarettes were safer than regular cigarettes (Choi & Forster, 2013; Goniewicz & Zielinska-Danch, 2012; Sutfin et al., 2013), and 45%–100% believed that e-cigarettes could be used for smoking cessation (Camenga et al., 2015; Choi & Forster, 2013). Moreover, youth and young adults were able to describe different methods of using e-cigarettes for smoking cessation: (1) nicotine reduction followed by

cessation, (2) cigarette reduction/dual use, and (3) long-term exclusive e-cigarette use (Camenga et al., 2015).

Until today, however, no studies have explored young adult smokers' positive or negative attitudes and beliefs towards flavored e-cigarettes, their intentions of using flavored e-cigarettes given a flavored e-cigarette ban, as well as whether they believe flavored e-cigarettes help them cut down on cigarette smoking. Thus, little is known if young adult smokers perceive flavored e-cigarette use as having more benefits than harm or vice versa; nor do we know if e-cigarettes with certain flavors are more helpful in cutting down smoking than other flavors. Without this information, public health practitioners and policymakers may lack the knowledge and evidence to develop messages, programs, and policies for reducing the harm associated with e-cigarette use and assisting smoking cessation among young adult smokers.

2.3.2. The Influence of E-cigarette Use on Cigarette Smoking

In recent years, evidence showed that e-cigarettes are a healthier and safer alternative to cigarette smoking, producing much less harm to one's health and the surrounding environment. Completely or partially switching to e-cigarettes from smoking cigarettes also reduces nicotine dependence (Farsalinos & Polosa, 2014; Nutt et al., 2014). One study found that current e-cigarette users reported being less dependent on e-cigarettes than they retrospectively reported having been dependent on cigarettes prior to switching (Foulds et al., 2015). However, definitive conclusions supporting e-cigarettes' effectiveness for smoking reduction or cessation are absent due to mixed evidence and a lack of high-quality studies (Grana, Popova, & Ling, 2014; Kalkhoran & Glantz, 2016; Malas et al., 2016; Vickerman et al., 2013). A recent systematic review article regarding e-cigarettes' impact on smoking cessation concluded that, at present, there are simply "too few well-designed studies" to establish a strong body of evidence (Malas et

al., 2016). The recently published report on the public health consequences of e-cigarettes also highlighted that there is insufficient evidence to permit a definitive conclusion that e-cigarettes serve as cigarette smoking cessation aids (National Academies of Sciences, Engineering, and Medicine [The National Academies], 2018).

As stated above, mixed evidence showed that e-cigarettes may or may not be an effective tool for smoking cessation. First, a number of studies have suggested that e-cigarettes help with smoking cessation. For example, a two-year prospective study surveyed adults in two U.S. metropolitan areas (N=695) with probability sampling (Biener & Hargraves, 2015). The study categorized e-cigarette users as intensive users, intermittent users, triers, and non-users. The results showed that the intensive users were six times as likely as non-users and triers to report smoking cessation at the follow-up. In another example, Brown and colleagues (2014) used a large representative sample of British adults (N=5,863) who had smoked within the previous 12 months and made at least one quit attempt. The study found that e-cigarette users were more likely to report abstinence than either those who used nicotine replacement therapies bought over-the-counter or those who used no aid.

Conversely, other studies suggested that e-cigarettes might not be effective in reducing or quitting smoking. For example, one longitudinal study followed 6,652 adults for 26 weeks in Canada (Zawertailo et al., 2016). The study found that among the 18.1% participants who reported using e-cigarettes, e-cigarette use was negatively associated with smoking abstinence results at follow-up. Similarly, a one-year prospective study examined cigarette smoking behavior among 1,000 “established cigarette smokers” in California (Al-Delaimy et al., 2015). The study revealed that, compared to smokers who never used e-cigarettes, smokers who had ever used e-cigarettes were significantly less likely to decrease cigarette consumption and to quit

for 30 days or more at follow-up. Additionally, a focus group study among 128 youth and young adults found that although many participants perceived e-cigarettes to be a product for smoking reduction and cessation when discussing their personal experiences, they denied that e-cigarettes were successful in helping smokers quit (Camenga et al., 2016). Finally, a randomized control trial among 657 cigarette smokers found that the mean cigarette consumption decreased by two cigarettes per day more among cigarette smokers using nicotine-contained e-cigarettes than the smokers using nicotine patches ($p=0.002$) (Bullen et al., 2013). However, biochemically verified continuous abstinence rate after six months among the smokers who used nicotine-contained e-cigarettes (7.3%) was not statistically higher than those who used nicotine patches (5.8%) or placebo e-cigarettes (4.1%).

2.3.4. The Influence of Flavored E-cigarette Use on Cigarette Smoking

To date, only a handful of published studies have specifically examined flavored e-cigarettes' role in influencing one's cigarette smoking behavior. One qualitative study using in-depth interviews among 50 current adult smokers found that some participants reported flavor as an important part of quitting smoking cigarettes (Cooper, Harrell, & Perry, 2016). Several studies also suggested that e-cigarette use with some flavors (e.g., fruit, candy, and menthol) might be helpful in suppressing smoking among adults (Audrain-McGovern et al., 2016; Litt, Duffy, & Oncken, 2016; Tackett et al., 2015). For example, a cross-sectional survey among 215 adult vape shop customers in the Midwestern U.S. asked participants about their current use of e-cigarette flavors and their cigarette smoking abstinence status (Tackett et al., 2015). The study found that using "non-tobacco" and "non-menthol" flavored e-liquid was associated with higher rates of smoking abstinence. However, due to the cross-sectional study design, this study could

not infer the temporal or causal relationship between flavored e-cigarette use and smoking cessation.

One recently published experimental study also provided evidence on the effects of flavored e-cigarette use on cigarette smoking reduction (Litt et al., 2016). The study examined the influence of e-cigarette flavors on cigarette smoking over six weeks. In this study, researchers assigned five flavor conditions (e.g., no flavor, tobacco, chocolate, mint, and cherry) to 88 adult smokers and found that e-cigarette flavors had a significant effect on suppressing cigarette smoking. Specifically, the largest drop in cigarette smoking was observed among those who used the menthol flavor, while the smallest drop was observed in those who used cherry and chocolate flavors. Over the study period, however, none of the participants, regardless of the e-cigarette flavors used, gave up smoking, potentially due to their established nicotine dependence.

Finally, another recent experimental study examined e-cigarette use satisfaction among cigarette smokers and suggested a way through which flavored e-cigarettes may influence cigarette smoking reduction and cessation (Audrain-McGovern et al., 2016). Researchers found that flavorings in e-cigarettes with nicotine concentration enhanced the rewarding (e.g., “satisfying”) and reinforcing (i.e., motivation to “work for” using e-cigarettes) aspects of e-cigarette use. Specifically, both fruit- and dessert-flavored e-cigarettes were rated as more rewarding than unflavored e-cigarettes, and participants “worked” twice as hard for flavored than unflavored e-cigarettes. Although this study did not directly examine the role of flavored e-cigarettes in smoking reduction and cessation, it suggested that due to the enhanced nicotine-intake experience from using flavored e-cigarettes compared to unflavored e-cigarettes, young adult smokers might be more likely to use flavored e-cigarettes as a substitute for cigarette smoking.

These above-described studies suggest that e-cigarette flavors may play a role in adult smokers' cigarette smoking behavior and the outcomes of smoking reduction and cessation. However, little is known about how flavored e-cigarettes are used among young adult smokers, as well as how its use is associated with young adults' cigarette smoking behavior. This information is needed to inform public health practitioners regarding the evidence-based messages and programs to help young adult smokers quit smoking and reduce the harm and risks associated with multiple tobacco use. Such evidence will also inform policymakers' decisions regarding developing and implementing flavored e-cigarette regulations in U.S.

2.4. Risks and Harm of Using Flavored E-cigarettes

2.4.1. Role of Flavored E-cigarettes in E-cigarette Initiation and Maintenance

The tobacco industry offers flavor additives to enhance the palatability and attractiveness of their products to young people. Flavored tobacco products are widely considered to be “starter” products for young users and may encourage experimentation or reduce “harshness” associated with tobacco use and nicotine intake (Stanton et al., 2016). Although the tobacco and e-cigarette industries have refuted the assertions that flavors are aimed toward younger or minority consumers, sugar preference is strongest among youth and young adults, declining with age (De Graaf & Zandstra, 1999; Desor & Beauchamp, 1987; Enns et al., 1979). A review of tobacco industry reports found that tobacco companies added flavors, particularly sweet flavors, to increase smokers' pleasure and satisfaction from smoking (Cummings et al., 2002). Thus, flavored tobacco products are marketed to take advantage of the powerful appeal of flavors to increase initiation and sustain use, particularly in young or inexperienced users (Lewis & Wackowski, 2006).

Appealing e-cigarette flavors were found to increase e-cigarette initiation among youth and young adults. Specifically, studies consistently found flavors to be among the most cited reasons for young adults to use e-cigarettes and discovered that many youth and young adults initiate e-cigarette use because of flavors. For example, a study using a large sample of adults (N=2,448) recruited online found that young adults (ages 18–34) were more likely to cite flavors as the reason to use e-cigarettes than were older adults (35+ years) (Patel et al., 2016). Similarly, “appealing flavors” was the second most chosen reason for using e-cigarettes by 127 adolescents and young adults in Connecticut; the first was “curiosity” (Kong et al., 2015). As consistently reported in several qualitative studies, the availability of a variety of flavors was an attractive and beneficial feature of e-cigarettes (Choi et al., 2012; Coleman et al., 2016; McDonald & Ling, 2015; Wagoner et al., 2016). Young people also treat the preparation and use of e-cigarette flavors as a “hobby” by spending lots of time collecting new flavors, creating new flavor combinations, and performing “tricks” (Measham & Turnbull, 2016).

Flavors in e-cigarettes were also found to maintain e-cigarette use over time. For example, a small qualitative study conducted among 11 dedicated e-cigarette users asked participants to describe the role that flavor plays in their continued use of e-cigarettes (Barbeau, Burda, & Siegel, 2013). The vapers reported that flavor was a component of the “hobby element: the experience of ‘mixing and matching different types of e-cigarette parts and juice flavors.’” Thus, the authors concluded, the availability of flavors partly sustains users’ interests in e-cigarettes. Additionally, a survey study using convenience sampling found that among 1,434 e-cigarette users who were former smokers, those who had positive expectancies towards the “taste” of e-cigarettes were less likely to plan to reduce using e-cigarettes compared to those who did not have the expectancies (Harrell et al., 2015). Another study used the concept mapping

approach to examine the reasons for using flavored e-cigarettes among current adult e-cigarette users (N=46) (Soule et al., 2016). Participants reported reasons such as satisfaction and enjoyment as well as a better feel and taste than cigarettes. Some statements indicated that flavors were perceived as masking agents for nicotine or other bad tastes associated with cigarette smoking, and thus making e-cigarette use more palatable. These findings suggested that flavors might contribute to the continued use of the products through increasing e-cigarettes' rewarding and addictive effects.

2.4.2. Health Risks Associated with Flavored E-cigarette Use

Many studies have confirmed that the use of flavored e-cigarettes, just like other flavored tobacco products, hide the harshness of nicotine and may encourage users to use more of the e-cigarette product. For example, one research study suggested that menthol/mint e-cigarette flavors may be particularly effective in reducing the harshness of nicotine by providing extra "cooling" and "soothing" effects (Rosbrook & Green, 2016). Previous research also indicated that e-cigarette use with fruit flavors may be more likely to increase the rate of nicotine absorption than tobacco flavors (Helen et al., 2017) and e-cigarette use may cause nicotine overdose or poisoning when used inappropriately (Chatham-Stephens et al., 2014). Research has also frequently showed that e-cigarette flavoring ingredients may have potentially harmful effects on human health. Specifically, studies have found that e-cigarette flavoring ingredients might pose health risks to e-cigarette users' lungs and respiratory systems (Allen et al., 2016; Barrington-Trimis et al., 2014; Behar et al., 2013). Notably, inhalation exposure of the flavoring chemical diacetyl found in tobacco products, including e-cigarettes, was found to be associated with a disease that became known as "popcorn lung," an irreversible loss of pulmonary function that can become so severe that the only treatment option may be a lung transplant (Allen et al.,

2016). Another laboratory study found that e-cigarette use with various flavorings might affect toxicity of e-cigarette aerosol, which may induce inhalation toxicity in human (Leigh et al., 2016). Additionally, one research showed that sweeteners in e-cigarette liquids exposed users to furans, a toxic class of compounds that may cause irritation to the upper respiratory tract in humans (Soussy et al., 2016). Finally, although no research was found to show the difference in nicotine dependence among e-cigarette users who adopted various flavors, substantial evidence has been found to show that e-cigarette use results in symptoms of dependence on e-cigarettes (The National Academies, 2018).

2.5. Flavored E-cigarette Sales Restrictions and Community Characteristics

2.5.1. Rationale for Flavored E-cigarette Sales Restrictions

Historically, health policies impose changes on many different health risk factors and hold a great potential for reaching the entire population of interest. The Health Impact Pyramid theory illustrates that great public health improvements come from focusing on policy changes that make people easy to attain healthy options through changing communities' physical environment and social norms (Frieden, 2010). Several policy evaluation studies have shown that restricting the sale of tobacco products had an impact on preventing the onset of tobacco use and reducing tobacco use prevalence among youth. For example, one study showed that banning the sale of tobacco products to minors was associated with a significant reduction in adolescent smoking initiation in Massachusetts (Siegel, Biener, & Rigotti, 1999). Another study revealed that the 2009 nationwide flavored cigarette sales restriction has led to a possible 17% reduction in cigarette smoking prevalence and 58% decrease in cigarette consumption among youth (Courtemanche, Palmer, & Pesko, 2017). Additionally, former research demonstrated that the flavored tobacco ban (not including flavored e-cigarettes) in New York City has resulted in a

37% lower prevalence of ever trying flavored tobacco products among youth (Farley & Johns, 2016).

Given the potential great impact of restricting flavored tobacco products on combating e-cigarette use epidemics among young people, some researchers explored the hypothetical influence of flavored e-cigarette restrictions on young people's intentions of using the product. For example, Pesko and colleagues (2015) found that potentially restricting e-cigarette flavor availability to tobacco and menthol flavors may lead to a significant 2.1% reduction in e-cigarette use among adult smokers. Similarly, another study showed that, given an e-cigarette flavor ban, most young adults would likely quit using e-cigarettes or significantly reduce their e-cigarette consumption (Harrell et al., 2017a). Taken together, although numerous research studies implied that restricting the sale of flavored e-cigarettes would largely contribute to the prevention and reduction of tobacco use, little research has been done to explore the strictness of these restrictions in preventing youth use of e-cigarette products or the community characteristics that may determine the strictness. Without this knowledge, little can be done to inform legislators regarding the strategies for improving current regulations and enacting nationwide regulations to ban the sales of flavored e-cigarettes in this country.

2.5.2. Community Characteristics for Local Tobacco Control Regulations

Some research studies sought to understand the community characteristics that determine the enactment of local tobacco control regulations in order to inform local and national decisions on tobacco control. It is imperative to understand the community characteristics since the legislators can use the information to gauge the readiness of policymaking and status of tobacco control measures in their own communities. Mainly, two relevant research studies were conducted to investigate this topic. Bartosch and Pope (2002) examined local factors that

influenced tobacco policy enactment in cities and towns of Massachusetts. These local factors included but not limited to local board of health receiving Massachusetts Tobacco Control Program (MTCP) funding, population size, average education level, average income level, percentage of White residents, percentage of residents under 18 years of age, and percentage of Democrats. The study found that receiving MTCP funding and the locality's population size significantly predicted local tobacco control policy enactment in Massachusetts. The second study examined town-level characteristics and local restaurant smoking regulations in towns of Massachusetts (Skeer et al., 2004). The study found that community characteristics important to the adoption of stronger restaurant smoking regulations included but not limited to higher education, higher per capita income, voter support for a state cigarette tax initiative, and board of health funding to promote clean indoor air policymaking.

2.6. Conclusion

The literature review indicates that e-cigarette flavors are appealing to youth and young adults and that the use of flavored e-cigarettes among young people are prevalent and may potentially have detrimental health effects among this vulnerable group. This review shows gaps in current literature, highlighting the need for further investigation on the topic of flavored e-cigarette use among youth and young adults. These gaps include: (1) the predictors of flavored e-cigarette use, especially NTM flavored e-cigarette use, among young adults; (2) young adult cigarette smokers' attitudes and beliefs towards flavored e-cigarettes; (3) young adult smokers' intentions of using flavored e-cigarettes given a flavored e-cigarette ban; (4) young adult smokers' perceived role of flavored e-cigarettes on cigarette smoking behavior; (5) the potential strictness of local flavored e-cigarette sales restrictions on preventing youth use of e-cigarettes; and (6) the community characteristics that influence the strictness of local flavored e-cigarette

sales restrictions. This dissertation research was intended to fill these research gaps to further inform the development of interventions and messages aimed at preventing and reducing e-cigarette use among youth and young adults as well as the local and nationwide legislations that may most effectively curb the use of e-cigarette products among young people.

CHAPTER THREE: STUDY 1

Prospective Predictors of Flavored E-cigarette Use: A One-Year Longitudinal Study of Young Adults in the U.S.

ABSTRACT

Introduction. E-cigarettes with fruit and sweet flavors are particularly appealing among young adults. The current study examined the prospective predictors of young adults' flavored e-cigarette use to inform the prevention efforts targeting this group.

Methods. We used the wave 1 (2013–2014) and wave 2 (2014–2015) data of the Population Assessment of Tobacco and Health (PATH) Study, a nationally representative, longitudinal cohort study of adults in the U.S. We analyzed a sample of young adults aged 18–34 ($n=12,383$) and a sub-sample of young adult e-cigarette users ($n=1,421$) to identify the wave 1 prospective predictors (i.e., socio-demographic characteristics, mental health symptoms, marijuana use, and tobacco use and perceptions) of wave 2 flavored e-cigarette use.

Results. At wave 2, about 8% of young adults used e-cigarettes, among which 35% and 65% used tobacco and menthol (TM) and non-tobacco and non-menthol flavors (NTM) flavors, respectively. In the full multivariate model, significant predictors (wave 1) of NTM flavored e-cigarette use (wave 2) were younger age ($AOR=1.9$, $p<0.001$), female gender ($AOR=1.8$, $p<0.001$), education attainment of high school/GED degree ($AOR=1.7$, $p<0.05$) and higher ($AOR=1.8$, $p<0.01$), marijuana use ($AOR=1.8$, $p<0.001$), non-current cigarette smoking ($AOR=3.0$, $p<0.001$), and lower harm perception of e-cigarettes ($AOR=1.6$, $p<0.01$).

Conclusion. Evidence-based information about the risks and harm of NTM flavored e-cigarette use should be disseminated among young adults. Legislative actions are recommended to restrict

or limit e-cigarette flavors to protect the health of the most vulnerable groups (e.g., 18–24 year olds, female, and non-cigarette smokers).

Keywords: Electronic Cigarettes, Vaping, Young Adults, Flavored Tobacco, The PATH Study, Nicotine, Tobacco Use, Substance Use

INTRODUCTION

In recent years, electronic cigarettes, or e-cigarettes, have increased in popularity among adolescents and young adults in the U.S. In 2013, about 21.6% of 12–24 year-olds had tried ever e-cigarettes and 5.1% were current users (Schoenborn & Gindi, 2015). Flavored e-cigarettes, enhanced to taste like fruit, candy, chocolate, and other sweet flavors, are particularly appealing to young adults (Bonhomme et al., 2016; Choi et al., 2012). Not only has research shown that flavors are an attractive characteristic of e-cigarettes for young adults (McDonald & Ling, 2015) but flavors appear to be a primary reason for initiation of e-cigarette use (Shiplo, Czoli, & Hammond, 2015) among this group. During 2013–2014, among 18–24 and 25–29 year-old e-cigarette users, 85% and 73% used flavored e-cigarettes during the past 30 days, respectively (Bonhomme et al., 2016).

Despite their popularity, flavored e-cigarettes are associated with adverse short-term and long-term health consequences. First, e-cigarette flavoring ingredients might be toxic to inhale (Leigh et al., 2016) and result in harm to the respiratory system (Allen et al., 2016; Behar et al., 2013; Callahan-Lyon, 2014). Second, to enhance the palatability and attractiveness of their products, the tobacco industry offers flavor additives to reduce the harshness of the nicotine (Stanton, et al., 2016) and minimize throat irritation (Kostygina, Glantz, & Ling, 2016). As a result, flavors in tobacco products might potentiate nicotine over-consumption and poisoning among novice users (Chatham-Stephens et al., 2014). Third, e-cigarettes with attractive flavors could increase nicotine addiction by enhancing the rewarding and reinforcing properties associated with vaping (Audrain-McGovern, Strasser, & Wileyto, 2016), as well as promote regular and more frequent e-cigarette use (Huang et al., 2016; Morean et al., 2018). This is concerning, as young adults are still forming tobacco use behaviors (HHS, 2014). Young adult

users of flavored tobacco are more likely to develop persistent tobacco use patterns as they grow older compared to peers who do not use flavored products (Villanti et al., 2013). Lastly, flavored e-cigarette use among young, non-cigarette smokers might escalate cigarette smoking intentions (Chen, et al. 2017), leading to increased cigarette smoking in the future.

Considering the numerous negative health consequences, initiatives are needed to prevent and reduce flavored e-cigarette use among young people. Prevention efforts require an understanding of the specific risk factors for using flavored e-cigarettes, over and above what might predict other forms of tobacco use. Many studies have explored the correlates of flavored tobacco use in general among adults. These studies showed that young age (King, Dube, & Tynan, 2013; Kostygina et al., 2016; Rath et al., 2016; Smith et al., 2016; Villanti et al., 2013), female gender (Delnevo et al., 2015; King et al., 2013; Kostygina et al., 2016; Smith et al., 2016; Villanti et al., 2013), African American race (Delnevo et al., 2015; Kostygina et al., 2016; Smith et al., 2016; Sterling et al., 2016; Villanti et al., 2013), LGBT sexual identity (Rath et al., 2016), and low income (King et al., 2013; Sterling et al., 2016) are associated with flavored tobacco use. Evidence for education levels as a predictor of flavored tobacco use is mixed; one study found that lower levels of education was a predictor of flavored tobacco products (Smith et al., 2016), whereas another study identified higher education as a predictor (Villanti et al., 2013). One study also observed an association between anxiety symptoms and flavored tobacco use (Rath et al., 2016). This study also identified marijuana use as a predictor of flavored vs. non-tobacco flavored tobacco use in young adults (Rath et al., 2016).

With regard to the association between flavored e-cigarette use and use of traditional tobacco cigarettes, it appears that never and former adult smokers are more likely to use fruity and candy flavored e-cigarettes than current smokers (Farsalinos et al., 2013; Harrell et al.,

2017). Long-time e-cigarette users, as opposed to novice users, appear to be more likely to use fruity and candy flavored e-cigarettes (Tackett et al., 2015). Tobacco harm perceptions influence consumers' choice towards tobacco flavors; individuals who consider tobacco use as less harmful or with more beneficial outcomes are more likely to use non-tobacco flavored tobacco compared to individuals who perceive tobacco use more negatively (Ashare et al., 2007; Czoli et al., 2015; Thrasher et al., 2015).

In an attempt to fill a critical knowledge gap regarding our understanding of the predictors of flavored e-cigarette use in particular, especially among young adults, this study analyzed data from a large, nationally representative study that administered interviews to young adults at two time points. Analyses allowed for the examination of the independent and combined effects of a wide array of predictors (i.e. sociodemographic characteristics, mental health status, marijuana and tobacco use) that, according to previous research, might impact young adults' flavored e-cigarette use. Specifically, the analyses aimed to identify how these predictors were associated with (1) non-e-cigarette use versus e-cigarette use with tobacco and menthol (TM) flavors and non-tobacco and non-menthol (NTM) flavors, and (2) e-cigarette use with TM flavors versus NTM flavors.

METHODS

Sample

The Population Assessment of Tobacco and Health (PATH) Study is a nationally representative, longitudinal cohort study of civilian, non-institutionalized adults and youth in the U.S. The PATH study used audio computer-assisted self-administered interviews in English and Spanish to collect information on tobacco use and health status and more information on the study design can be found elsewhere (Hyland et al., 2017). Waves 1 and 2 of the adult surveys of

the PATH Study were collected between 2013–2014 and 2014–2015, respectively. For this prospective analysis, the sample was restricted to the 12,383 18–34-year-old respondents who completed both waves (retention rate=81.8%). The subsample of past-month e-cigarette users at wave 2 (n=1,421) was used to identify the predictors of e-cigarette use with TM versus NTM flavors. The University of Maryland College Park Institutional Review Board approved this study.

Measures

E-cigarette use status (wave 2)

E-cigarette use status was categorized as: Non-E-cigarette Use, E-cigarette Use with TM Flavors, and E-cigarette use with NTM Flavors. The respondents who did not report using e-cigarettes in the past 30 days were considered non-e-cigarette users. The respondents who used e-cigarettes that are “flavored to taste like menthol, mint, clove, chocolate, alcoholic drinks, candy or other sweets” were then asked which specific flavors they used. Response options included: (1) “Menthol/mint,” (2) “Clove/spice,” (3) “Fruit,” (4) “Chocolate,” (5) “An alcoholic drink,” (6) “Candy/other sweets,” and (7) “Some other flavor.” Individuals who did not use e-cigarettes with any of these flavors or only selected “Menthol/mint” flavors were categorized as “E-cigarette Use with TM Flavors.” Individuals who used at least one flavor other than menthol/mint were categorized as “E-cigarette Use with NTM Flavors.”

The distinction between TM versus NTM e-cigarette flavors was important for two reasons. First, because of the sensory similarities between TM flavored e-cigarettes and conventional regular and menthol cigarettes), TM flavored e-cigarette users might be different from the users of NTM flavors in regards to their tobacco use history and socio-demographic characteristics (Farsalinos et al., 2013; Tackett et al., 2015; Yingst et al., 2015). Second, most of

the U.S. localities that have restricted the sale of flavored e-cigarettes only banned NTM flavors and exempted TM flavors (TCLC, 2017). Thus, studies that are able to distinguish TM vs. NTM flavor users are hold great potential to inform the advancement and evaluation of flavored e-cigarette sales restrictions, a regulation that could help significantly reduce young people's use of e-cigarette products.

Baseline sociodemographic characteristics (wave 1)

The following sociodemographic characteristics were included as potential predictors of flavored e-cigarette use at wave 2: age, sex, race, household income, education, and sexual identity (see Table 3.1 for variable categories).

Baseline mental health symptoms (wave 1)

A mental health symptom binary variable was constructed by combining the answers of four questions that assess the presence of depression, somatic, anxiety, and distress symptoms (Dennis, Feeney, Stevens, & Bedoya, 2008). These questions have shown moderate to high reliability among youth and adult samples (Titus, Dennis, Lennox, & Scott, 2008). Specifically, respondents were asked to identify the last time they experienced: (1) "Feeling very trapped, lonely, sad, blue, depressed, or hopeless about the future?" (2) "Sleep trouble, such as bad dreams, sleeping restlessly, or falling asleep during the day?" (3) "Feeling very anxious, nervous, tense, scared, panicked, or like something bad was going to happen?" and (4) "Becoming very distressed and upset when something reminded you of the past?" Possible response categories were: "Past month," "2 to 12 months ago," "Over a year ago," and "Never." Respondents who experienced at least one of the four symptoms during the past month were coded as having mental health symptoms (yes/no).

Baseline marijuana use (wave 1)

For individuals answering affirmatively to using “marijuana, hash, THC, grass, pot or weed” during their lifetime, they were further asked whether or not they used these substances in the past month. Past-month use of marijuana was therefore coded as a binary variable (yes/no).

Baseline tobacco use and perceptions (wave 1)

Respondents were asked about their use of e-cigarettes and cigarette smoking in the past 30 days, which was used to construct two separate variables for past month e-cigarette and tobacco use (yes/no). Perceived harm of e-cigarettes compared to cigarettes was measured by the question “Is using e-cigarettes less harmful, about the same, or more harmful than smoking cigarettes?” The response categories were: “Less harmful,” “About the same,” and “More harmful.” The latter two categories were collapsed to create a binary variable (e-cigarettes less harmful/e-cigarettes same or more harmful than smoking cigarettes).

Statistical analysis

Chi-square tests were employed to identify the associations between each wave 1 predictor and wave 2 flavored e-cigarette use. Using the entire sample, pair-wise bivariate logistic regressions were then conducted to determine the predictors of TM flavored e-cigarette use and NTM flavored e-cigarette use with non-e-cigarette use as the reference as well as the predictors of NTM flavor use with TM flavor use as the reference. Using the sample of past-month e-cigarette users at wave 2, multivariate logistic regression models were finally adopted to assess the predictors of NTM flavor use with TM flavor use as the reference. Prospective predictors were added to the models as groups in a sequential manner: socio-demographics, mental health symptoms, marijuana use, and tobacco use and perceptions. The Stata 14.0 survey command was used to account for the wave 2 weights for weighting and calculating proportions with 95% confidence intervals employing the balanced repeated replications (BRR) method with

Fay's adjustment ($p=0.3$) (FDA, 2017). The wave 2 longitudinal weights also account for the nonresponse from wave 1 to wave 2 (FDA, 2017). No imputation strategy was used to fill in missing data. Data analysis using wave 1 and 2 surveys of the PATH Study was conducted in October 2017. The significance level of the statistical analysis was set at $p<0.05$.

RESULTS

Descriptive Findings

This study found that during 2014–2015, about 8% of U.S. young adults aged 18–34 used e-cigarettes in the past month, and the use of NTM flavors was more prevalent than TM (65% vs. 35%). Among TM flavored e-cigarette users, about 57% used tobacco flavors and 43% used menthol/mint flavors. Among NTM e-cigarette users, the most popular flavors included fruit (71%) and candy (52%) flavors. Close to half (47%) of NTM flavor users used one flavor, 27% used two flavors, and 26% used more than two flavors.

Predictors of E-cigarette Use as Compared to Non-E-cigarette Use

All wave 1 variables significantly predicted e-cigarette use at wave 2 (Table 3.1). Compared to non-e-cigarette users, past-month e-cigarette users were more likely to be male, white, and identify as LGBT. Additionally, they were more likely to have lower household incomes, less education, and mental health symptoms, and use addictive substances including marijuana, e-cigarettes, and cigarettes. Users were more likely than non-users to perceive e-cigarettes as less harmful than cigarettes.

Predictors of Flavored E-cigarette Use as Compared to Non-E-cigarette Use

Table 3.2 presents the unadjusted logistic regression model results and shows the predictors of TM and NTM flavored e-cigarette use compared to non-e-cigarette use. When compared to non-e-cigarette use, the predictors of TM and NTM flavored e-cigarette use were

similar except for three variables: age, education, and sexual orientation. Specifically, similar to Table 3.1, younger respondents were less likely to use TM flavors (OR=0.7) and more likely to use NTM flavors (OR=1.6) compared to older respondents. For another example, LGBT respondents were more likely to use NTM flavors (OR=2.0) than straight or heterosexual respondents. Sexual orientation, however, was not found to be significantly different between TM flavored e-cigarette use and non-e-cigarette use.

Predictors of NTM Flavor Use as Compared to TM Flavor Use

When comparing NTM and TM flavored e-cigarette use, Table 3.2 shows that individuals who were younger (OR=2.0), female (OR=1.7), high school educated (OR=1.6) or more (OR=1.9), marijuana users (OR=1.6), not currently smoking cigarettes (OR=2.8), and with lower levels of perceived harm about e-cigarettes (OR=1.7) were more likely to use NTM flavors than their counterparts. Race, household income, mental health symptoms, and past-month e-cigarette use did not differentiate NTM and TM flavor users.

Table 3.3 highlights the adjusted regression results for assessing the predictors of NTM flavored e-cigarette use compared to TM flavor use among past-month e-cigarette users. Across all four models, younger age (AOR=2.0, AOR=2.0, AOR=2.0, AOR=1.9, respectively), being female (AOR=1.6, AOR=1.6, AOR 1.7, AOR=1.8, respectively), having a high school/GED degree or higher (AOR=1.7; AOR=1.8 in all models) were more likely to use NTM flavored e-cigarettes compared to their counterparts. In model 3 that controlled for socio-economics, mental health symptoms, and marijuana use, the respondents who self-identified as past-month marijuana users (AOR=1.6) were more likely to use NTM flavored e-cigarettes compared to non-marijuana users. In the full model (model 4) that controlled for all predictors, past-month marijuana users (AOR=1.9) were still more likely to use NTM flavors than non-marijuana users.

Additionally, non-smokers (AOR=3.0) and those who perceived e-cigarettes as less harmful than cigarettes (AOR=1.6) were more likely to use NTM flavors compared to their counterparts. No significant differences in odds of NTM flavor use were observed for race, household income, sexual identity, mental health symptoms, or past-month e-cigarette use throughout the four models.

DISCUSSION

This study complements and extends prior research regarding what influences NTM flavored e-cigarette use among young adults. Among e-cigarette users, younger age, female gender, higher education levels, marijuana use, non-current cigarette smoking, and diminished harm perceptions of e-cigarettes predicted NTM flavor use after statistical adjustment for all other predictors. Results also showed that about 8% of young adults aged between 18 and 34 in the U.S. used e-cigarettes in the past month and about 69% of these users adopted NTM flavors. Consistent with previous research (Bonhomme et al., 2016; Choi et al., 2012), fruit and candy flavors are the most popular NTM flavors used by this group. The fact that more than half of NTM flavor users had tried more than one flavor in the past month indicates that this group might frequently switch between multiple e-cigarette flavors.

Among young adult e-cigarette users, those who were younger and female were more likely to use NTM flavors than their older and male counterparts. Historically, tobacco companies used sweetened tobacco products as a way to attract young, female consumers (Carpenter, Wayne, & Connolly, 2005; Samet & Yoon, 2010). Additionally, previous research showed that young, female users of e-cigarettes are more likely than males to be influenced by non-tobacco flavored e-cigarette use with regards to developing cigarette smoking intentions (Chen et al., 2017). Therefore, research is needed to determine how the taste of NTM flavored e-

cigarettes can be modified or regulated to reduce its appeal to younger females. The recent trend of raising the minimum legal sale age for tobacco products from 18 to 21 in some states and localities (Winickoff et al., 2015) might potentially reduce risk for tobacco use. The influence of this regulation on curbing flavored e-cigarette use among young adults is also promising but warrants further investigation.

We found that the relationship between educational level and e-cigarette use in general is consistent with prior research (Regan et al., 2011). This finding might indicate that the purpose and motivations of using e-cigarette products vary between higher and lower educated young adults, and these differences drive their choices for e-cigarette flavors. Perhaps more highly educated users are using e-cigarettes for non-nicotine purposes such as recreational and social reasons, and these motivations might in turn encourage them to choose popular NTM flavors with an appealing taste and smell. Further studies are warranted to explore this idea more fully in-depth to understand the reasons for the discrepancies in e-cigarette flavor use among young adults with different educational backgrounds.

Our research also comports with previous studies showing that white young adults are more likely to use e-cigarettes, regardless of flavors, than other race/ethnic groups (Saddleson et al., 2015; Sutfin et al., 2013), presumably because the majority of e-cigarette marketing strategies were heavily tailored to the white population (Richardson et al., 2013). Our findings, however, regarding the racial differences of NTM flavored e-cigarette use contradicts previous research. Former studies have consistently found that African American adults are more likely to use flavored tobacco products compared to their white peers (Delnevo et al., 2015; Kostygina et al., 2016; Smith et al., 2016; Sterling et al., 2016; Villanti et al., 2013), since this minority group is heavily targeted by the tobacco industry's marketing and promotion of flavored tobacco

products (Connolly, 2004). We suspect that this discrepancy is partially due to the fact that we grouped menthol/mint flavors with tobacco flavors, thereby attenuating the effect of African American's disproportionately higher use of menthol tobacco flavors (Gardiner, 2004).

Nevertheless, more research is warranted to investigate whether and how flavored e-cigarettes are marketed and promoted differently between white and racial minority young adults and whether these discrepancies lead to disparities in flavored e-cigarette use among these groups.

We discovered that non-current cigarette smoking at wave 1 is the most influential predictor for NTM flavored e-cigarette use at wave 2. This finding is worrisome since NTM flavored e-cigarettes might serve as this group's starter tobacco product and thereby facilitate their development of regular tobacco use and nicotine addiction (Stanton et al., 2016). Evidence suggests that non-smoking youth who use non-tobacco flavored e-cigarettes have a higher cigarette smoking susceptibility than those who use tobacco flavored e-cigarettes (Chen et al., 2017). The existence of a similar pattern among young adults is highly likely given that e-cigarette use increases the likelihood of cigarette smoking openness among non-smoking young adults (Coleman et al., 2014). Nevertheless, considering the great harm associated with the use of NTM flavored e-cigarettes, prevention efforts should ideally focus on non-smokers to reduce their curiosity and positive perceptions of NTM flavored e-cigarettes. Future longitudinal research is also greatly needed to (1) determine whether baseline NTM flavored e-cigarette use leads to greater cigarette smoking intentions and behaviors at follow-up, and (2) explore the psychosocial and environmental-related pathways that might establish this longitudinal relationship.

Our results also showed that past-month marijuana use at wave 1 predicted e-cigarette use at wave 2. This finding signified that marijuana use might increase the risk for initiating and

regularly using e-cigarettes among young adults. This finding might be explained by two underlying mechanisms. First, young adults with high levels of sensation seeking are likely to use multiple addictive substances, including marijuana and e-cigarettes. Previous research has demonstrated the linkage between sensation seeking, e-cigarette use, and marijuana use among college students (Sutfin et al., 2013). Second, young adults might engage in vaping as a method for administering marijuana (Budney, Sargent, & Lee, 2015). Marijuana users might perceive vaping marijuana to be safer or less harmful compared to combustible smoking methods (Malouff, Rooke, & Copeland, 2014). Furthermore, we found that past-month marijuana use at wave 1 influences respondents' future adoption of e-cigarettes with NTM flavors in particular. We ruled out the possibility that young adults tended to mix marijuana with NTM flavorings since a previous research showed that when vaping, college students in the U.S. tended to mix marijuana with nicotine instead of flavors (Lee et al., 2016). Thus, this relationship could also be explained, again, by high sensation seeking shared among NTM flavor users and marijuana users. Previous research found that the appeal of sweet flavored tobacco products is high only among young people who are highly sensation-seeking (Manning, Kelly, & Comello, 2009). Due to the lack of data for measuring sensation seeking in the PATH adult study, we were unable to further investigate the potential mechanisms described above.

Not surprisingly, e-cigarette users and NTM flavor users were more likely to perceive e-cigarettes to be less harmful compared to non-e-cigarette users and TM flavor users, respectively. This finding signified the importance of reinforcing public education on the harm associated with using e-cigarettes, particularly e-cigarettes with fruity and sweet flavors. Research has found that e-cigarette sales and marketing websites frequently contain unfounded health claims that might be misleading to young people (Grana & Ling, 2014). Additionally,

research has shown that young adults tend to have limited knowledge about the harm of e-cigarette use (Sanders-Jackson et al., 2014) and considered non-tobacco flavored e-cigarettes less harmful than tobacco flavored e-cigarettes (Cooper et al., 2016; Czoli et al., 2015). Thus, given that young adults are still developing their tobacco use behaviors, informing this group about the known health risks and debunking unknown facts related to e-cigarette use (e.g., e-cigarettes contain toxicants and carcinogens just like cigarettes) might deter their interest in trying the product. We also found that about half of wave 2 e-cigarette users also used e-cigarettes during wave 1. This finding is concerning since long-time and chronic e-cigarette use might exacerbate the adverse health consequences associated with vaping (Callahan-Lyon, 2014) and therefore should be particularly addressed by evidence-based efforts to help young adults quit e-cigarette use.

This study has three major strengths. Our research improves upon prior efforts by (1) examining specific predictors of flavored e-cigarette use instead of flavored tobacco use generally, (2) using a prospective longitudinal design to assess flavored e-cigarette use behavior within a one-year follow-up, and (3) assessing the differences of e-cigarette use with TM flavors versus NTM flavors. The use of prospective rather than retrospective data means that the outcomes under investigation are less likely to be affected by baseline variables.

This study is limited insofar as it does not include other potentially important predictors that might be unique to e-cigarette products only. Previous research has shown that adults might have different biologically driven responses (e.g., rewarding and reinforcing values) to the use of e-cigarettes with flavors, and such differences might influence their frequency and intensity of e-cigarette use (Audrain-McGovern et al., 2016). Additionally, interpersonal relationships (e.g., peer use of flavored e-cigarettes) might also play a role in influencing young adults' choice of

flavored e-cigarettes. Future research needs to discover these and other factors associated with flavored e-cigarette use in particular. More intensive investigation of mental health as a potential predictor is also needed. Additionally, although the prospective design of the study removes the influence of the outcome measure on the baseline predictors, e-cigarette flavor use at the baseline, which was not captured by the wave 1 adult survey of the PATH Study, might still bias the results and needs to be taken into account in future studies.

This study has significant implications for developing public health initiatives with the purposes of preventing and reducing e-cigarette use among young adults. First, public health programs and mass media campaigns are greatly needed to provide knowledge about the harm and risks associated with using NTM flavored e-cigarettes, particularly among the most vulnerable groups (e.g., 18–24 year olds, females, and non-cigarette-smokers). Messages tailored to the characteristics of target group's gender, age, and culture would greatly improve its acceptance among the audience. Second, the authors call for more scrutiny with respect to the availability and access of flavored e-cigarettes. Tobacco regulative actions to reduce the variety of NTM flavors and restricting young people's exposure to NTM flavored e-cigarette products would greatly help prevent and reduce the use of e-cigarettes, and, eventually curb regular tobacco use among this group.

CONCLUSION

A higher proportion of young adult e-cigarette users in the U.S. adopted NTM flavored e-cigarettes compared to TM flavored e-cigarettes. Fruit and candy e-cigarette flavors are extremely popular among these users. Younger age, female gender, education attainment of high school degree and higher, marijuana use, non-cigarette smoking, and diminished harmful perceptions about using e-cigarettes significantly predicted NTM flavor use among young adult

e-cigarette users. Public education messages and regulative actions regarding NTM flavored e-cigarettes are both needed to prevent and reduce the use of e-cigarettes among the young adult population.

Table 3.1. Wave 1 Sample Characteristics by Wave 2 E-cigarette Use Status
Among U.S. Young Adults (Aged 18–34), 2013–2015 PATH Study Wave 1 and 2 Surveys (n=12,383)

Wave 1 Sample Characteristics	Wave 2 E-cigarette Use Status				Overall Difference	Difference Between TM and NTM Flavor Use
	Non E-cigarette Use	E-cigarette Use with TM Flavors	E-cigarette Use with NTM Flavors			
	Total	N=10,962; 92.0%	N=428; 2.5%	N=993; 5.5%		
	%	% [95% CI]	% [95% CI]	% [95% CI]	p value	p value
Age					0.0000	0.0000
18–24	42.5	42.0 [41.3, 42.8]	35.0 [30.4, 39.9]	53.5 [49.5, 57.5]		
25–34	57.5	58.0 [57.3, 58.7]	65.0 [60.2, 69.6]	46.5 [42.6, 50.5]		
Sex					0.0000	0.0003
Male	50.6	49.6 [48.8, 50.4]	70.8 [65.4, 75.6]	59.0 [55.7, 62.3]		
Female	49.4	50.4 [49.7, 51.2]	29.2 [24.4, 34.6]	41.0 [37.7, 44.3]		
Race					0.0000	0.2455
White Alone	72.5	71.7 [70.5, 72.9]	82.4 [78.1, 86.0]	82.2 [79.0, 85.1]		
Black Alone	13.8	14.4 [13.6, 15.3]	8.4 [6.0, 11.8]	6.3 [4.8, 8.2]		
Others/Multi-racial	13.7	13.9 [12.9, 15.0]	9.2 [6.8, 12.4]	11.4 [8.9, 14.6]		
Past-Year Household Income					0.0023	0.2597
<\$10,000	20.0	19.7 [18.6, 20.9]	26.3 [21.3, 32.0]	22.0 [19.2, 25.1]		
\$10,000–24,999	22.5	22.3 [21.0, 23.7]	22.6 [18.9, 26.7]	25.8 [22.5, 29.4]		
>\$24,999	57.5	58.0 [56.4, 59.6]	51.1 [45.1, 57.2]	52.2 [48.3, 56.1]		
Education					0.0000	0.0167
<High School	9.9	9.8 [9.3, 10.4]	14.6 [11.3, 18.7]	8.8 [7.2, 10.8]		
High School/GED	29.2	28.7 [27.7, 29.6]	36.3 [30.9, 42.1]	35.8 [32.1, 39.7]		
>High School	60.9	61.5 [60.6, 62.5]	49.1 [43.6, 54.6]	55.4 [51.2, 59.4]		
Sexual Orientation					0.0000	0.1588
LGBT	8.0	7.6 [6.8, 8.3]	10.5 [7.5, 14.6]	13.9 [11.3, 16.9]		
Heterosexual/Straight	92.0	92.5 [91.7, 93.2]	89.5 [85.4, 92.5]	86.1 [93.1, 88.7]		
Past-Month Mental Symptoms					0.0000	0.2026
Yes	38.9	37.8 [36.4, 39.3]	48.7 [43.2, 54.3]	53.1 [49.2, 57.0]		
No	61.1	62.2 [60.7, 63.6]	51.3 [45.7, 56.9]	46.9 [43.0, 50.8]		
Past-Month Marijuana Use					0.0000	0.0041
Yes	13.5	12.2 [11.2, 13.2]	22.6 [18.6, 27.2]	31.4 [28.0, 35.1]		
No	86.5	87.8 [86.8, 88.8]	77.4 [72.8, 81.5]	68.6 [64.9, 72.1]		
Past-Month E-cigarette Use					0.0000	0.0851
Yes	11.4	8.2 [7.7, 8.8]	43.9 [38.4, 49.7]	50.3 [45.8, 54.9]		
No	88.6	91.8 [91.2, 92.3]	56.1 [50.3, 61.6]	49.7 [45.1, 54.2]		
Past-Month Cigarette Smoking					0.0000	0.0000
Yes	29.3	25.7 [25.6, 26.8]	84.0 [79.1, 88.0]	65.3 [61.1, 69.3]		
No	70.7	74.3 [73.2, 75.4]	16.0 [12.0, 20.9]	34.7 [30.7, 38.9]		
Perceived Harm of E-cigarettes Compared to Cigarettes					0.0000	0.0006
E-cigs less harmful	48.2	46.2 [44.9, 47.6]	60.6 [55.2, 65.8]	72.7 [69.0, 76.1]		
E-cigs same or more harmful	51.8	53.8 [52.5, 55.1]	39.4 [34.2, 44.8]	27.3 [23.9, 31.0]		

Note 1: Bold signifies statistical significance at $p < 0.05$

Note 2: LGBT stands for lesbian, gay, bisexual, transgender, queer, trisexual, omnisexual and pan-sexual, etc.

Table 3.2. Odds Ratios for Predicting Wave 2 E-cigarette Use Status
Among U.S. Young Adults (Aged 18–34), 2013–2015 PATH Study Wave 1 and 2 Surveys (n=12,383)

Wave 1 Sample Characteristics	Pair-wise Comparisons of E-cigarette Use Status						Note 1
	TM flavor use (Compared to Non-use)		NTM flavor use (Compared to Non-use)		NTM flavor use (Compared to TM flavor use)		
	OR [95% CI]	p value	OR [95% CI]	p value	OR [95% CI]	p value	
Age							
25–34	Reference		Reference		Reference		
18–24	0.74 [0.60, 0.92]	0.007	1.59 [1.35, 1.88]	0.000	2.14 [1.62, 2.82]	0.000	
Sex							
Male	Reference		Reference		Reference		
Female	0.41 [0.31, 0.52]	0.000	0.68 [0.59, 0.78]	0.000	1.70 [1.27, 2.22]	0.000	
Race							
NH Whites	Reference		Reference		Reference		
NH Blacks	0.51 [0.34, 0.75]	0.001	0.38 [0.28, 0.52]	0.000	0.75 [0.49, 1.16]	0.197	
NH Others	0.58 [0.41, 0.81]	0.001	0.71 [0.54, 0.94]	0.019	1.25 [0.80, 1.94]	0.328	
Past-Year Household Income							
<\$10,000	Reference		Reference		Reference		
\$10,000-24,999	0.76 [0.97, 1.78]	0.073	1.04 [0.82, 1.31]	0.754	1.37 [0.95, 1.97]	0.090	
>\$24,999	0.66 [0.70, 1.14]	0.009	0.81 [0.67, 0.97]	0.025	1.22 [0.85, 1.74]	0.271	
Education							
<High School	Reference		Reference		Reference		
High School/GED	0.86 [0.61, 1.21]	0.375	1.39 [1.09, 1.79]	0.010	1.63 [1.06, 2.51]	0.028	
>High School	0.54 [0.39, 0.74]	0.000	1.00 [0.78, 1.30]	0.978	1.86 [1.26, 2.74]	0.002	
Sexual Orientation							
Heterosexual/Straight	Reference		Reference		Reference		
LGBT ¹	1.44 [0.99, 2.11]	0.060	1.97 [1.53, 2.55]	0.000	1.37 [0.88, 2.15]	0.163	
Past-Month Mental Symptoms							
No	Reference		Reference		Reference		
Yes	1.56 [1.24, 1.97]	0.000	1.86 [1.58, 2.19]	0.000	1.19 [0.91, 1.56]	0.201	
Past-Month Marijuana Use							
Yes	2.10 [1.60, 2.76]	0.000	3.30 [2.81, 3.89]	0.000	1.57 [1.15, 2.14]	0.004	
No	Reference		Reference		Reference		
Past-Month E-cigarette Use							
No	Reference		Reference		Reference		
Yes	8.75 [6.94, 11.02]	0.000	11.3 [9.27, 13.80]	0.000	1.29 [0.96, 1.73]	0.086	
Past-Month Cigarette Smoking							
Yes	Reference		Reference		Reference		
No	0.07 [0.05, 0.09]	0.000	0.18 [0.15, 0.22]	0.000	2.80 [1.97, 4.00]	0.000	
Perceived Harm of E-cigarettes Compared to Cigarettes							
E-cigs same or more harmful	Reference		Reference		Reference		
E-cigs less harmful	1.79 [1.43, 2.24]	0.000	3.10 [2.55, 3.79]	0.000	1.73 [1.27, 2.36]	0.001	

Note 1: Bold signifies statistical significance at $p < 0.05$

Note 2: LGBT stands for lesbian, gay, bisexual, transgender, queer, trisexual, omnisexual and pan-sexual, etc.

Table 3.3. Multivariate Models to Identify Predictors Associated with Wave 2 NTM Flavor Use
Among U.S. Young Adult E-cigarette Users (Aged 18–34), 2013–2015 PATH Study Wave 1 and 2 Surveys (n=1,421)

Wave 1 Sample Characteristics	Wave 2 NTM Flavored E-cigarette Use (Compared to TM Flavored E-cigarette Use)							
	Model 1		Model 2		Model 3		Model 4	
	AOR [95% CI]	p value	AOR [95% CI]	p value	AOR [95% CI]	p value	AOR [95% CI]	p value
Socio-economic Characteristics								
Age								
25–34	Reference		Reference		Reference		Reference	
18–24	2.0 [1.5, 2.7]	0.000	2.0 [1.5, 2.7]	0.000	2.0 [1.5, 2.6]	0.000	1.9 [1.4, 2.5]	0.000
Sex								
Male	Reference		Reference		Reference		Reference	
Female	1.6 [1.2, 2.1]	0.002	1.6 [1.2, 2.1]	0.002	1.7 [1.2, 2.3]	0.001	1.8 [1.3, 2.5]	0.000
Education								
<High School	Reference		Reference		Reference		Reference	
High School/GED	1.7 [1.1, 2.7]	0.030	1.7 [1.1, 2.6]	0.030	1.7 [1.1, 2.7]	0.023	1.7 [1.1, 2.7]	0.024
>High School	1.8 [1.2, 2.7]	0.006	1.8 [1.2, 2.7]	0.006	1.8 [1.2, 2.8]	0.006	1.8 [1.2, 2.8]	0.007
Mental Health Symptoms								
Past-Month Mental Symptoms								
No			Reference		Reference		Reference	
Yes			1.1 [0.8, 1.5]	0.651	1.0 [0.8, 1.4]	0.888	1.1 [0.8, 1.4]	0.736
Marijuana Use								
Past-Month Marijuana Use								
No					Reference		Reference	
Yes					1.6 [1.1, 2.3]	0.008	1.9 [1.4, 2.8]	0.000
Tobacco Use and Perceptions								
Past-Month Cigarette Smoking								
Yes							Reference	
No							3.0 [2.0, 4.4]	0.000
Perceived Harm of E-cigarettes Compared to Cigarettes								
E-cigs same or more harmful							Reference	
E-cigs less harmful							1.6 [1.2, 2.6]	0.004

Note 1: Bold signifies statistical significance at $p < 0.05$.

Note 2: Race, past year household income, sexual identity, and past-month e-cigarette use were included in the models but were excluded from the table because they were not associated with NTM flavored e-cigarette use in any of the models.

CHAPTER FOUR: STUDY 2

Perceptions about E-Cigarette Flavors: A Qualitative Investigation of Young Adult Cigarette Smokers Who Use E-cigarettes

ABSTRACT

Background. Although in recent years, an increased number of young adult smokers have used flavored e-cigarettes, little research has been conducted to explore young adult smokers' perceptions related to e-cigarette flavors.

Methods. This study used qualitative methods to examine young adult smokers' attitudes and beliefs towards e-cigarette flavors, intentions of using e-cigarettes given an e-cigarette flavor ban, and perceptions of the role of e-cigarette flavors in their smoking behaviors. We conducted in-depth, semi-structured interviews to explore these themes among a purposive sample of 25 young adult smokers (aged 18–34) who used e-cigarettes to reduce cigarette smoking. Thematic content analysis was employed to assess qualitative data.

Results. Most participants (n=20) reported enjoying e-cigarettes with fruit, candy, dessert or menthol/mint flavors and valued having a wide selection of flavors. Most participants (n=19) reported that they would likely quit or significantly reduce e-cigarette use if e-cigarette flavors were banned. Additionally, participants (n=22) generally perceived e-cigarette flavorings as helpful in cutting down smoking through increasing e-cigarette use frequency and duration.

Conclusion. Although many participants held positive beliefs about the role of e-cigarette flavors in smoking reduction, the reported approaches (e.g., escalated e-cigarette use) of cutting down cigarette smoking are concerning and may have negative health implications. E-cigarette flavors should be restricted or limited to reduce the prevalence and amount of e-cigarette use and

minimize its health-related risks. Young adult smokers should be educated about the potential harm of using flavored e-cigarettes and the benefits of quitting tobacco products altogether.

Keywords: Electronic Cigarettes, Flavored Tobacco, Vaping, Cigarette Smoking, Qualitative Research, In-depth Interview,

INTRODUCTION

Although the smoking prevalence in the U.S. has decreased drastically over the past two decades, it still remains high for young adults; about 13% of adults aged 18–24 currently smoke cigarettes (HHS, 2014). In recent years, electronic nicotine delivery systems or electronic cigarettes (e-cigarettes) have started to gain great popularity among young adult cigarette smokers. By 2013–2014, young adult smokers aged 18–35 had the highest prevalence of e-cigarette use (~30%–40%) among any adult age group (Biener et al., 2015; Ramo, Young-Wolff, & Prochaska, 2015). The most frequently cited reasons for young adults to adopt e-cigarettes involve e-cigarette flavors (Choi et al., 2012; Kong et al., 2015). Young adults are attracted to appealing e-cigarette flavors and are generally excited to have a great selection of e-cigarette flavors (Bonhomme et al., 2016). Consequently, more than 80% of young adult e-cigarette users adopted flavored e-cigarettes that tasted like mint, candy, dessert, fruit, or various beverages (Bonhomme et al., 2016).

Recently, a vigorous national debate over restricting characterizing flavors in e-cigarette products has occurred (Kostygina et al., 2014; TCLC, 2014), reflecting scientific opinion about the negative public health impact that fruit- and candy-flavored e-cigarettes have on young people as a tobacco starter product (Chen et al., 2017; Kostygina et al., 2014) and its potential harm to users' respiratory health (Allen et al., 2016; Barrington-Trimis, Samet, & McConnell, 2014). The 2016 ruling by the U.S. Food and Drug Administration (FDA) extended its authority to e-cigarettes but did not include regulations to restrict e-cigarette flavorings (FDA, 2016). The decision of whether to restrict flavorings hinged on the question of e-cigarettes' potential harm reduction impact among combustible tobacco users (Cahn & Siegel, 2011). Specifically, some policymakers feared that an e-cigarette flavor ban would jeopardize the chance for smokers to

successfully quit smoking, as many e-cigarette users, regardless of their cigarette smoking status, were likely to drop the product if it came with only limited flavors (Harrell et al., 2017). Unfortunately, little evidence existed demonstrating how flavored e-cigarettes influence smokers' cigarette smoking behavior, especially young adult smokers. Thus, to achieve a balanced policy decision, the FDA recently sought public input to learn how tobacco flavorings (including menthol) affect individuals' cigarette smoking behaviors (FDA, 2017).

In order to ascertain how flavored e-cigarette use influences the smoking behavior of young adults, it is critical to first understand how this group perceives e-cigarette flavors. The extant literature on young adult smokers' perceptions of e-cigarette flavors, however, is limited and focuses primarily on the perceived attractiveness of flavors (Kong et al., 2015; Patel et al., 2016). Little is known about how young adult smokers perceive e-cigarette flavors in both positive and negative ways and how they consider e-cigarette flavors' roles in influencing their smoking behavior. Moreover, research is limited regarding this group's intention of using e-cigarettes in the hypothetical instance of an e-cigarette flavor ban, a topic that should be foundational in any regulatory discussions.

Considering these critical research gaps, the primary aim of this study was to explore young adult smokers' attitudes and beliefs toward e-cigarette flavors. This research applied the Theory of Reasoned Action (TRA), which posits that a person's attitudes, beliefs, and intentions influence their health behavior (Ajzen, 1991). Using TRA, we designed an in-depth interview with young adults who used both cigarettes and e-cigarettes to explore their perceptions of flavored e-cigarette use. We decided to prioritize dual users of cigarettes and e-cigarettes, instead of former smokers who have already quit smoking through using e-cigarettes, because with a much shorter recall period, current smokers may be more likely to accurately describe how e-

cigarette flavors influence their smoking behaviors. The objective of this research was to address the following research questions: (1) what are young adult smokers' attitudes and beliefs towards e-cigarette flavors?; (2) what are their intentions of using e-cigarettes given an e-cigarette flavor ban?; and (3) what are their perceptions of the role of e-cigarette flavors in cigarette smoking behaviors? We used qualitative inquiry to facilitate an in-depth understanding of why individuals adopt, maintain, and stop practicing new behaviors in a given socio-cultural environment (Agee, 2009). By examining these perceptions, this study has the potential to inform the development of education messages regarding e-cigarette use among young adult smokers, as well as the decision-making of tobacco control regulations related to flavored e-cigarettes.

METHODS

Study Design and Sample

We conducted a qualitative analysis of 25 phone interviews among young adult dual users of cigarettes and e-cigarettes. Study participants were recruited via postings on Craigslist.com, a recommended approach to recruit young adult smokers (Ramo, Hall, & Prochaska, 2010). Interested individuals were screened online and by phone to verify eligibility. The requirements were participants must (1) be between 18 and 34 years of age; (2) read and speak English; (3) currently smoke cigarettes (answering at least "some days" to the question "Do you now smoke cigarettes?"); (4) have smoked 100 cigarettes in their lifetimes; (5) currently use e-cigarettes (answering at least "some days" to the question "Do you now use e-cigarettes?"); (6) have used e-cigarettes for at least two months; and (7) have used e-cigarettes with the purpose of cutting down on cigarette smoking.

Prior to the interview, participants read the online consent form and completed a brief online background survey in which they answered questions regarding their socio-economic

characteristics and their past and current use of e-cigarettes and cigarettes. Next, participants were contacted to schedule the in-depth interview. Those who completed both the survey and interview received a \$40 CVS gift card for their participation. The University of Maryland Review Board approved the study.

Interview Instrument and Structure

One-on-one interviews are a powerful methodological means for gaining a deep understanding of participants' perceived experience and complex behaviors and enabling participants to express themselves thoughtfully and honestly (Kvale, 1983). The semi-structured design of the study encouraged participants to go beyond the predetermined questions and freely share their experiences. During the interview, we did not distinguish types of e-cigarettes (e.g., rechargeable and refillable), but instead referred to them collectively as "e-cigarettes" or "e-cigs." All interviews were completed by the first author to maintain consistency across interviews. Post-interview notes documented key points from each interview and were used to confirm data saturation, defined as no new information being garnered from the interviews (Patton, 1990). Although data saturation was reached around interview #19, additional interviews were conducted to confirm saturation had been reached. All interviews were conducted May–July 2017 and lasted about 26 minutes on average with a range of 20 to 35 minutes.

Analysis

All interviews were audio-recorded and transcribed verbatim with participants' consent. Data were stored and managed electronically on password-protected computers. QSR Nvivo v.11 software was used to code and organize transcripts. Two coders developed the preliminary codebook based on the interview guide and coded two transcripts together. Subsequently, they revised the preliminary codebook based on emergent themes from the two transcripts (e.g.,

perceived harm of using flavored e-cigarettes) and completed the final codebook. Two additional transcripts were coded using the final codebook. The overall Kappa score between the two coders was 89.2% (range 85.2% to 95.6% across themes), showing strong agreement (McHugh, 2012). Any disagreements on themes and codes were resolved through discussion, and the lead coder (the first author) then coded the remainder of the interviews. This method allowed for a single researcher to be immersed in both data collection and analysis in order to ensure that the coding frame adequately described the intentions and content of the interviews.

Our goal of coding the transcripts was to identify major themes from the participants' perspective. We used thematic analysis to analyze the transcripts by closely examining the coded text and identifying emergent themes or patterns both within and across codes (Rice & Ezzy, 1999). Following the identification of themes and sub-themes, the transcripts were reviewed again to select representative data (quotes) for each theme. Finally, all authors reviewed the coded themes and verified the results of the analysis. In this paper, all participants were given a pseudonym to protect confidentiality.

E-cigarette Flavor Classification

The interviewer first asked the participants what e-cigarette flavors they currently used and then referred to their specific flavors in the remaining questions. The flavors reported by the participants were categorized based on their flavor attributes (Yingst et al., 2017). The flavor categories included Tobacco, Menthol/Mint, Fruit, Dessert/Sweets, Alcohol, Nuts/Spices, Candy, Coffee/Tea, Beverage, and Unflavored.

RESULTS

Table 4.1 shows participants' profiles. Specifically, fifteen participants self-identified as male, and the average age was 24.9 years. Nine participants self-identified as non-Hispanic (NH)

black, seven as NH white, five as mixed races, two as Hispanic, and two as Other races. Table 4.2 summarizes the results of the interviews based on the following themes.

Theme 1: The Attitudes and Beliefs about E-cigarette Flavors

Attitudes about the taste and smell of flavored e-cigarettes

The fruit and sweet e-cigarette flavors (e.g., fruit, candy, dessert/sweets flavors) were repeatedly described by our participants as “sweet,” “tasty,” and “delicious” (n=20). For examples, Jessica stated, “I really enjoy the drinks and the fruits [flavors] because they leave a better taste,” and Alvin mentioned, “I like those flavors because they’re fruity, and I enjoy fruits.” In contrast, two participants reported purposefully staying away from sweet flavors such as “strawberry banana” since they tasted “too good” and were “addicting.” Menthol/mint flavors were popular among both menthol and regular cigarette smokers as they tasted “refreshing,” were “soothing,” and could be easily mixed with other sweet and fruit flavors (n=8). For example, Maggie stated, “I think the menthol taste always relaxes me. It reminds me of every time I go to the massage, they add those minty oils, and it is just soothing.” Conversely, many participants (n=11) recounted negative experiences vaping traditional tobacco flavors, which they described as “nasty” and “harsh.”

Perceived harm of using flavored e-cigarettes

Although not asked specifically about the harm of flavored e-cigarettes, this topic was often brought up during the interview. Eleven participants revealed their perceptions of the harm of using e-cigarette flavors during the interview. Five of them deliberately discussed the topic, yet others unintentionally touched on the topic when discussing other themes. When describing their current e-cigarette flavors of choice, four participants mentioned that their e-juice possibly contained harmful chemicals, but they were unsure of any specific chemicals that were included.

Interestingly, two participants stated that they preferred e-cigarette flavors with names that sound more “organically made” or “natural.” Moreover, four participants reported that they would not use tobacco and menthol/mint flavors because these flavors seemed to be “more harmful” and contain more “dangerous chemicals” than fruity and sweet flavors. For example, Spencer mentioned “I think for tobacco flavored e-cigarettes, they put some chemicals in there. That’s not something you want to be inhaling. The juice is brown. It’s not too friendly, as opposed to other flavors.” Notably, when describing the harm of using flavored e-cigarettes, nine of the eleven participants expressed ambivalence and uncertainty by frequently using words such as “maybe” and “not sure,” and, in some cases, even asked the interviewer to provide scientific facts about the harm of using e-cigarette flavorings.

When asked about the nicotine concentration in the e-cigarette products they currently used, only about half (n=13) of the participants could clearly describe the specific nicotine concentration. Three participants expressed concerns about accidental nicotine overuse, acknowledging that they did not know the nicotine concentration and noting that the concentration was not labeled on the e-liquid bottles. Six participants mentioned that the sweet taste of the e-liquid hid the harsh taste of nicotine and suspected that they may be consuming more nicotine than they previously did when only smoking cigarettes. As participant Donald asserted, “I know I am inhaling nicotine, but it still doesn’t really register because of the [candy] flavor.” Jessica said when using the strawberry flavors, “you don’t taste the nicotine as much.” Several participants recounted negative biological responses towards using e-liquids with high nicotine concentration. Wilson reported jittery and anxious feelings after trying a fruit flavored e-liquid, while Mary stated, “It made me feel like really nauseous. It just wasn’t very pleasant at all.”

Theme 2: Intentions of Using E-cigarettes Given the E-cigarette Flavor Bans

Participants responded with a wide range of opinions when asked whether they would continue using e-cigarettes if the sale of e-cigarette flavors were legally restricted. They were asked to consider three scenarios: (1) all flavors except tobacco were banned, (2) all flavors except menthol/mint were banned, and (3) all e-cigarettes except unflavored e-cigarettes were banned. For half of the participants (n=12), flavor sales bans would not affect them directly and they would continue to use e-cigarettes following any bans in order to quit smoking. However, many of these participants (n=8) reported that a ban would reduce their interest and enthusiasm in using e-cigarettes and perhaps cause them to use e-cigarettes less frequently or in smaller amount. Alvin stated, “I would use them but sparingly. I will only use them when I feel like it. I will use it less.” Lucas mentioned, “I think I would probably use them differently. I would probably cut back a lot more.” In contrast, some participants (n=11) asserted that flavor varieties were vital to them and that all three scenarios would directly cause them to stop vaping. John mentioned, “The only reason that I am doing it now is that I enjoy the flavors. Once you take away that enjoyment, there is really no reason for me to be doing it.” Similarly, Pamela responded, “I enjoy them for the variety. If they made it more difficult to buy or get access to, I feel that it would make it more difficult to use.” For others (n=2), they felt flavor bans likely would not affect them at all since their only reason for using e-cigarettes was to quit smoking. When asked why he would still vape when no flavors are available, Zack responded, “Either vape, or the craving hits me, and I’ll light up a cigarette.”

Among participants who would still use e-cigarettes after the flavor ban (n=12), the majority of them (n=9) felt they would still use menthol/mint flavors (scenario 2) if that were the only flavor left. In contrast, only a few participants (n=4) reported they might be willing to use

tobacco flavors (scenario 1), but they were not sure how they would like them or did not believe they would help reduce smoking due to the taste resemblance. Only two participants thought they would want to use unflavored e-cigarettes (scenario 3), while many others reported that using unflavored e-cigarettes would be like “puffing in hot air” or “sitting in a hot sauna.” Among the participants who would rather not use e-cigarettes given a flavor ban (n=11), most (n=8) appeared to be avowed flavor enthusiasts by stating that they used e-cigarettes mainly for their taste and thought that quitting smoking represented an additional benefit. For example, when asked, Lisa explained why she would quit vaping given the flavor restrictions - “I vape mostly for the taste. It’s an added bonus for me that I can use e-cigarettes to quit smoking.” These participants were further probed on what methods they would use to cut down smoking if they no longer using e-cigarettes. Among them, seven answered “cold turkey” and three responded some type of nicotine replacement therapies such as nicotine patches as options. When discussing the potential smoking behaviors of using these methods following an e-cigarette flavor ban, some of them (n=5) expressed less confidence in cutting down smoking. For example, when discussing the impact of e-cigarette flavor restrictions on his smoking reduction progress, Stanley stated, “I don’t think it’s going to help with my progress too much.”

Theme 3: The Perceived Role of E-cigarette Flavors in Cigarette Smoking

Perceived role of e-cigarette use in cigarette smoking behaviors

When asked whether they believed that e-cigarettes had influenced their cigarette smoking behavior, most of the participants stated that e-cigarettes helped them cut down smoking (n=22). Two participants mentioned they had stopped smoking cigarettes temporarily but relapsed by the time of the interview (n=2). Only one participant (Linda) said that e-cigarettes did not influence her smoking behavior at all. Those participants who cut down on

cigarettes reported cutting down by around half (n=11), more than half (n=9), or less than half (n=2) of their previous daily amount. When asked how e-cigarettes helped reduce smoking or quit smoking temporarily, most participants (n=20) reported that e-cigarettes served as a replacement to cigarettes and help alleviate their craving for cigarettes.

Perceived role of e-cigarette flavors in cigarette smoking behaviors

Most of the participants stated that e-cigarette flavors have influenced their cigarette smoking behaviors (n=22), and only one claimed there was no effect (n=1). Interestingly, two participants (n=2) commented that flavors did not really matter to them, and that cutting down smoking was the main reason for them to vape. For example, Kevin stated, “It’s more about quitting tobacco for me.” Gary reported that he used e-cigarettes just to “kill the nicotine urge” and said “flavors are not a consequence for me.” Among the participants who found fruity and sweet flavors beneficial, some emphasized that tobacco and menthol/mint flavors were not helpful at all because they increased the urge to smoke and caused them to smoke more. When asked why and how certain e-cigarette flavors helped reduce smoking, participants expressed a wide range of opinions. Many participants (n=17) mentioned that the pleasant and enjoyable taste and smell of fruit and candy e-cigarette flavors could not be matched by cigarettes, and thus encouraged them to replace cigarette smoking with vaping. Specifically, some participants said that fruit and candy flavors masked the harshness of cigarette taste, reducing cigarette cravings. Donald noted, “When you are using candy flavors, you associate it with sugar, so it’s most likely that the candy smell distracts me from wanting to smoke a cigarette.” Jessica stated, “Why would I smoke a cigarette when it’s going to leave that awful taste in my mouth? Instead, I could vape, and it tastes like fruit, bubble tea, or a popsicle.” Some participants (n=3) also emphasized that they gradually switched from smoking cigarettes to

vaping e-cigarettes because e-cigarettes came in a variety of flavors, whereas cigarettes “always taste the same.” For instance, Lewis stated, “Why am I going to continue investing [in] a cigarette that pretty much tastes the same when I could get different flavors of something and try it out on an e-cig.” Quite a few participants (n=11) mentioned that their enjoyment of e-cigarette flavors and excitement over selecting new flavors kept them “interested” and “hooked” on e-cigarettes. John mentioned, “New flavors come out every once in a while. Change it up just a little bit, and you never get bored [of vaping].” As Pamela stated, “Over time, I want to try as much as possible to have a lot [of flavors] that I can turn to rather than cigarettes.” Additionally, four participants reported having a preferred flavor or a variety of flavor choices prompted them to use e-cigarettes more frequently. According to Lucas, “I like fruit flavors a lot. It is just what my taste buds like more. I found myself using more e-cigarettes with that flavor.”

Some users (n=8) of tobacco and menthol/mint flavored e-cigarettes suggested that tobacco and menthol/mint flavors were helpful in cutting down smoking since they tasted similar to regular and menthol cigarettes and were “the closest thing” they could get. This was particularly true for menthol cigarette smokers who also used menthol/mint flavored e-cigarettes. Two participants specifically commented that menthol/mint flavors gave them the same “throat hit” as menthol cigarettes by providing a similar cooling effect and refreshing feeling. Bonnie mentioned, “The menthol helps because I am tasting that menthol feeling more than anything. It does help.” Conversely, some participants (n=8) stressed that they feared that tobacco and menthol/mint flavors would trigger their urge to smoke a regular or menthol cigarette while they actively try to cut down smoking. For example, Stanley said, “When I vape tobacco flavored e-cigarettes, it just reminds me of a normal cigarette. It gives me the cravings and I want to go back to smoking. That’s not what I am trying to do.” Pamela said, “I was trying to stop smoking

cigarettes. So if the e-cigarettes give me the same flavor as the regular cigarettes, then what's the use of vaping?"

DISCUSSION

Results from our in-depth interviews add to the current limited research on attitudes and beliefs towards flavored e-cigarette use among young adult smokers. In general, we found that young adult smokers used a variety of flavors and that most used multiple flavors concurrently. Almost all participants reported reducing cigarette smoking through vaping over time, and a large proportion of the participants would most likely reduce or quit e-cigarette use, which might hinder their process of quitting smoking.

Our study provided unique perspectives on how young adult smokers perceive various approaches to using flavored e-cigarettes to cut down smoking. Specifically, they reported: (1) flavors provide an enjoyable sensory experience of vaping that encourages the replacement of smoking with e-cigarettes; (2) the satisfaction from vaping flavors and the excitement of collecting new flavors help maintain and increase e-cigarette use over time; and (3) tobacco and menthol/mint flavors facilitate the replacement of smoking by offering a similar taste and smell. Notably, we found a strong perceived positive role of candy, fruit, and dessert/sweets flavors in reducing cigarette smoking. These flavors were not only deemed to provide strong sensory pleasures but were also most likely to add fun and selection excitement to the experience of using e-cigarettes. Additionally, we found that the participants appeared to enjoy menthol/mint e-cigarette flavors far more than tobacco flavors. Their preference towards menthol/mint flavors may be explained by the reason that menthol/mint flavors are particularly effective in reducing the harshness of nicotine by providing extra "cooling" and "soothing" effects, as suggested by our study and previous research (Rosbrook & Green, 2016). Interestingly, our results showed

that while some young adult smokers found vaping with tobacco and menthol flavors helpful in curbing their smoking urges, others found the opposite— tobacco and menthol flavors prompted their urges of smoking due to similar sensory experiences. Future research needs to explore the behavioral and psychological rationale behind this differential response.

In light of our sampling frame—young adult smokers who reported using e-cigarettes to quit smoking—it is not surprising to find that most participants perceived e-cigarette use to be helpful for smoking reduction. Although many participants claimed using non-tobacco flavored e-cigarettes to be helpful in cutting down smoking, the reported approaches of smoking reduction by maintaining and increasing e-cigarette use over time are worrisome and merit special attention from public health researchers and practitioners. In fact, these reported approaches reflect the tobacco industry’s tactics of using sweet flavors to attract young adults, increase tobacco initiation and regular use among this group, and encourage addiction to tobacco products (Stanton et al., 2016). These tactics may be particularly effective among young adults, who as a group are often motivated to use e-cigarettes for smoking reduction. Thus, although young adult smokers may cut down on cigarettes temporarily by using e-cigarettes of preferred flavors, they might engage in prolonged tobacco dual use and increased nicotine dependence over time. Furthermore, our study and previous research (Tseng et al., 2016) both suggest that cigarette smokers reportedly successful in using e-cigarettes to reduce smoking most likely cut their daily cigarette consumption in half. The reduction, however, is unlikely to produce beneficial health effects as smokers may engage in substantial compensatory smoking (e.g., deeper inhalation per cigarette), resulting in a limited decrease in biomarkers for toxicant exposure and cardiovascular risks (Hatsukami, Stead, & Gupta, 2008). Further research is needed to examine smokers’ compensatory smoking behavior while replacing cigarettes with e-cigarettes of various flavors.

We also conclude that the fruity and sweet taste and aroma in e-cigarette liquids may be especially appealing to young adults as these flavors reportedly hide the harshness of nicotine. This finding is consistent with previous research suggesting that flavored tobacco was manufactured to diminish the harshness and taste of nicotine (Stanton et al., 2016), potentially resulting in detrimental health effects from nicotine overuse. Nicotine poisoning is also likely to occur when inappropriately using e-cigarettes, resulting in vomiting, nausea, and eye irritation (Chatham-Stephens et al., 2014). What is also concerning is that using e-cigarettes with sweet flavors is more likely to increase the rate of nicotine absorption than vaping tobacco flavors (Helen et al., 2017), which may result in a higher level of nicotine dependence over time (Hatsukami et al., 2008). Lastly, most of the respondents in our sample were unaware of the nicotine concentration in their e-liquids, leaving them more susceptible to nicotine overuse and its associated health risks.

This study also revealed that young adult smokers might lack the knowledge about the chemical compositions of flavored e-liquids and perceive fruity and sweet flavors to be healthier and less harmful than tobacco flavors. This finding is troubling given that multiple studies have shown that harmful chemicals in e-cigarette flavorings might pose health risks to e-cigarette users' lungs and respiratory systems (Allen et al., 2016; Barrington-Trimis et al., 2014). Moreover, evidence related to the effectiveness of e-cigarette use, regardless of flavors, on smoking reduction and cessation is still limited, and thus no conclusion can be drawn (Hemmerich, Klein, & Berman, 2017; Malas et al., 2016). Young adults' positive perceptions of e-cigarette flavors in smoking reduction are unfounded and possibly driven by a temporary reduction of cigarette smoking. Nevertheless, many young adults in our sample showed strong interests in knowing more about the ingredients and harm of flavored e-liquids and were willing

to learn about the scientific facts regarding the product. Considering all of the evidence, we suggest public health practitioners educate young adult smokers about the dangers of nicotine overuse from using e-cigarettes with fruit and candy flavors, as well as the potential risks of consuming harmful chemicals when vaping flavored e-juices. Health messages and programs need to be developed to further inform this group regarding the benefits of quitting e-cigarettes, and to encourage dual users of cigarettes and e-cigarettes to quit tobacco products altogether by using evidence-based approaches such as FDA-approved pharmacological nicotine replacement therapies.

Our study also offers useful findings on young adult smokers' intentions of using e-cigarettes in the event of a flavored e-cigarette ban. Our research and another recent study (Harrell et al., 2017) both showed that, given an e-cigarette flavor ban, most young adults would likely quit using e-cigarettes or significantly reduce their e-cigarette consumption. We also found that whether a young adult would still use e-cigarettes after a flavor ban may largely depend on their primary reason for using e-cigarettes— smoking cessation or enjoyment of the flavors. Those who vape primarily for the purpose of quitting smoking might continue to vape regardless of the available flavors. Conversely, those who use e-cigarettes for the pleasure of flavors may be more likely to be affected by an e-cigarette flavor ban. Thus, in the event of a flavored e-cigarette sales ban, the professional and timely guidance of using evidence-based smoking cessation methods needs to be given to young adults who previously relied on flavored e-cigarettes to cut down on smoking. We also conclude that reducing e-cigarette flavor varieties or completely restricting e-cigarettes with non-tobacco flavors might help reduce e-cigarette use prevalence or e-cigarette use amount and frequency among young adult smokers.

This study also has significant implications for regulating flavored e-cigarette products. Since it is unclear whether the reported smoking reduction in our study is sustainable and will finally lead to smoking abstinence, we suggest legislative action to restrict e-cigarettes with non-tobacco flavors in order to minimize the product's immediate and long-term harm among young adult smokers. Furthermore, our study and previous research (Barbeau, Burda, & Siegel, 2013) both found that some young adults are excited about using e-cigarettes because of the constant introduction of new flavors. Thus, even if a nationwide ban on all non-tobacco flavors does not pass, legislators would still have an excellent case for restricting a selection of particularly attractive flavors, such as fruity and sweet flavors, in order to curb young people's interest in using e-cigarette products. Future studies are also warranted to examine the particular role of less appealing non-tobacco flavors (e.g., nuts/spices, alcohol, coffee/tea) in cigarette smoking behaviors in order to further inform decisions on regulating e-cigarette flavors. Lastly, this study revealed that young adult smokers are very likely to accept menthol/mint flavors when all other flavors were restricted. Therefore, leaving menthol/mint flavors exempted from an e-cigarette flavor ban will not greatly help reduce the prevalence of e-cigarette use among this group. Overall, we suggest the FDA to take into account the evidence from this study to further weigh the harm and benefits of flavored e-cigarettes use in the context of tobacco use and nicotine dependence among young adult smokers.

Study Limitations

This study should be reviewed with the following limitations. Our interviews were conducted among a purposive sample of young adults in the Eastern region of the United States. While our findings may not apply to all young adult e-cigarette users, they highlight critical factors on the attitudes, beliefs, and intentions of flavored e-cigarettes. Another limitation is the

potential bias from the researchers during data analysis stages. This was minimized, however, by tightly following the coding scheme drafted according to the theoretically based psychological constructs from TRA. Social desirability is also a possible limitation as participants may have provided answers they believed the interviewer wanted to hear. The interviewer of this study, however, had extensive experience in conducting qualitative investigations and had been trained to listen without responding or giving cues, thereby limiting participants' expression of social desirability. Additionally, this study involved using a purposive sample of users of cigarettes and e-cigarettes in the greater Washington D.C. metropolitan area to inform future larger studies with young adults (Hennink, Hutter, & Bailey, 2010). Lastly, our findings are based on self-reports and do not include biochemical verification of cigarette or e-cigarette use.

Regardless of the limitations, this study offers significant public health implications regarding young adult smokers' use of flavored e-cigarettes. By applying TRA, this study indicates that young adult smokers' perceptions about e-cigarette flavors may be important antecedents of their e-cigarette use behavior and in turn, their cigarette smoking behavior. Similarly, the intentions of using e-cigarettes may predict young adults' actual e-cigarette use behaviors given e-cigarette flavors were restricted. Thus, this study offers critical evidence to policymakers regarding whether and how flavored e-cigarette sales restrictions would potentially affect young adult smokers' choices of smoking cessation methods, which in turn may largely determine their smoking reduction and cessation outcomes. Legislations to restrict the availability of flavored e-cigarettes or flavor varieties may in turn influence the society norm about the product and thus further minimize its uptake and regular use.

CONCLUSIONS

Our study results indicate that young adult smokers used a wide variety of e-cigarette flavors including tobacco, menthol/mint, fruit, candy, and dessert/sweets. Although most young adult smokers perceived fruity and sweet flavors to be helpful in smoking reduction, the approaches to using flavored e-cigarettes for smoking reduction are troublesome and deserve special attention from public health researchers and practitioners. We recommend public health practitioners educate young adult smokers about the potential harm of using flavored e-cigarettes and encourage them to quit both cigarettes and e-cigarettes altogether using evidence-based approaches. We also suggest that legislators limit or restrict non-tobacco flavors in e-cigarettes, especially fruity and sweet flavors, in order to reduce the prevalence of e-cigarette use.

Table 4.1. In-depth Interview Participant Profile (N=25)

Name ¹	Gender	Age	Race/ Ethnicity	Cigarette Smoking Frequency ²	Menthol Cigarette Smoking ³	E-cigarette Use Frequency ⁴	Current E-cigarette Flavor(s)	Number of CPD ⁵ Cut Down
Alvin	Male	31	Black	Daily	Yes	<15 Days	Fruit	Less than half
Bonnie	Female	25	Black	Daily	Yes	≥15 Days	Menthol/Mint	More than half
Danna	Female	21	White	Daily	Yes	≥15 Days	Menthol/Mint, Nuts/Spices, Candy	More than half
Donald	Male	34	Black	Daily	Yes	≥15 Days	Menthol/Mint, Candy	About half
Gary	Male	19	Mixed Race	Some days	No	<15 Days	Fruit	About half
Jason	Male	28	NHPI ⁶	Daily	Yes	≥15 Days	Tobacco, Menthol/Mint, Coffee/Tea	About half
Jeffrey	Male	22	White	Some days	No	<15 Days	Menthol/Mint, Fruit	Temporary Cessation ⁷
Jessica	Female	21	White	Daily	No	≥15 Days	Fruit, Beverage	About half
John	Male	33	Black	Daily	Yes	<15 Days	Fruit, Dessert/Sweets, Candy	Less than half
Kevin	Male	25	Black	Some days	Yes	<15 Days	Tobacco, Menthol/Mint, Alcohol	More than half
Lewis	Male	20	Black	Daily	Yes	<15 Days	Dessert/Sweets	About half
Linda	Female	19	Hispanic	Some days	No	<15 Days	Menthol/Mint, Fruit, Unflavored	Did not help at all ⁸
Lisa	Female	21	Mixed Race	Daily	No	≥15 Days	Menthol/Mint, Dessert/Sweets	About half
Lucas	Male	18	Black	Some days	Yes	≥15 Days	Fruit	More than half
Maggie	Female	31	Asian	Some days	No	<15 Days	Menthol/Mint	About half
Mary	Female	21	Mixed Race	Daily	No	<15 Days	Dessert/Sweet	More than half
Mason	Male	30	White	Some days	No	≥15 Days	Tobacco, Fruit, Dessert/Sweets	About half
Mike	Male	22	Black	Daily	No	<15 Days	Tobacco	About half
Nancy	Female	26	Mixed Race	Some days	No	<15 Days	Tobacco	Temporary Cessation ⁷
Pamela	Female	19	Hispanic	Some days	Yes	<15 Days	Fruit, Dessert/Sweets	More than half
Spencer	Male	32	White	Daily	Yes	≥15 Days	Coffee/Tea	About half
Stanley	Male	29	White	Daily	No	<15 Days	Fruit, Candy	More than half
Teresa	Female	23	White	Some days	Yes	<15 Days	Menthol/Mint, Candy	More than half
Wilson	Male	20	Black	Some days	Yes	<15 Days	Menthol/Mint, Fruit	More than half
Zack	Male	32	Mixed Race	Daily	Yes	≥15 Days	Fruit, Dessert/Sweets	About half

1. Participants were given a pseudonym to protect confidentiality.

2. Frequency of cigarette smoking and e-cigarette use in the past 30 days.

3. Smoked menthol cigarettes in the past 30 days.

4. E-cigarette use frequency in the past 30 days.

5. Number of CPD (cigarettes per day) reduced since the beginning of the smoking reduction process using e-cigarettes.

6. Native Hawaiian and Pacific Islanders.

7. Participants reported having temporarily stopped smoking through using e-cigarettes and relapsed to smoking by the time of the interview.

8. Participant reported using e-cigarettes did not help with smoking reduction at all.

Table 4.2. In-depth Interview Themes and Summarized Results

Themes	Interview Results
Attitudes and Beliefs about Flavored E-cigarettes	<p>Positive attitudes:</p> <ul style="list-style-type: none"> • Fruit, candy, and menthol/mint flavors are “tasty, “delicious,” “refreshing,” and “soothing.” • Tobacco and menthol/mint e-cigarette flavors resemble the taste and smell of conventional cigarettes. <p>Negative attitudes:</p> <ul style="list-style-type: none"> • Tobacco flavors are “nasty” and “harsh.” • Fruity and sweet flavors are “too good” and “addicting.” <p>Perceived harm of using flavored e-cigarettes:</p> <ul style="list-style-type: none"> • E-cigarette flavors, especially fruity and sweet flavors, may result in nicotine overuse or poisoning because these flavors mask the taste of nicotine. • E-cigarette flavors may cause long-term and escalated e-cigarette use, which may increase nicotine addiction and health risks associated with vaping. • Flavored e-liquids contain harmful chemicals that may cause lung diseases and harm respiratory health.
Intentions of Using E-cigarettes Given a Flavor Ban	<p>Stop or reduce e-cigarette use because:</p> <ul style="list-style-type: none"> • E-cigarette flavor varieties are the main appeal. • The taste and smell of tobacco and menthol/mint flavors are acceptable or appealing. • Non-preferred flavors are not perceived as helpful as preferred flavors for smoking reduction. <p>Continue to use e-cigarettes because:</p> <ul style="list-style-type: none"> • Quitting smoking is the most important reason for using e-cigarettes. • Fruity and sweet e-cigarette flavors are not attractive.
Perceived Role of E-cigarette Flavors in Cigarette Smoking	<p>Helpful because:</p> <ul style="list-style-type: none"> • E-cigarette flavors provide enjoyable sensory experience of vaping that helps replace smoking. • E-cigarette flavors help maintain and increase e-cigarette use over time. • Tobacco and menthol/mint e-cigarette flavors replace smoking with familiar taste and smell. <p>Unhelpful because:</p> <ul style="list-style-type: none"> • Tobacco and menthol/mint e-cigarette flavors offer similar taste and smell to conventional cigarettes, which prompts smoking.

CHAPTER FIVE: STUDY 3

Restricting the Sale of Flavored E-cigarettes in the U.S. — An Examination of Local Regulations

ABSTRACT

Background. In the absence of nationwide restrictions for flavored e-cigarettes, many local governments have taken the initiative to ban the sale of flavored e-cigarettes in order to discourage youth e-cigarette use. This paper examines the strictness of local flavored e-cigarette sales restrictions and their local characteristics as a way to inform local and national policymaking.

Methods. We identified 121 U.S. jurisdictions from five states (California, Illinois, Massachusetts, Minnesota, and Rhode Island) with sales restrictions on flavored e-cigarettes, as of October 1, 2017. We coded all the restrictions based on three policy provisions, specifically, whether or not the restriction applies to: (1) the entire jurisdiction, (2) menthol flavors, and (3) retail tobacco stores and/or smoking bars. We then used the coding results to classify the localities according to the strictness of the restrictions in terms of preventing youth use of e-cigarettes. Finally, we assessed each locality's socio-economic and smoking characteristics to predict the strictness of the restrictions.

Results. Among all the localities with flavored e-cigarette sales restrictions, 117 (96.7%) applied the restriction to the entire jurisdiction, 11 (9.1%) restricted the sale of menthol flavors, and 16 (13.2%) restricted the sale of flavored e-cigarettes in retail tobacco stores. Additionally, we classified four (3.3%), 15 (12.4%), and 102 (84.3%) localities as strict, moderate, and lax, respectively. All three strict restrictions occurred in California, while 92.1% of the lax restrictions occurred in Massachusetts. Localities that enacted strict or moderate restrictions were

more likely to have low adult cigarette smoking prevalence, large population sizes, high racial/ethnic minority proportions, and high percentages of voters for the Democratic Party than localities that adopted lax restrictions.

Conclusion. Since 2012, 121 localities (including towns, cities, and counties) in the U.S. have enacted a flavored e-cigarette sales restriction. Most of these localities, however, did not enact a comprehensive ban restricting the sale of e-cigarettes with all flavors (including menthol) among all types of retailers across the entire jurisdiction. As a result, national- and state-level flavored e-cigarette sales restrictions are greatly needed to strengthen efforts to prevent and reduce youth use of e-cigarettes.

Keywords: Flavored Tobacco, Electronic Cigarettes, Sales Restrictions, Local Regulations, Tobacco Control, Health Policy

INTRODUCTION

Since entering the market, electronic cigarettes (e-cigarettes or e-cigs) have gained tremendous popularity, especially among youth. By 2015, about 40% and 16% of U.S. youth had ever used or currently used e-cigarettes, respectively (CDC, 2016a). E-cigarettes, or more specifically the e-liquid used in e-cigarettes, come in a variety of flavors that youth find appealing (Kong, et al., 2015). As of 2013, more than 7,000 flavors of e-cigarettes were marketed in the U.S, including candy, dessert, and fruit flavors (Zhu et al., 2014). By 2013–2014, about 85% of youth e-cigarette users had adopted e-cigarettes with flavors other than tobacco flavors (Ambrose et al., 2015), with sweet flavors that taste like fruits and candy being the most frequently used flavors (Krishnan-Sarin et al., 2015). Researchers suggest that e-cigarette flavors may entice youth to experiment with e-cigarettes (Krishnan-Sarin et al., 2015) and boost e-cigarettes’ gateway effect (Chen, et al., 2017), leading this group to smoke cigarettes and facilitating the renormalization of cigarette smoking (Soneji et al., 2017).

Prior to 2016, the federal government did not regulate e-cigarettes. This changed with the so-called “Deeming Rule” when the U.S. Food and Drug Administration (FDA) extended its regulatory reach to include all tobacco products, including e-cigarettes. The Deeming Rule regulates the manufacture, distribution, and marketing of e-cigarettes. While the 2009 Family Smoking Prevention and Tobacco Control Act (TCA) prohibits the manufacturing and sale of flavored cigarettes (except for menthol flavors), the Deeming Rule does not restrict flavored e-cigarettes (FDA, 2016). Proponents believe that it is critical to impose restrictions on flavored e-cigarettes, advocating that this would largely reduce youth exposure to flavored e-cigarettes and further deter youth initiation and continued use of the product (Chen et al., 2017; Harrell et al., 2017). Previous research indicates that the 2009 national sales restriction of flavored cigarettes

was associated with a 17% reduction in cigarette smoking prevalence and a 58% decrease in cigarette consumption among youth (Courtemanche, Palmer, & Pesko, 2017).

To deter youth from using e-cigarettes, effective health policy is needed to reduce the availability of flavored e-cigarettes. In absence of federal laws, there is an imperative for state and local governments to fill these regulatory holes. Historically, state and local governments have served as “laboratories” in which innovative tobacco policies were enacted and tested. For example, many provisions that were included in the 2009 TCA, such as banning tobacco sales to minors, restricting the distribution of promotional samples of tobacco products, and prohibiting self-service displays, were preceded by successful state and local regulations. The 2016 Surgeon General’s Report recommended a comprehensive strategy, including enacting policies at the federal, state, and local levels to restrict youth exposure to e-cigarettes (CDC, 2016a). State or local regulation of e-cigarettes offers numerous advantages: (1) state and local governments can act more rapidly than the FDA; (2) state and local governments may be able to pass more aggressive regulation, laws that are broader and more stringent than federal law; and (3) state and local governments can customize laws to meet the specific needs of their communities (Zellers & McLaughlin, 2010).

Some local jurisdictions have gone so far as restricting the sale of flavored e-cigarettes in an effort to reverse the e-cigarette use epidemics among youth. Starting in 2012, large cities such as Chicago and San Francisco and numerous localities in Massachusetts changes the ways flavored e-cigarettes could be sold. The specific restrictions vary from locality to locality and this affects their potential impact. Broadly speaking, the current flavored e-cigarette sales restrictions involve three approaches to influence the sale of flavored e-cigarettes. They include (1) only targeting retailers within a certain radius of youth-populated areas such as schools,

libraries, and parks (i.e., has a “restriction zone”); (2) restricting menthol flavors; and (3) restricting retail tobacco stores and/or smoking bars, locations where the primary product sold is tobacco or e-cigarettes.

We are unaware of any published studies reviewing local flavored e-cigarette sales restrictions or examining locality factors associated with the restrictions. Understanding how locality factors relate to enactment of strict flavored e-cigarettes sales restrictions would offer valuable information to localities in gauging their own socio-economic and tobacco use characteristics as they make policy decisions as well as help public health researchers and practitioners understand the key factors driving the enactment of stricter restrictions. Therefore, the goals of this study were to (1) identify state and local sales restrictions of flavored e-cigarettes in the U.S., (2) classify the regulations according to their strictness in preventing youth use of e-cigarettes, and (3) determine the socio-economic and tobacco use characteristics of the localities that predict the strictness of the restrictions. This research can provide a foundation for future research analyzing the effectiveness of flavored e-cigarette sales restrictions in preventing youth e-cigarette use, while also informing the local and national debate over flavored e-cigarette regulations.

METHODS

Identifying Localities with Flavored E-cigarette Sales Restrictions

In November 2017, we conducted a review of states and localities that, as of October 1, 2017, had enacted a restriction on selling flavored e-cigarettes. We started by examining two major, and most comprehensive sources that listed localities with flavored e-cigarette sales restrictions (Massachusetts Municipal Tobacco Control Technical Assistance Program [MTCP], 2017; TCLC, 2017). Using these sources, we identified 117 locations. In order to identify other

jurisdictions not included in these sources, we performed online searches using the keywords “flavored tobacco sales restriction” and “flavored e-cigarette sales restriction” as well as the names of 50 states plus Washington D.C. This helped us to identify five additional localities (Barrington, RI; Johnston, RI; Middletown, RI; and Sonoma, CA) with restrictions. To determine whether our list was comprehensive, we consulted with three U.S. tobacco policy and law experts with extensive experience in policy making and legal consulting related to tobacco control. In most cases, direct contact with the experts through phone or email was made to clarify questions and verify our findings. Using this search strategy, we found that, as of October 1, 2017, no state-level legislation had been enacted to restrict the sale of flavored e-cigarettes, yet 121 local jurisdictions had enacted such restrictions. These jurisdictions ranged from large cities like Chicago (population size 2.7 million in 2010) to small towns like Granby, Massachusetts (population size 6,240 in 2010), and included three counties and 17 towns/cities from four states (CA, IL, MN, and RI) and, remarkably, 22 cities and 79 towns from Massachusetts.

Coding Restriction Provisions and Classifying Restrictions

To classify the locations according to their strictness in attempting to prevent youth use of e-cigarettes, we content coded the reported restrictions from the 121 localities. We began by searching published online documents and contacting local health officials to collect city and township ordinances and other legal documents concerning flavored e-cigarette sales restrictions by searching published online documents and contacting local health officials. To code the restrictions, three defining provisions were used: (1) the entire jurisdiction (does not have a “restriction zone”), (2) menthol flavors, or (3) retail tobacco stores and/or smoking bars. As part of this, we coded whether the regulation involved a restriction zone or exempted the retail tobacco stores using the main policy language of flavored e-cigarette sales restrictions. As for

policies' exemption of menthol flavors, we coded either the main policy language or its definition of "characterizing flavors" depending on where menthol flavors were mentioned in the document. Additionally, we coded the effective dates of the sales restrictions in order to assess the policy timeline and checked whether e-cigarettes were defined as a tobacco product to ensure that flavored e-cigarettes were included in the locality's flavored tobacco sales restriction. Furthermore, to demonstrate the reliability of the coding, a second trained coder coded half of the policies (n=60) randomly selected from the entire sample. The two coders reached 100% agreement on the coding of the three provisions for all 60 restrictions. Figure 1 illustrates the content coding method adopted in this study, using the regulation from Hayward, CA as an example. Finally, we classified the jurisdictions according to their strictness levels. The regulation was considered "strict" if the restriction applied to all three provisions, "moderate" if it only applied to two of the three provisions, and "lax" if it only applied to one. For example, we considered Hayward, CA (Figure 1) as having a lax restriction: although its regulation restricts menthol flavors, it includes a restriction zone and does not apply to all retail tobacco stores.

Identifying and Assessing Localities' Socio-economic and Smoking Characteristics

In order to understand how socio-economic backgrounds and tobacco use of a locality are associated with the strictness of its flavored e-cigarette sales restrictions, we examined a number of characteristics previously shown to relate to the enactment of local tobacco control policies (Bartosch & Pope, 2002; Skeer, 2004). Specifically, we researched U.S. Census data (U.S. Census Bureau, 2016) to consider a locality's population size, youth population (% of population less than 18 years of age), average annual median household income, education attainment (% of high school graduates or higher), poverty status (% of population below federal poverty line), and race/ethnicity composition (% of Non-Hispanic white residents). County-level adult cigarette

smoking prevalence rates were obtained from the 2016 Behavioral Risk Factor Surveillance Survey (BRFSS) data (CDC, 2016b), and county-level percentages of residents voting for the Democratic Party during the 2016 Presidential Election were retrieved from David Leip's Atlas of U.S. Presidential Elections website (Leip, 2016). Additionally, we examined the locality's state (CA, IL, MA, MN, and RI) and years of enactment (2012–2018) in relation to the policy strictness. The 2010–2015 Census data (U.S. Census Bureau, 2016) on the socio-economic characteristics of the U.S. were also included to compare the localities with the country as a whole. Finally, we conducted bivariate and multivariate regression analysis to identify the relationship between locality characteristics and the enactment of strict/moderate vs. lax restrictions. Statistical analysis was conducted using Stata 14.0.

RESULTS

Among the 121 localities examined in our study, 117 (96.7%) applied the restriction to the entire jurisdiction, 11 (9.1%) restricted the sale of menthol flavors, and 16 (13.2%) restricted the sale of flavored e-cigarettes in retail tobacco stores. Notably, all four localities with strict restrictions were from California, and 92.1% (n=94) of the localities with lax restrictions were from Massachusetts. According to our criteria, we found that 4 (3.3%) of localities had enacted strict, 15 (12.4%) moderate and 102 (84.3%) lax restrictions.

When compared to the U.S. as a whole, we found that the locations with the restrictions were better off economically and had a lower adult cigarette smoking prevalence rate (Table 5.2). Additionally, these locations had higher percentages of Non-Hispanic (NH) white residents and Democratic Party voters during the 2016 Presidential Election. When using these socio-economic and smoking characteristics to predict the enactment of a strict/moderate vs. lax restriction, in bivariate models (Table 5.3), we found that the locations with lower adult cigarette

smoking prevalence (OR=0.51, $p < .001$), a higher proportion of residents voting for the Democratic Party (OR=1.10, $p < .01$), more recent policy effectiveness dates (OR=1.83, $p < .05$), lower percentages of NH white population (OR=0.06, $p < .05$), and larger population sizes (OR=1.01, $p < .05$) were more likely to enact strict/moderate policies. Additionally, localities in California (OR=60.42, $p < .001$) and Rhode Island (OR=8.95, $p < .05$) were more likely than those in Massachusetts to enact stricter restrictions. When adjusting for all locality characteristics and the year of policy enactment, only adult cigarette smoking prevalence (AOR=0.52, $p < .05$) was associated with enacting strict/moderate restrictions. The McFadden's pseudo R-squared for the multivariate model was .31, indicating that the locality characteristics selected in this study presented a "very good fit of the model" (McFadden, 1973).

DISCUSSION

This study provides useful evidence to inform the policymaking and evaluation of flavored e-cigarette sales restrictions at the local, state, and national levels. In the absence of current federal laws restricting e-cigarettes with characterizing flavors, we identified that within the last five years, although no states have enacted sales restrictions on flavored e-cigarettes, 121 localities have passed such restrictions. Most (84%) localities, however, have lax restrictions leaving youth with great access and exposure to flavored e-cigarettes. Certain community characteristics, including low adult cigarette smoking prevalence, large population sizes, high racial and ethnic minority concentrations, and large percentages of Democratic Party voters are more likely to enact a moderate or strict restriction.

The high prevalence of lax restrictions and low prevalence of moderate and strict restrictions is concerning. Less stringent restrictions may leave youth with abundant exposure to flavored e-cigarettes. Such exposure undermines the public health goals of reducing e-cigarette

use and curbing long-term cigarette smoking. Yet a community that has adopted a restriction, even if lax, may wrongly believe that the law has addressed concerns about youth attraction to and use of e-cigarettes. These communities may be less likely to take additional action to protect youth. And often it is more difficult to tighten up a lax law than to get a more stringent law passed in the first instance, as legislators may be unwilling to go back to the law for revision. The fact that most of the localities (87%) restrict only flavored e-cigarette sales among non-tobacco retailers (for example, convenience stores) raises significant concerns, since these retailers carry far fewer e-cigarette flavor varieties shown to be attractive to young people compared to retail tobacco shops (for example, vape shops) that are exempted from the restriction (Giovenco et al., 2015). Moreover, just 11 localities (9%) prohibited menthol flavors may help maintain e-cigarettes' appeal to youth. While perhaps not as attractive to youth as fruity and sweet flavors, menthol flavored e-cigarettes still appeal to youth, and are frequently used as an entry into tobacco use (Krishnan-Sarin et al., 2015). Lastly, just four localities banned the sale of flavored e-cigarettes within restriction zones. It is recommended that these restriction areas to be broadened to cover the entire jurisdiction to greater reduce youth's exposure to flavored e-cigarettes. Youth are increasingly mobile, particularly in urban and suburban communities so that these restriction zones do not adequately protect youth. To maximize public health impact, we suggest that more localities adopt strict regulations. For the locations with a less stringent restriction, we recommend further amend their policies to eliminate the presence of flavored e-cigarettes, including menthol flavors, for all types of retailers across their jurisdictions.

This study indicates that the localities with moderate or strict flavored e-cigarette sales restrictions are more likely to be large cities rather than small towns. This finding may result

because small localities tend to have fewer tobacco retailers, and thus may not perceive regulating tobacco sales as a high priority (Bartosch & Pope, 2002). The negative relationship between the percentage of the NH white population and stricter flavored e-cigarette bans concords with the fact that racial and ethnic minority populations are more likely to use flavored tobacco products than NH white populations (Villanti et al., 2013). This contradicts prior research showing that e-cigarettes, including flavored e-cigarettes, are more likely to be used by whites in the country (Webb Hooper & Kolar, 2016). This discrepancy may partially result from the tobacco industry's unique marketing strategies and messaging targeting current users and potential users of e-cigarettes (Noel, Rees, & Connolly, 2011). Thus, we suggest that when designing regulations to curb e-cigarette use, localities should consider whether and how the specific patterns and demographic characteristics of e-cigarette use differ in the use of traditional tobacco products. Interestingly, our results show that compared to the restrictions enacted and made effective in earlier years such as 2012, 2014, and 2015, stricter restrictions were enacted in recent years. This likely results from increased access to information about youth use of e-cigarettes and proliferation of the products across the country. This trend suggests that we may see more moderate and strict flavored e-cigarette sales restrictions being introduced.

Localities with lower adult cigarette smoking prevalence rates were more likely to enact stricter flavored e-cigarette sales restrictions, even after controlling for socio-economic characteristics. We hypothesize that the localities that chose to enact stricter flavored e-cigarette restrictions may be more likely to implement tighter tobacco control regulations in the past, and as a consequence have a lower cigarette smoking prevalence. Alternatively, it might be easier to pass a restriction in localities where smoking is less popular. Flavored e-cigarette bans may further reduce adult cigarette smoking since curbing the youth uptake or use of e-cigarettes

would result in less uptake of cigarette smoking (Soneji et al., 2017). Perhaps these jurisdictions could be encouraged to adopt more rigorous tobacco product sales restrictions and for those restrictions to include e-cigarettes.

This study shows that it is feasible for local jurisdictions (i.e., the three localities from California) to pass strict sales restrictions of flavored e-cigarettes. Additionally, the initiatives from Massachusetts municipalities demonstrate how local governments, regardless of their geographical or population sizes, may independently enact and implement sales restrictions of flavored e-cigarettes that together cover large portions of a state (MTCP, 2017). Massachusetts' success could be credited to the state's decentralized system: each of the 351 Municipal Boards of Health in Massachusetts has the authority to pass its own regulations (NORC, 2012). Furthermore, the state does not have preemptive tobacco control legislation that prohibits localities from enacting tobacco sales policies that are more stringent than the state law (CDC, 2011). Eliminating state preemption laws, one of the Healthy People 2020 goals (HHS, 2018), may further help localities enact tobacco control measures to reduce tobacco use prevalence. The Massachusetts example also shows that when making policy decisions, local governments can leverage community resources such as state-funded and -organized tobacco control coalitions. Research shows that localities that received funding from the Massachusetts Tobacco Control Program (MTCP) were more likely to enact local tobacco control policies than those which did not receive funding (Bartosch & Pope, 2002).

During the policymaking process, localities may face powerful resistance from owners of local non-tobacco retailers who are concerned that the sale restrictions would threaten their businesses as tobacco “brings people through the door” (Buell, 2016). Due to such arguments and opposition, Chicago rolled back their policy and only banned flavored tobacco sale near high

schools (Chicago Tribune, 2016). San Francisco also experienced widespread and strong resistance from e-cigarette users and vape shop owners who argued that the ban would lessen their options for buying and offering e-cigarettes (Jacobs & Fojtik, 2017). To avoid and counter strong public resistance, the introduction of policy charges should be preceded and reinforced by public education and mass media campaigns (CDC, 2007). This can be difficult as the tobacco industry and its lobbying organizations are highly interested in the e-cigarette market. Evidence suggests that passing e-cigarette regulations at the state level has become increasingly difficult due to intensified tobacco lobbying (Cox, Barry, & Glantz, 2016), and that the tobacco lobbying, in general, has operated more effectively at the federal and state levels than at the local level (Begay, Traynor, & Glantz, 1993). This may partially explain why no states have passed a flavored e-cigarette sales restriction as of October 1, 2017, and underscores that local legislation may remain a viable option for overcoming the tobacco industry's interference in the e-cigarette policymaking process.

Finally, these 121 local regulations restricting sale of flavored e-cigarettes offer guidance for national policymakers looking to regulate flavored e-cigarettes. One major consideration that thwarts the enactment of the national ban on flavored e-cigarettes involves flavored e-cigarettes' potential impact on harm reduction of combustible tobacco use. While some researchers and harm reduction advocacy groups insist that flavored e-cigarettes can assist adults in their attempts to quit combustible products (Tackett et al., 2015; Takala, 2017), very little evidence supports this claim (Malas et al., 2016). Thus, without having strong evidence showing that flavored e-cigarettes can actually produce more benefits than harm among various population groups, nationwide regulations should remain focused on restricting the use of flavored e-cigarettes, especially among youth. This is especially true when no other tobacco-related

regulations at the country or local levels are specifically developed to reduce the use of flavored e-cigarettes in particular.

Strengths and Limitations

The major strength of this study involves that this is the first study to review a national sample of flavored e-cigarette sales restrictions. This study also employs three important policy provisions that are crucial for evaluating and assessing the impact of such restrictions.

Additionally, this research is the first to use a series of community characteristics to predict the strictness of flavored e-cigarette sales restrictions, offering useful information for public health legislators, researchers, and practitioners to gain an understanding of the key factors contributing to the result of policymaking.

This study has following limitations. First, although we have searched a wide range of sources and consulted with tobacco policy experts, it is possible that we missed or overlooked some localities with such restrictions. Future studies may need to adopt a more intensive inquiry strategy through contacting state and local health officials. Second, we did not account for an important locality characteristic—affiliation with the state tobacco control coalition—which has been shown to determine policy enactment and strictness (Bartosch & Pope, 2002; CDC, 2007; Skeer et al., 2004). Future studies should consider local policy-making resources as a factor in policy making.

CONCLUSIONS

Since 2012, an increased number of U.S. localities have passed sales restrictions on flavored e-cigarettes. Most of these localities, however, enacted lax restrictions that may still leave youth with abundant exposure to flavored e-cigarettes, potentially causing them to establish tobacco use behavior and develop nicotine dependence. It is advisable that jurisdictions

amend their policies to enact strict restrictions. Local and national legislation regulating flavored e-cigarettes should consider the advantages and limitations of existing local policies in order to finally achieve public actions that most effectively prevent youth initiation and use of e-cigarettes.

SEC. 10-1.2782 – Definitions

“Characterizing Flavor” means a distinguishable taste or aroma, other than the taste or aroma of tobacco, imparted by a tobacco product or any byproduct produced by the tobacco product, including, but not limited to, tastes or aromas relating to any fruit, chocolate, vanilla, honey, candy, cocoa, dessert, alcoholic beverage, menthol, mint, wintergreen, herb, or spice; provided, however, that a tobacco product shall not be determined to have a characterizing flavor solely because of the use of additives or flavorings or the provision of ingredient information.

Restrict
menthol/mint
flavors

SEC. 10-1.2783 – Requirements and Operational Standards For Tobacco Retail Sales Establishments

With the exception of Tobacco Retailers whose business included the sale of flavored tobacco products prior to the effective date of this Article, it shall be a violation of these regulations for any Tobacco Retailer or any of the Tobacco Retailer's agents or employees to sell or offer for sale, or to possess with intent to sell or offer for sale, any flavored tobacco product within a 500 foot radius of any private or public kindergarten, elementary, middle, junior high, or high school. The burden of proof to establish that sales of flavored tobacco products preceded the effective date of these regulations shall be on the Tobacco Retailer.

Do not restrict
tobacco retailers
selling flavored
tobacco prior to the
effective date

Have a
restriction
zone

Figure 5.1. An Example of Coding Flavored E-cigarette Sales Restrictions

Table 5.2. Comparing Community Characteristics Between Locations with Flavored E-cigarettes Sales Restrictions and the U.S. as a Whole

	Comparing Locations with Restrictions vs. U.S.	
	Locations with restrictions	U.S.
Non-Hispanic white residents (%)	78.1%	62.4%
Residents <18 year (%)	20.5%	23.3%
Median household income (U.S. Dollar)	79,229	56,516
Residents under the poverty line (%)	10.3%	14.1%
Residents with high school education or higher (%)	91.3%	87.5%
Adult resident smoking cigarettes (%)	13.9%	15.1%
Residents who voted for the Democratic Party in the 2016 U.S. presidential election (%)	62.2%	48.2%

Table 5.3. Unadjusted and Adjusted Odds Ratios of Enacting Strict/Moderate Restrictions Compared to Lax Restrictions (n=121)

	Comparing Locations Enacting Strict/Moderate (n=19) vs. Lax (n=102) Restrictions			
	Enacting strict/moderate restrictions (Compared to lax restrictions)			
	OR	P value	AOR ¹	P value
Policy effective year (2012–2018) ²				
2012				
2014				
2015	1.83	<0.05	1.42	0.26
2016				
2017				
2018				
State ⁴				
Massachusetts	Reference			
California	60.42	<0.001		
Illinois	---	³		---
Minnesota	6.71	0.14		
Rhode Island	8.95	0.03		
Average population size	1.01	<0.05	1.00	0.33
Non-Hispanic white residents (%)	0.96	<0.05	0.96	0.19
Residents <18 year (%)	0.93	0.16	0.95	0.48
Median household income (U.S. Dollar)	1.00	0.86	1.00	0.55
Residents under the poverty line (%)	0.99	0.83	0.91	0.32
Residents with high school education or higher (%)	0.98	0.64	1.01	0.92
Adult resident smoking cigarettes (%)	0.51	<0.001	0.52	<0.05
Residents who voted for the Democratic Party in the 2016 U.S. presidential election (%)	1.10	<0.01	0.92	0.21

1. The McFadden's pseudo R-squared of the multivariate logistic regression equals to .31. The likelihood ratio (LR) chi-square is 32.74 and Prob>chi2=0.0001.

2. Policy effective years were treated as a continuous variable in the unadjusted and adjusted regression models.

3. Estimate suppressed due to small sample size.

4. The State variable was not included in the multivariate model due to wide confidence intervals.

CHAPTER SIX: DISCUSSION

6.1. Overview and Summary

Since entering the market, e-cigarettes, especially those with attractive fruity and sweet flavors, have rapidly gained popularity among youth and young adults. As more evidence becomes available related to the potential harm and risks of using e-cigarettes with various flavorings among young people, some researchers and policymakers have proposed a ban on the sale of flavored e-cigarettes in the U.S. The 2016 FDA rule on e-cigarette products did not restrict flavored e-cigarette products, thus leaving it to states and local jurisdictions to enact their own restrictions to curb e-cigarette use among youth who are at risk for developing tobacco use behavior and nicotine dependence through using e-cigarettes. Consequently, public health interventions and mass media campaigns are greatly needed to further new local legislation and prevent and reduce flavored e-cigarette use among youth and young adults. Studies that illustrate the predictors and patterns of flavored e-cigarette use among the target groups can be used to inform the development and evaluation of such initiatives. Additionally, in order to facilitate evidence-based policymaking with regards to flavored e-cigarettes, research is warranted to investigate existing local flavored e-cigarette restrictions, their strictness in preventing youth use of e-cigarette products, and the local characteristics that predict that level of strictness. Taken together, this dissertation research, including three independent studies, is designed to address the above-mentioned research needs and advance our understanding of the evidence-based strategies for preventing and reducing e-cigarette use, especially flavored e-cigarettes, among young people.

The quantitative study (Study 1) examined the prospective predictors of young adults' flavored e-cigarette use in order to inform the prevention efforts targeting this group. The study

used waves 1 and 2 survey data from the PATH Study. The researcher analyzed a sample of young adults aged 18–34 (n=12,383) and a sub-sample of young adult e-cigarette users (n=1,421) to identify the prospective predictors (wave 1) of flavored e-cigarette use (wave 2). The results showed that from 2014–2015, about 8% of young adults used e-cigarettes in the past month, among which 35% and 65% used TM flavors and NTM flavors, respectively. In the full multivariate model, significant predictors (wave 1) of NTM flavored e-cigarette use (wave 2) included younger age (AOR=1.9), female gender (AOR=1.8), education achievement of high school (AOR=1.7) and higher (AOR=1.8), past-month marijuana use (AOR=1.9), non-cigarette smoking (AOR=3.0), and lower harm perception of e-cigarettes (AOR=1.6). The study concluded that NTM flavored e-cigarette prevention initiatives should disseminate evidence-based information and implement interventions related to the risks and harms associated with NTM flavor use among young adults, particularly among the most vulnerable groups (e.g., 18–24 year olds, female, marijuana users, and non-smokers).

The qualitative study (Study 2) was designed to explore a series of individual perceptions (including attitudes, beliefs, and intentions) related to e-cigarette flavors among young adult cigarette smokers using in-depth interview techniques. It is important to note that since this dissertation is not a mixed-methods study, Study 2 was not designed as a sequential research to Study 1. Instead, Study 2 was conceptualized as an independent study to qualitatively explore flavored e-cigarette related themes that might reflect and explain young adult cigarette smokers' flavored e-cigarette use behavior. Specifically, three topics were included in the interview: (1) young adult smokers' attitudes and beliefs towards e-cigarette flavors; (2) their intentions of using flavored e-cigarettes given a flavor ban; and (3) their perceptions of using flavored e-cigarettes to cut down smoking. Semi-structured in-depth interviews were used to explore these

themes among a purposive sample of 25 young adult smokers (aged 18–34) who had used e-cigarettes to cut down smoking. Thematic content analysis was employed to assess qualitative data and document themes. The results of the study showed that most participants reported enjoying e-cigarettes with sweet, fruity, or menthol/mint flavors and valued having a wide selection of flavors. When asked about their intentions of using flavored e-cigarettes given an e-cigarette flavor ban, about half of the participants reported they would still vape if e-cigarette flavors were banned, while the other half would not. Most participants also perceived e-cigarette flavorings as helpful in the process of reducing smoking. However, some participants stated that sweet, fruity, and menthol/mint flavors hid the harshness of nicotine and were too “addicting,” possibly causing them to consume more nicotine from vaping than from smoking cigarettes. Many young adult smokers also expressed concerns about inhaling toxic chemicals from e-cigarette flavorings.

The policy paper (Study 3) examined local flavored e-cigarette sales restrictions across the U.S. The study found that as of October 1, 2017, no statewide restrictions for flavored e-cigarettes were enacted. In the absence of the federal and state regulations, many local governments have taken the initiative to ban the sale of flavored e-cigarettes to discourage youth e-cigarette use. The policy paper thus examined the strictness of local restrictions and the characteristics of the localities that determine the policy strictness to inform policymaking at local and national levels. Through searching for information via a variety of sources and confirming the search results with tobacco law and policy experts in the U.S., the researchers identified 121 U.S. jurisdictions with municipal or local sales restriction on flavored e-cigarettes as of October 1, 2017. The author and a second coder coded all the restrictions based on three provisions of the regulation—specifically, whether or not the restriction applies to: (1) the entire

jurisdiction, (2) menthol flavors, and (3) retail tobacco stores and/or smoking bars. The author then organized the localities according to the restrictions' strictness in preventing youth e-cigarette use. We found that among all the localities with flavored e-cigarette sales restrictions, 117 (96.7%) applied the restriction to the entire jurisdiction, 11 (9.1%) restricted the sale of menthol flavors, and 16 (13.2%) restricted the sale of flavored e-cigarettes in retail tobacco stores/smoking bars. Additionally, the author classified four (3.3%), 15 (12.4%), and 102 (84.3%) localities as strict, moderate, and lax, respectively. Lastly, the author used community characteristics to predict the strictness of the restrictions. The study found that localities that have enacted strict or moderate restrictions were more likely to have low adult cigarette smoking prevalence, large population sizes, high racial/ethnic minority proportions, and high percentages of voters for the Democratic Party than localities that adopted lax restrictions.

6.2. Implications

The three studies conducted for this dissertation examine significant public health questions for preventing and reducing youth and young adult use of flavored e-cigarettes and minimizing the harm associated with flavored e-cigarette use among young adult smokers. The quantitative study (Study 1) indicated that young adults with certain characteristics (e.g., younger age and female gender) were more likely to use NTM flavored e-cigarettes compared to those without those characteristics, and thus interventions aimed at preventing and reducing flavored e-cigarette use should target these vulnerable groups in particular. The study results also suggested that young adult non-cigarette smokers were more likely to use NTM flavored e-cigarettes compared to smokers. This finding is worrisome since it suggests that NTM flavored e-cigarettes may serve as a starter tobacco product for this group, facilitating their establishment of regular tobacco use behavior and nicotine dependence during the transition from youth to adulthood.

Thus, this study indicates the importance of limiting and restricting the availability of e-cigarette flavors among young adults in order to prevent and reduce the use of e-cigarettes by this group.

The qualitative study (Study 2) has potential implications for policymakers in designing programs and legislation to reduce the harm and risks associated with flavored e-cigarette use among young adult smokers. First, the results may help inform public health practitioners regarding the possibility of nicotine overuse and poisoning brought by flavored e-cigarette use among young adult smokers. This might prompt public health practitioners to develop evidence-based messages and strategies to inform young adult users regarding the danger of nicotine consumption and overuse from e-cigarette products, especially those with attractive flavors. Second, the study revealed important information about the dangers of using flavored e-cigarettes to quit smoking since prolonged tobacco dual use caused by flavored e-cigarette consumption might increase nicotine dependence and establish life-long tobacco use behavior among young adult smokers. Thus, public health practitioners need to warn young adult smokers about the harm of using multiple forms of tobacco and the benefits of using FDA approved pharmacological therapies to quit smoking and other tobacco products. Additionally, the study revealed that young adult smokers lacked knowledge about the chemicals contained in flavoring ingredients and the nicotine concentration of the e-cigarette products they currently used. This finding suggests the need for public health programs or mass media campaigns that educate young adult smokers about the chemical and nicotine components of e-cigarette products and the associated health risks from inhaling these substances.

Furthermore, this dissertation research provides critical information to policymakers and advocacy groups who are interested in enacting sales restrictions of flavored e-cigarettes in the U.S. The policy study (Study 3) findings indicate that for local jurisdictions that have already

enacted a moderate and lax regulation that bans flavored e-cigarettes, more stringent restrictions need to be implemented in order to reduce youth exposure to flavored e-cigarettes. We also recommend that these localities actively educate their minors regarding the harm of using e-cigarettes in order to diminish their positive perceptions and curiosity towards e-cigarette products. This research also informs local governments of the potential resources and barriers that may influence the passage of the flavored e-cigarette sales restrictions in their own jurisdictions. Resources may include state government technical assistance and funding support, while barriers may include strong opposition from local business owners and tobacco industry advocacy groups. Furthermore, the study calls for statewide and nationwide legislation in order to maximize the impact of flavored e-cigarette sales restrictions in deterring youth from using e-cigarettes. Additionally, this dissertation research informs policymakers regarding young adult smokers' intentions of using e-cigarettes given a flavored e-cigarette ban. In short, evidence that most young adult smokers may reduce or quit e-cigarettes given an e-cigarette flavor ban confirms that limiting or restricting e-cigarette flavors may largely reduce e-cigarette use prevalence. Nevertheless, in the event of a flavored e-cigarette sales ban, professional and timely guidance for using evidence-based smoking cessation methods needs to be given to young adult smokers who previously relied on flavored e-cigarettes to reduce smoking.

This dissertation research also emphasized the importance of revoking state tobacco preemption laws, which hinder the local governments from making their own tobacco control policies. For example, due to the preemption law in Maryland, Maryland's Prince George's County and Baltimore City failed to authorize regulations on cigar packaging in 2013, leaving "unpackaged" cigar products widely available in these jurisdictions. More legislative actions and

advocacy efforts are needed to achieve the Healthy People goal of eliminating state tobacco preemption laws by 2020.

Overall, by applying the Social Ecological Model, this dissertation research may contribute to the design of a comprehensive public health intervention to improve the prevention and reduction of flavored e-cigarette use among youth and young adults. Specifically, at the individual level, an increased presence of public health education and mass media campaigns may improve the target population's knowledge about the harm and risks of using flavored e-cigarettes. At the society level, a change in social norms by enforcing sales restrictions of flavored e-cigarettes may further reinforce and maintain the protective perceptions and behavior. This synergy of interventions at various levels may provide lasting and sustainable efforts that are beneficial to restrain the young generations from using e-cigarette products.

Finally, this dissertation research emphasizes the need to limit or restrict e-cigarette flavors in the U.S. The dissertation findings once again confirm that young adults are drawn to e-cigarettes with fruity and sweet flavors, and that young adult e-cigarette users tend to use multiple flavors at the same time. Furthermore, the dissertation results highlight the possibility that flavored e-cigarette restrictions would reduce young adult smokers' intentions of using e-cigarette products, which may potentially reduce e-cigarette use prevalence and minimize the harm and risks associated with such use. Finally, the policy study (Study 3) results indicate that flavored e-cigarette sales restrictions with strict provisions can potentially eliminate youth exposure to flavored e-cigarette products, thereby minimizing their curiosity and intentions of using e-cigarettes to the fullest extent.

6.3. Strengths and Limitations

Several strengths and limitations of this dissertation are important to acknowledge. Study 1 has several strengths, including improving upon previous research by examining the specific risk factors of flavored e-cigarette use instead of flavored tobacco use in general and by using a prospective longitudinal design. Additionally, this study assessed the differences between e-cigarette use with TM flavors versus NTM flavors, a classification that is helpful for policymakers given the current policymaking pattern related to flavored e-cigarettes as well as the socio-economic and tobacco use differences between the users of these two flavors. This study also has several limitations. Mainly, the prospective risk factors examined in this study reflected the significant predictors of flavored tobacco use in general. Future qualitative studies should identify risk factors that are unique to flavored e-cigarette use. Additionally, this study used self-reported measures of mental health symptoms and tobacco and marijuana use. Future studies ideally should use clinically and biochemically verified measures for these variables in order to gain more accurate interpretations.

One of the important strengths of Study 2 is that it provides meaningful information regarding the attitudes, beliefs, and intentions of young adult smokers toward flavored e-cigarette use. Such individual perceptions have been shown to predict health behaviors in previous research (Ajzen, 1991). Another strength is that the researcher recruited a racially and ethnically diverse sample of young adult smokers with various backgrounds in e-cigarette use and cigarette smoking. The main limitation of the qualitative study is that, due to the study's recruitment criteria, the study results only pertain to young adults who were current smokers in the process of cutting down smoking through using e-cigarettes. Thus, their perceptions of e-cigarette flavors may differ from those who had completely quit smoking cigarettes through vaping. Another

limitation is that the study over-sampled menthol cigarette smokers who may be more prone than regular cigarette smokers to use flavored e-cigarettes. Future research is recommended in order to recruit a sample of participants representative of various tobacco use backgrounds and histories.

Study 3 also has several strengths worth mentioning. First, the study reports the largest collection of current local flavored e-cigarette sales restrictions, which provides a portrait of how flavored e-cigarettes are currently being regulated in the country. Another strength of the study is that it proposes a method of characterizing and evaluating flavored e-cigarettes sales restrictions according to their potential effectiveness in eliminating exposure to flavored e-cigarettes among youth. Furthermore, by uncovering the community characteristics that determine the strictness of the restrictions, this study gives policymakers a valuable tool to gauge the resources and barriers within their own jurisdiction for enacting such restrictions. The study results should also be interpreted with some limitations. Most significantly, the author did not examine or code some other important policy provisions, such as policy enforcement options, that might impact the restrictions' effectiveness. These provisions were not considered in this study since they did not apply solely to flavored e-cigarette sales restrictions, but instead, were used for all tobacco-related regulations in the jurisdictions. Moreover, although the researcher has consulted with tobacco policy and law experts and used a wide range of legal and policy documents to obtain a comprehensive list of existing restrictions, the study might still have missed some restrictions. Lastly, although this study examined the strictness of flavored e-cigarette sales restrictions and its associated community characteristics, it did not assess the direct impact of these restrictions on flavored e-cigarette use prevalence.

Additionally, the overall dissertation design using the Social Ecological Model framework also carries several strengths and limitations. The main strength of using this framework is that the model emphasizes public health interventions from multiple levels of influence (e.g., intrapersonal, interpersonal, organizational, community, and public policy). Specifically, in this dissertation we presumed that intrapersonal, community, and public policy level influences might affect flavored e-cigarette use among youth and young adults. The limitation of the dissertation framework mainly involves the Social Ecological Model lacking specifics about the most important hypothesized influences (Glanz et al., 2008). This limitation may put a greater burden on public health researchers and practitioners to identify and address critical risk factors for each behavioral level. In absence of evidence-based interventions to prevent flavored use or users' transitioning from e-cigarettes to cigarettes, this dissertation research suggests that we may first prioritize public policy changes to combat e-cigarette use epidemics among young people. The Health Impact Pyramid theory illustrates the degree of influence that various types and levels of intervention have on addressing public health issues (Frieden, 2010). The theory posits that policy changes make the biggest impact since they allow for people to attain healthy options by changing a community's physical environment and social norms. Specifically, eliminating the presence of flavored e-cigarette products in the community may most effectively diminish youth's exposure to the product, and therefore potentially have the greatest impact on preventing and reducing youth use of e-cigarettes. Another limitation related to the framework is this dissertation did not investigate interpersonal or organizational factors that may also potentially influence young people's flavored e-cigarette use. Relevant interpersonal factors may include social norms and relationships that may facilitate or discourage flavored e-cigarette use, and organizational factors may include formal and informal rules of e-

cigarette use on school campuses and other young people-populated facilities. Future research is necessary to incorporate these new perspectives when examining multi-level factors and interventions that may influence flavored e-cigarette use among the younger generations. Lastly, this dissertation study might lack specific attention to the biologically driven addictive nature of tobacco use. Specifically, this study did not explore or assess how nicotine dependence or nicotine addiction-related factors may play a role in young people's choice of e-cigarette flavors. Therefore, future research is warranted explore the addiction aspects of flavored e-cigarette use.

6.4. Future Research Directions

The evidence gathered from this dissertation points to the following future research directions. First, this dissertation research explored the individual risk factors of flavored e-cigarette use by testing a set of predictors shown to influence flavored tobacco use in general. Little is known, however, about other individual risk actors unique to flavored e-cigarette use. The author hypothesizes that peer influences such as peer use of e-cigarettes and perceived social norm of using the product and collecting new and attractive flavors may serve as the unique risk factors of NTM flavored e-cigarette use among young adults. Nevertheless, more research is warranted to explore this topic, given that e-cigarette use is a comparatively newer phenomenon, and much is still unknown about the behavior and characteristics of e-cigarette users. Specifically, future studies are recommended to use qualitative investigation methods such as focus groups or in-depth interviews to explore the unique reasons for flavored e-cigarette initiation and regular use among youth and young adults in order to inform the prevention efforts among this target population. Finally, as the prevalence of marijuana use increases drastically among young adults in the U.S. (Azofeifa, 2016), the relationship between marijuana use and

vaping, as well as the health consequences of their co-use, also warrants special attention from public health researchers and practitioners.

Findings from the qualitative study speak to the complex and multifaceted relationship between flavored e-cigarette use and cigarette smoking behavior among young adult smokers. Future longitudinal studies are warranted to further examine the mechanisms (e.g., use history, vaping frequency, vaping amount, and device types) linking e-cigarette use with various flavors and cigarette smoking outcomes. Such studies are important to determine whether e-cigarette use with certain flavors is more likely to lead to increased use of e-cigarettes and thus influence users' cigarette smoking behaviors. In a similar vein, longitudinal studies using large, representative samples of cigarette smokers are greatly needed to understand if flavored e-cigarette use is associated with long-term cigarette smoking reduction and cessation, prolonged tobacco dual use, and escalated nicotine dependence. Studies are suggested to apply multiple longitudinal waves of the PATH Study to investigate these research questions, which most likely will require nationally representative longitudinal data and a rich set of questions related to tobacco use behavior among youth and young adults. This type of research will enhance our understanding of the harm and benefits of using flavored e-cigarettes among vulnerable populations in order to inform nationwide legislations on the regulation of flavored e-cigarettes.

Additionally, although the author tried to gauge the potential effectiveness of local flavored e-cigarette restrictions by including three policy provisions, future research using policy evaluation methods will be needed to assess changes in the perceptions and behaviors related to e-cigarettes and flavored e-cigarettes both before and after such restrictions are implemented. Several other important outcomes related to e-cigarette perceptions can also be used for such evaluation research. These outcomes include but are not limited to the perceived availability of

e-cigarettes as well as the perceived addictiveness, harm, and social acceptability of e-cigarette use. Studies are also needed to compare the different community characteristics of the locations that have already enacted flavored e-cigarette sales restrictions and those that have not enacted such restrictions.

Overall, in order to better inform e-cigarette prevention and reduction efforts and legislations for regulating flavored e-cigarette products, additional research is greatly needed in the following areas: (1) the individual risk factors that uniquely influence flavored e-cigarette use; (2) the long-term relationship between flavored e-cigarette use and cigarette smoking behaviors; and (3) the impact of flavored e-cigarette sales restrictions on the perceptions and use of e-cigarettes with various flavors.

APPENDICES

Appendix I: In-depth Interview Screener

Thank you for your interest in our study at the University of Maryland. The purpose of the study is to learn about your use of tobacco products. If you are eligible to participate in the study, you will be asked to do the following: (1) Complete a 15–20 minute online survey about your socio-demographic background and tobacco use; and (2) Complete a 30–40 minute phone interview about your tobacco use.

Q1 Does this sound of interest to you?

Yes (1)

No (2)

I am not sure. I need further information. (3)

We would like to ask you a few questions to see if you are eligible for the study. Please continue with the survey.

Q2 How old are you?

< 18 (1)

18-24 (2)

25-34 (3)

35 and older (4)

Q3 What is your gender?

Male (1)

Female (2)

Q4 Are you of Hispanic or Latino origin? (choose one)

Yes (1)

No (2)

Q5 What is your race? (choose all that apply)

White (1)

Black or African American (2)

American Indian or Alaska Native (3)

Asian (4)

Native Hawaiian or Pacific Islander (5)

Other (6)

Q6 There is a survey and a phone interview to be completed. Can you read and speak English?

Yes (1)

No (2)

Q7 Do you now smoke CIGARETTES?

Yes, every day (1)

Yes, some days (2)

Not at all (3)

Q8 How many CIGARETTES have you smoked in your entire life?

- 1 or more puffs but never a whole cigarette (1)
- 1 to 10 cigarettes (about 1/2 pack total) (2)
- 11 to 20 cigarettes (about 1/2 pack to 1 pack) (3)
- 21 to 50 cigarettes (more than 1 pack but less than 3 packs) (4)
- 51 to 99 (more than 2 1/2 packs but less than 5 packs) (5)
- 100 or more cigarettes (5 packs or more) (6)

Q9 Do you now use ELECTRONIC CIGARETTES such as NJOY and Blu? (E-cigarette products include e-hookah, e-shisha, hookah pens, vape pens, tanks, mods, and vapes)

- Yes, every day (1)
- Yes, some days (2)
- Not at all (3)

Q10 About how long have you used ELECTRONIC CIGARETTES?

- Less than 2 months (1)
- 2-6 months (2)
- 6-12 months (3)
- More than a year (4)

Q11 Which ELECTRONIC CIGARETTE flavors (or e-juice, e-liquid flavors) have you used in the past 30 days? (choose all that apply)

- Tobacco (1)
- Menthol or mint (such as menthol, mint, or peppermint) (2)
- Nuts or spices (such as peanut butter, almond, cinnamon, or pecan) (3)
- Fruit (such as apple, strawberry, coconut, orange, or berries) (4)
- Desserts or sweets (such as chocolate, vanilla, quick breads, cakes, waffles, donut cereals, or ice cream) (5)
- Alcohol (such as rum, absinthe, or absolute) (6)
- Candy (such as licorice, sweetTARTS, bumble gum or Swedish fish) (7)
- Coffee or tea (such as espresso, cappuccino, green tea, or black tea) (8)
- Beverages (such as soda, energy drinks, or lemonades) (9)
- Unflavored (10)
- Some other flavor, please specify: (11) _____

Q12 Have you ever used ELECTRONIC CIGARETTES to reduce or quit cigarette smoking?

- Yes, I have tried to quit cigarettes completely (1)
- Yes, I have tried to reduce or cut back cigarettes (2)
- No (3)
- Not sure (4)

Q13 Have you once successfully reduced or quit cigarette smoking through using ELECTRONIC CIGARETTES?

Yes (1)

No (2)

Not sure (3)

Now, we'd like to ask some information about you in order to arrange the study with you.

Q14 What is your first and last name?

First Name (1) _____

Last Name (2) _____

Q15 To arrange the survey and interview, what phone number can we reach you at (include area code)?

Phone number (1) _____

Q16 What are good days and times to call you? (e.g., weekdays after 5 PM; weekends before noon)

Q17 What is your Email address?

Appendix II: In-depth Interview Consent Form

Project Title:

Perceptions about E-Cigarette Flavors—A Qualitative Investigation of Young Adult Cigarette Smokers Who Also Used E-cigarettes

Purpose of the Study:

This research is being conducted by Ms. Julia Chen, at the University of Maryland, College Park. The purpose of this research project is to learn how flavored e-cigarette use might affect cigarette smoking reduction and cessation among young adults (aged 18–34 years). We are inviting you to participate in this research project because you currently use cigarettes and e-cigarettes, aged 18-34 years, and have used e-cigarettes to reduce or quit smoking.

Procedures:

If you agree to participate, we will enroll you in the study online. The study procedure first involves completing a 15–20 minute background survey. Next, we will schedule an interview with you. The phone interview will take about 30–40 minute at your convenient time. We will call you at mutually-agreed-upon time, and we will record the phone interview after obtaining verbal permission from you.

Potential Risks and Discomforts:

There may be some risks from participating in this research study. The participation in the online survey and phone interviews does not involve any physical or emotional risk to participants beyond that of your everyday life. Financial risks are not likely to occur due to this study. You will be asked questions about their smoking habits; these questions carry little likelihood of psychological risk. We are asking about a legal behavior (tobacco smoking among adults) that you have already engaged in. You are free to refuse to answer any question and can withdraw at any time.

Potential Benefits:

There are no direct benefits from participating in this research. This research is not designed to help you personally, but the results may help the investigator learn more about the effectiveness of flavored e-cigarette use on cigarette smoking cessation among young adult population. We hope that, in the future, other people might benefit from this improved understanding.

Confidentiality:

Your name will not be included on the collected data. A code will be placed on the collected data. Through the use of an identification key, the researcher will be able to link your survey to your identity. Only the research will have access to the identification key. Electronic data will be encrypted in the phone app and you will need to access the surveys on your phone using a unique password. Electronic data will be kept on a password-protected computer. Forms with your identifying information will be kept in files separate from the source documents in another locked filing cabinet. Only trained members of the research team will have access to study documents. Paper records will be stored for 10 years after study completion then destroyed. If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.

Compensation:

You will earn a \$40 CVS voucher (redeemable at CVS/pharmacy locations or CVS websites) for completing both online survey and phone interview. The electronic voucher information will be given to you at the end of the interview. If you expect to earn over \$100 as a research participant in this study, you

must provide your name, address, and SSN to receive compensation. If you do not earn over \$100 only your name and address will be collected to receive compensation.

Right to Withdraw and Questions:

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify. If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator:

Julia Cen Chen, MPP

University of Maryland College Park, School of Public Health
Department of Behavioral and Community Health
SPH Building, Rm 2387
College Park, MD 20742
E-mail: JChen8@umd.edu
Telephone: 240-473-3088

Participant Rights:

If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:

University of Maryland College Park
Institutional Review Board Office
1204 Marie Mount Hall
College Park, Maryland, 20742
E-mail: irb@umd.edu
Telephone: 301-405-0678

This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.

Statement of Consent:

Your signature indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You will receive a copy of this signed consent form.

If you agree to participate, please click **YES** below.

☐ Yes ☐ No

Please write your **FULL NAME** below to indicate your consent.

Today's date is:

Appendix III: In-depth Interview Moderator Guide

Perceptions about E-Cigarette Flavors—
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IN-DEPTH INTERVIEW DISCUSSION GUIDE

Thank you for agreeing to participate in the study. My name is Julia Cen Chen. I am a student researcher at the University of Maryland. I am interested in hearing your opinions about e-cigarette and cigarette use, especially your thoughts and experience of using e-cigarettes to reduce or quit cigarette smoking.

We will have 30–40 minutes for our discussion. Before we get started, I want to go over a few things:

- First, you are a participant to this interview because you currently use both products. There are no wrong answers. The whole purpose of this interview is to hear your perspectives, opinions, and experiences.
- Your participation is voluntary, and you have the right not to answer any question or withdraw from the interview at any time.
- Everything we discuss today will be kept confidential. Your name and contact information will not be given to anyone else, and no one will contact you after this discussion is over.
- Our interview will be audio-recorded, and the audio files will be transcribed. The information that could identify you will be removed from the transcripts.
- Please maintain a quiet environment while the interview is ongoing so we can obtain a complete and clean transcript.

Do you have any questions before we begin?

OK, Thanks! Let's jump right in.

Section 1: Flavored E-cigarette Use

Read: First of all, let's talk about your experiences with e-cigarettes.

1. Now, name up to three e-cigarette flavors you currently use most often.
 - What do they smell and taste like?
 - What are your reasons of using those flavors?
 - What is your favorite flavor?
 - Could you tell me why you like the flavor?
 - What makes this flavor different than other flavors that you currently use?
 - Are you aware of the nicotine concentration in the flavored e-cigarettes that you are currently using? And what are they?
 - Have you used e-cigarettes with tobacco flavor before?
 - Did you like it?
 - *What makes you say that?*

- *Will you use it again?*
- Have you used flavorless e-cigarettes or e-cigarettes without flavors before?
 - Did you like it?
 - *What makes you say that?*
 - *Will you use it again?*
- Have you used menthol or mint flavored e-cigarettes before?
 - Did you like it?
 - *What makes you say that?*
 - *Will you use it again?*
- Have you used e-cigarettes with other flavors before? What were they?
 - *Could you name a few?*
 - Did you like them?
- What e-cigarette flavors did you use when you first started to use e-cigarettes?
 - *What are the primary reasons, if there is any, for your transitions between these flavors and current flavors?*

Section 2: E-cigarette Flavor Ban Scenarios

Now, consider a situation where only tobacco-flavored e-cigarettes are allowed from purchasing and using.

2. Would you continue to use e-cigarettes to reduce or quit cigarette smoking?
 - [If yes] Would you use e-cigarettes differently? What about flavors?
 - *How do you think switching to tobacco flavor would affect the results of your efforts of cutting down on smoking?*
 - *Are there any other changes that you think you would make?*
 - [If no] Could you tell me why?
 - What would you replace e-cigarettes with?
 - *Would you choose to use other tobacco or nicotine products instead?*
 - *How important is flavor when you are deciding what other product to use?*

3. Repeat Question 5 for Flavorless E-cigarettes

4. Repeat Question 6 for Menthol Flavored E-cigarettes

Section 3: E-cigarette Use and Cigarette Smoking Reduction and Cessation

Read: Now let's discuss how you use e-cigarettes to reduce or quit cigarette smoking.

5. What is your experience of using e-cigarettes to reduce or quit smoking?
 - How long has it been?
 - Have you successfully reduced or quit cigarette smoking by using e-cigarettes so far?
 - *What makes you say that?*
 - How has using e-cigarettes changed your cigarette smoking behavior or habits?

- What roles do you think e-cigarette flavors play in this process? And why?
 - How are favors helpful or not helpful?
 - *How are e-cigarette flavors helpful?*
 - *Are certain flavors more helpful than other flavors?*
 - *How are e-cigarette flavors unhelpful?*
- Do you notice differences when you use e-cigarettes of different flavors?
 - For example, the differences of how you feel and how your body reacts, etc.
- Do you remember what e-cigarette flavors you started with to cut down on smoking?
 - What were they?
 - *What made your change your preference over time?*

6. Do you have any other thoughts about e-cigarettes that you would like to share with me or that I didn't ask you?

I would like to thank you for participating in the interview today

Appendix IV: In-depth Interview Coding Dictionary

Perceptions about E-Cigarette Flavors— A Qualitative Investigation of Young Adult Cigarette Smokers Who Also Used E-cigarettes

In-depth Interview Transcript Codebook

Code	Sub-code	Definition
Section 1: E-cigarette Flavor Use		
E-cigarette Flavor 1	Flavor 1 Name	Code describes the name of e-cigarette flavor current used
	Flavor 1 Description	Code describes the smell and taste of the flavor, the reasons of using the flavor, and other details related to attitudes and beliefs about the flavor
	Flavor 1 Nicotine Concentration	Code describe the nicotine concentration of the e-cigarette flavor
E-cigarette Flavor 2	Flavor 1 Name	Code describes the name of e-cigarette flavor current used
	Flavor 2 Description	Code describes the smell and taste of the flavor, the reasons of using the flavor, and other details related to attitudes and beliefs about the flavor
	Flavor 2 Nicotine Concentration	Code describe the nicotine concentration of the e-cigarette flavor
E-cigarette Flavor 3	Flavor 1 Name	Code describes the name of e-cigarette flavor current used
	Flavor 3 Description	Code describes the smell and taste of the flavor, the reasons of using the flavor, and other details related to attitudes and beliefs about the flavor
	Flavor 3 Nicotine Concentration	Code describe the nicotine concentration of the e-cigarette flavor
Favorite E-cigarette Flavor	Favorite Flavor Name	Code describes the name of the favorite flavor
	Favorite Flavor Reasons	Code describes the reasons why it is the favorite flavor
Used Tobacco Flavored E-cigarettes Before	Used the Flavor Before	Code describes past use of the flavor
	Perceptions about the Flavor	Code describes participants' attitudes and beliefs about the flavor
Used Menthol Flavored E-cigarettes Before	Used the Flavor Before	Code describes past use of the flavor
	Perceptions about the Flavor	Code describes participants' attitudes and beliefs about the flavor
Used Flavorless E-cigarettes Before	Used the Flavor Before	Code describes past use of the flavor
	Perceptions about the Flavor	Code describes participants' attitudes and beliefs about the flavor

Section 2: Intentions of Using E-cigarettes Given E-cigarette Flavor Bans		
Tobacco Flavored E-cigarettes Allowed		Code describes the use of e-cigarettes to cut down on cigarette smoking when only tobacco flavor is available and why
Menthol Flavored E-cigarettes Allowed		Code describes the use of e-cigarettes to cut down on cigarette smoking when only menthol flavor is available and why
Flavorless E-cigarettes Allowed		Code describes the use of e-cigarettes to cut down on cigarette smoking when only flavorless products are available and why
Other Smoking Cessation Methods		Code describes the use of other smoking cessation methods if no longer using e-cigarettes to cut down smoking given the ban
Section 3: The Perceived Role of E-cigarette Flavors in Smoking Reduction		
Smoking Reduction Outcome	History of Cutting Down on Cigarettes using E-cigarettes	Code describes the history of reducing cigarette smoking, the successful/failed experience, and any other relevant experience/thoughts regarding smoking reduction through using e-cigarettes
	Number of Cigarettes Cut Down	Code specifically describes the number/packs of cigarettes cut down if the participant has successfully cut down on cigarettes.
Roles of E-cigarettes on Smoking Reduction	Perceived Positive Roles	Code describes the perceived positive roles of e-cigarettes in general on cigarette smoking reduction
	Perceived Negative Roles	Code describes the perceived negative roles of e-cigarettes in general on cigarette smoking reduction
Roles of E-cigarette Flavors on Smoking Reduction	Perceived Positive Roles	Code describes the perceived positive roles of flavored e-cigarettes on cigarette smoking reduction
	Perceived Negative Roles	Code describes the perceived negative roles of flavored e-cigarettes on cigarette smoking reduction
	Flavor Differences	Code describes if certain flavors work better than other flavors in reducing and quitting cigarette smoking
	Sensory Similarities	Code describes the sensory similarities between e-cigarettes and cigarettes and how the similarities help with smoking reduction

Appendix V: Content Coding Results for Flavored E-cigarette Sales Restrictions

Table 1. Regulation Provisions of Banning the Sale of Flavored E-cigarettes in U.S. Localities As of October 1, 2017 (n=121)

Locality	Description of the Policy ¹	Policy Effective Date	Have a Restriction Zone or Does not Cover the Entire Jurisdiction	Exempt Menthol Flavors ²	Exempt Restrict Retail Tobacco Stores ³
California					
Berkeley, CA ⁴	No person shall sell, give away, barter, exchange, or otherwise deal in flavored tobacco products within 600 feet of any school as measured by a straight line from the nearest point of the property line of the parcel on which the school is located to the nearest point of the property line of the parcel on which the business is located.	Jan 1, 2017	Yes. 600 feet restriction zone.	No.	No.
Contra Costa County, CA ⁵	It is a violation of this division for any tobacco retailer to sell or offer for sale any flavored tobacco product or menthol cigarettes within 1,000 feet of any parcel occupied by a public or private school, playground, park, or library.	Jan 1, 2018	Yes. 1000 feet restriction zone.	No.	No.
El Cerrito, CA ⁶	No tobacco retailer, nor any of the retailer's agents or employees, shall sell or offer for sale, or possess with intent to sell or offer for sale, any imitation tobacco products or flavored tobacco product.	Jan 1, 2018	No.	No.	No.
Hayward, CA ⁷	With the exception of tobacco retailers whose business included the sale of flavored tobacco products prior to the effective date of this Article, it shall be a violation of these regulations for any Tobacco Retailer or any of the Tobacco Retailer's agents or employees to sell or offer for sale, or to possess with intent to sell or offer for sale, any flavored tobacco product within a 500-foot radius of any private or public kindergarten, elementary, middle, junior high, or high school. The burden of proof to establish that sales of flavored tobacco products preceded the effective date of these regulations shall be on the Tobacco Retailer.	Jul 1, 2014	Yes. 500 feet restriction zone.	No.	Yes. Exception for tobacco retailers whose business included the sale of flavored tobacco products prior to the effective date of the flavored tobacco regulation

¹ All of these tobacco policies were written to include all types of flavored tobacco products, including e-cigarettes.

² The definitions of tobacco characterizing flavors and flavored tobacco can be found in the definition part of the document corresponding to each location in the footnote.

³ The definitions of the retail tobacco stores and/or smoking bars can be found in the definition part of the document corresponding to each location in the footnote.

⁴ Berkeley municipal code. A Codification of the General Ordinances of the City of Berkeley, California. Retrieved from: <http://www.codepublishing.com/CA/Berkeley/>

⁵ Ordinance No 2017-01. Tobacco Product and Retail Sales Control. Contra Costa County, CA. Retrieved from: http://64.166.146.245/docs/2017/BOS/20170801_971/30542_Ordinance%20No.%202017-01%20Tobacco%20Product%20and%20Retail%20Sales%20Control%20-%20final.pdf

⁶ El Cerrito Code of Ordinances 6.100.160 - Flavored tobacco products prohibited. El Cerrito, CA. Retrieved from: https://library.municode.com/ca/el_cerrito/codes/code_of_ordinances?nodeId=tit6bupere_art2repr_6.100.160FLTOPRPR

⁷ Hayward Municipal Code. SEC. 10-1.2783 - Requirements and operational standards for tobacco retail sales establishments. Hayward, CA. Retrieved from: https://library.municode.com/ca/hayward/codes/municipal_code?nodeId=Hayward_municipal_code_ch10plzsu_art1zoor_s10-1.2780toresaes_s10-1.2783reopsttoresaes

Manhattan Beach, CA ⁸	No retailer shall sell a tobacco product, or any product used in an electronic smoking device, containing, as a constituent or additive, an artificial or natural flavor or an herb or spice (with the exception of mint, menthol, spearmint or wintergreen), including but not limited to strawberry, grape, orange, clove, cinnamon, pineapple, vanilla, coconut, licorice, cocoa, chocolate, cherry, or coffee, that is a characterizing flavor of the tobacco product or smoke produced by the tobacco product.	Jan 1, 2016	No.	Yes.	Yes. The prohibition shall not apply to a retailer that permits only patrons 18 years of age or older to enter the location where the tobacco product in sold.
Oakland, CA ⁹	It shall be a violation of this Chapter for any tobacco retailer or any of the tobacco retailer's agents or employees to sell or offer for sale, or to possess with intent to sell or offer for sale, any flavored tobacco product.	July 1, 2018	No.	No.	Yes. This section does not apply to the sale or offer for sale of flavored tobacco products by a "Tobacco Store."
San Francisco, CA ¹⁰	The sale or distribution by an Establishment of any flavored tobacco product is prohibited. "Establishment" means any store, stand, booth, concession or any other enterprise that engages in the retail sale of Tobacco Products, including stores engaging in the retail sale of food items. ¹¹	Apr 1, 2018	No.	No.	No.
San Leandro, CA ¹²	No tobacco retailer, nor any of the retailer's agents or employees, shall sell or offer for sale, or possess with intent to sell or offer for sale, any flavored tobacco product."	Aug 15, 2018	No.	No.	No.
Santa Clara County, CA ¹³	No retailer shall sell a tobacco product containing, as a constituent or additive, an artificial or natural flavor or aroma (other than tobacco) or an herb or spice, including strawberry, grape . . . that is a characterizing flavor or aroma of the tobacco product, smoke or vapor produced by the tobacco product.	Jul 1, 2017	No.	No.	Yes. The policy shall not apply to any retailer that meets all of the following criteria: (i) Primarily sells tobacco products; (ii) Generates more than 60 percent of its gross revenue annually from the sale of tobacco products; (iii) Does not permit any person under 21 . . . to be present or enter the premises . . . unless accompanied by . . . parent or legal guardian . . .

⁸ Manhattan Beach Code of Ordinances. 4.118.030 - Requirements and prohibitions. Manhattan Beach, CA. Retrieved from: https://library.municode.com/ca/manhattan_beach/codes/code_of_ordinances?nodeId=tit4puwemoco_ch4.118peretoprelsmde_4.118.030repr

⁹ Oakland, CA City Code of Ordinances. Retrieved from: https://library.municode.com/ca/oakland/ordinances/code_of_ordinances?nodeId=854090

¹⁰ San Francisco Health Code - Banning the Sale of Flavored Tobacco Products. Ordinance NO. 140-17. Amended in Board on 6/20/2017. Retrieved from: http://www.ggbreathe.org/wp-content/uploads/2014/08/Cohen_Flavored-Tobacco-Ordinance-version-3-final-signed-by-Mayor-Lee-July-7-2017.pdf

¹¹ San Francisco Health Code - Article 19H: Permits for the sale of tobacco. New Ordinance Notice. Retrieved from: <http://2gahjr48mok145j3z438sknv.wpengine.netdna-cdn.com/wp-content/uploads/SF-Health-Code-Article-19H-2014.pdf>

¹² San Leandro Municipal Code. San Leandro, California. Retrieved from: <https://qcode.us/codes/sanleandro/>

¹³ Santa Clara County Code of Ordinances. Ordinance No. NS-300.903. Santa Clara County, CA. Retrieved from: https://library.municode.com/ca/santa_clara_county/ordinances/code_of_ordinances?nodeId=796084

Sonoma, CA ¹⁴	No tobacco retailer shall sell a tobacco product containing, as a constituent or additive, an artificial or natural flavor (other than tobacco or menthol) or an herb or spice, including strawberry, grape, orange, clove, cinnamon, pineapple, vanilla, coconut, licorice, cocoa, chocolate, cherry, or coffee, that is a characterizing flavor of the tobacco product or smoke produced by the tobacco product unless (1) the tobacco product consists of a package of cigars that contains at least five cigars or more, or (2) a single cigar for which the retail price exceeds \$5.00, or (3) the tobacco product consisting of pipe tobacco, or (4) the package of chewing tobacco or snuff contains at least five units or more.	Sep 1, 2015	No.	Yes.	No.
Yolo County, CA ¹⁵	It shall be a violation of this Chapter for any licensee or any of the licensee's agents or employees to sell, offer for sale, or exchange for any form of consideration: any Flavored Tobacco Product.	May 1, 2017	No.	No.	No.
Illinois					
Chicago, IL ¹⁶	No person shall sell, give away, barter, exchange, or otherwise deal in flavored tobacco products, samples of such products, or accessories for such products at any location that has a property line within 500 feet of the property line of any public, private, or parochial secondary school located in the City of Chicago.	Dec 31, 2016	Yes. 500 feet restriction zone.	No.	Yes. This policy does not apply to retail tobacco stores.
Minnesota					
Minneapolis, MN ¹⁷	No person shall sell, offer for sale, give away, barter, exchange, or otherwise deal in flavored tobacco products or samples of such products.	Aug 1, 2018	No.	Yes.	Yes. This subsection does not apply to tobacco products shops or to a licensed tobacco dealer.

¹⁴ Sonoma City, CA. Regulating the manner of sale of tobacco products. Chapter 7.25. Retrieved from: <https://www.codepublishing.com/CA/Sonoma/html/Sonoma07/Sonoma0725.html>

¹⁵ An ordinance of the board of supervisors of the County of Yolo amending Chapter 15 of Title 6 of the Yolo County code regarding tobacco retailer permitting. Ordinance NO. 1474. Retrieved from: <https://www.secgov.org/sites/secphd/en-us/Partners/cdip/Documents/hcc-flav-yolo.pdf>

¹⁶ Municipal Code of Chicago. Title 4 businesses, occupations and consumer protection. Chapter 4-64 tobacco dealers. Retrieved from: [http://library.amlegal.com/nxt/gateway.dll/Illinois/chicago_il/title4businessesoccupationsandconsumerpr/chapter4-64tobaccodealers?f=templates\\$fn=default.htm\\$3.0\\$vid=amlegal:chicago_il\\$anc=JD_4-64-180](http://library.amlegal.com/nxt/gateway.dll/Illinois/chicago_il/title4businessesoccupationsandconsumerpr/chapter4-64tobaccodealers?f=templates$fn=default.htm$3.0$vid=amlegal:chicago_il$anc=JD_4-64-180)

¹⁷ Amending Title 13, Chapter 281 of the Minneapolis Code of Ordinances relating to Licenses and Business Regulations: Tobacco Dealers. Retrieved from: <http://www.minneapolismn.gov/www/groups/public/@clerk/documents/webcontent/wcmsp-202790.pdf>

Shoreview, MN ¹⁸	No person shall sell, offer for sale, or otherwise distribute any flavored products.				Yes. This policy does not apply to retail establishments that: (1) Prohibit minors from entering at all times; and (2) Derive at least 90% of their revenues from the sale of tobacco, tobacco-related devices, electronic delivery devices, or nicotine or lobelia delivery products.
St. Paul, MN ¹⁹	No person shall sell, offer for sale, or otherwise distribute any flavored products.	Apr 1, 2016	No.	Yes.	Yes. This policy shall not apply to retail stores which derive at least 90% their revenues from tobacco and tobacco-related devices, and where the retailer ensures that no person younger than 17 years of age is present, or permitted to enter, at any time.
Rhode Island					
Barrington, RI ²⁰	No licensee, or employee or agent of such licensee, shall sell any flavored tobacco product to a consumer. This section shall not apply to an electronic smoking device establishment.	Jun 5, 2017	No.	Yes.	Yes. The policy does not apply to an electronic smoking device establishment.
Central Falls, RI ²¹	No licensee, or employee or agent of such licensee, shall sell any flavored tobacco product to a consumer.	Oct 14, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars.
Johnston, RI ²²	No licensee, or employee or agent of such licensee, shall sell any flavored tobacco product to a consumer.	Jun 12, 2017	No.	Yes.	No.
Middletown, RI ²³	No licensee, or employee or agent of such licensee, shall sell any flavored tobacco product to a consumer.	Jun 19, 2017	No.	Yes.	No.
Providence, RI ²⁴	It shall be unlawful for any person to sell or offer for sale any flavored tobacco product to a consumer, except in a smoking bar.	Dec 1, 2012	No.	Yes.	Yes. The policy does not apply to smoking

¹⁸ Shoreview Ordinance Amendment- Section 706: Tobacco Regulations. Shoreview, MN- Retrieved from: http://shoreviewmn.granicus.com/MetaViewer.php?view_id=1&clip_id=182&meta_id=6684

¹⁹ St. Paul Code of Ordinances. Sec. 324.07. Sales prohibited. St. Paul, MN. Retrieved from: https://library.municode.com/mn/st._paul/codes/code_of_ordinances?nodeid=ptiileco_titxxixli_ch324to_s324.07sapr

²⁰ Town of Barrington Ordinance 2017-7. Part II. General Legislation. Chapter 170 Sale of Tobacco. Retrieved from: <http://ecode360.com/documents/BA1328/source/LF964251.pdf>

²¹ Central falls tobacco dealers license, flavors and discounts ordinance. October 14, 2015. Retrieved from: <http://tobaccofree-ri.org/Ordinances-CentralFalls-RetailLicense-NoDiscounts.pdf>

²² Town of Johnston. State of Rhode Island and Providence Plantations. Ordinance 2017-7. Retrieved from: <http://tobaccofree-ri.org/Ordinances-Johnston-RetailLicense.pdf>

²³ Ordinance of the Town of Middletown. An Ordinance Amending the Town Code of the Town of Middletown. Retrieved from: <http://tobaccofree-ri.org/Ordinances-Middletown-RetailLicense.pdf>

²⁴ Providence Code of Ordinances. Sec. 14-309. - Sale of flavored tobacco products prohibited. Providence, RI. Retrieved from: https://library.municode.com/ri/providence/codes/code_of_ordinances?nodeId=ptiicoor_ch14li_artxvtode_s14-309saf1toprpr

					bars.
Massachusetts					
Andover, MA ²⁵	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Jun 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Amherst, MA ²⁶	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Aug 15, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Arlington, MA ²⁷	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco or nicotine delivery product at retail, except in retail tobacco stores.	Mar 1, 2015	No.	Yes.	Yes. The policy does not apply to retail tobacco stores.
Ashland, MA ²⁸	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Jan 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Athol, MA ²⁹	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Nov 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Attleboro, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in adult-only retail tobacco stores in existence as of the effective date of this regulation.	Jan 1, 2016	No.	Yes.	Yes. The policy does not apply to adult-only retail tobacco stores.
Avon, MA ³¹	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product.	Jul 1, 2015	No.	Yes.	No.
Belmont, MA ³²	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Jan 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Beverly, MA ³³	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in adult-only retail tobacco stores.	Oct 1, 2017	No.	Yes.	Yes. The policy does not apply to adult-only

²⁵ Town of Andover Board of Health. Regulations Concerning the Sale and Use of Tobacco Products. Retrieved from: <https://andoverma.gov/DocumentCenter/View/147>

²⁶ Town of Amherst Board of Health, Restricting the Sale of Tobacco Products. Retrieved from: <http://www.amherstma.gov/DocumentCenter/View/31768>

²⁷ Town of Arlington Department of Health and Human Services Office of the Board of Health. Regulation Restricting the Sale of Tobacco Products and Nicotine Delivery Products. Retrieved from: <http://www.arlingtonma.gov/Home/ShowDocument?id=23990>

²⁸ Town of Ashland, Massachusetts. Regulation of the Ashland Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: <http://www.ashlandmass.com/DocumentCenter/Home/View/1465>

²⁹ Town of Athol Board of Health. Regulations of the Athol Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: http://www.athol-ma.gov/sites/atholma/files/u106/corrected_tobacco_regs_11-1-2016.pdf

³⁰ Policy document not found online but shared by local government officials.

³¹ Tobacco Control Regulation of the Avon Board of Health. Regulation Restricting the Sale of Tobacco and Nicotine Delivery Products. Retrieved from: https://www.avon-ma.gov/sites/avonma/files/uploads/tobacco_control_regulation_0.pdf

³² Regulation of the Belmont Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: <http://www.belmont-ma.gov/sites/belmontma/files/file/file/tobaccosalesregulationsignedeff1.1.2015.pdf>

³³ City of Beverly, MA. Board of Health Regulations Chapter 400. Retrieved from: <https://ecode360.com/30245883>

					retail tobacco stores.
Billerica, MA ³⁴	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Oct 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Boston, MA ³⁵	No retailer, retail establishment, or other individual or entity shall sell or distribute or cause to be sold or distributed or offer for sale any flavored tobacco product to a consumer. This provision shall not apply to a retail tobacco store or smoking bar as defined by this regulation.	Feb 15, 2016	No.	Yes.	Yes. This provision shall not apply to a retail tobacco store or smoking bar.
Brockton, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Sep 30, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Brookline, MA ³⁶	No entity shall sell or distribute or cause to be sold or distributed any flavored tobacco or e-cigarette products, except in retail tobacco stores.	Spring 2017 ³⁷	No.	Yes.	Yes. This provision shall not apply to retail tobacco stores.
Buckland, MA ³⁸	No entity shall sell or distribute or cause to be sold or distributed any flavored tobacco or e-cigarette products, except in smoking bars and retail tobacco stores.	Nov 15, 2015	No.	Yes.	Yes. This provision shall not apply to a retail tobacco store or smoking bar.
Cambridge, MA ³⁹	No retailer, or other individual or entity shall sell or distribute or cause to be sold or distributed or offer for sale any flavored tobacco to a consumer. This provision shall not apply to a retail tobacco store.	Jun 1, 2015	No.	Yes.	Yes. This provision shall not apply to a retail tobacco store.
Carver, MA ⁴⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product at retail, except in smoking bars and retail tobacco stores.	Jul 1, 2015	No.	Yes.	Yes. This provision shall not apply to smoking bars and retail tobacco stores.
Charlemont, MA ⁴¹	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product at retail, except in smoking bars and retail tobacco stores.	Oct 15, 2015	No.	Yes.	Yes. This provision shall not apply to smoking bars and retail tobacco stores.
Chelsea, MA ⁴²	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in tobacco retail stores.	Mar 15, 2016	No.	Yes.	Yes. The policy does not apply to tobacco

³⁴ Town of Billerica, MA. Chapter 4. Section 6. Tobacco Control. Restricting the Sale of Tobacco Products: Purpose. Retrieved from: <http://www.town.billerica.ma.us/DocumentCenter/Home/View/3632>

³⁵ Boston Public Health Commission. Tobacco Control Regulations. Retrieved from: <http://www.bphc.org/boardofhealth/regulations/Pages/Tobacco-Contol-Regulations.aspx>

³⁶ Town of Brookline, MA. General By-laws. Retrieved from: <http://www.brooklinema.gov/DocumentCenter/View/353>

³⁷ The exact date could not be determined.

³⁸ Regulation of the Buckland Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: http://town.buckland.ma.us/documents/BoardofHealth/BOH_Tobacco_Regs.pdf

³⁹ City of Cambridge Ordinance Number 1363. Chapter 8.28. Retrieved from: <https://www.somervillema.gov/sites/default/files/cambridge-tobacco-regulations.pdf>

⁴⁰ Regulation of the Carver Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: https://www.carverma.gov/sites/carverma/files/uploads/carver_tobacco_sales_regulation.pdf

⁴¹ Regulation of the Charlemont Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: http://www.charlemont-ma.us/sites/default/files/Attachments/tobacco_regs.pdf

⁴² Regulation of the Chelsea Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: <http://www.somervillema.gov/sites/default/files/chelsea-tobacco-regulations.pdf>

					retail stores.
Clinton, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Jul 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Cohasset, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Jun 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Concord, MA ⁴³	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product or flavored nicotine product except in retail tobacco stores as defined herein.	Nov 1, 2014	No.	Yes.	Yes. The policy does not apply to retail tobacco stores.
Dedham, MA ⁴⁴	No person, firm, entity or corporation shall sell or offer for sale or distribute drug paraphernalia, cigar wraps, bidi (beedie) and/or flavored Tobacco Products of any kind in The Town of Dedham.	Oct 1, 2016	No.	Yes.	No.
Deerfield, MA ⁴⁵	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Jan 1, 2017	No.	Yes.	Yes. The policy does not apply to retail tobacco stores.
Duxbury, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Feb 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Easthampton, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Jan 1, 2018	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Easton, MA ⁴⁶	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	May 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Essex, MA ⁴⁷	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Aug 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Everett, MA ⁴⁸	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail	May 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking

⁴³ Regulation of the Concord Board of Health. Sale of Tobacco Products and Nicotine Delivery Products. Retrieved from: <http://www.concordnet.org/DocumentCenter/Home/View/2049>

⁴⁴ Regulation Affecting Smoking and the Sale and Distribution of Tobacco and Nicotine Delivery Products in Dedham. Retrieved from: <http://www.dedham-ma.gov/Home/ShowDocument?id=1202>

⁴⁵ Town of Deerfield, MA. City Code. Chapter 242: Tobacco Products. Retrieved from: <https://ecode360.com/32444652>

⁴⁶ Regulation of the Easton Board of Health Restricting the Sale of Tobacco Products. Retrieved from: <http://www.easton.ma.us/Regulation%20of%20the%20Easton%20Board%20of%20Health%20Restricting%20the%20Sale%20of%20Tobacco%20Products%20stamped%20copy.pdf>

⁴⁷ Regulation of the Essex Board of Health Restricting the Sale of Tobacco Products. Retrieved from: http://www.essexma.org/Pages/EssexMA_Health/Tobacco%20Sales%20Final

⁴⁸ The Everett Board of Health Regulation Restricting the Sale of Tobacco Products. Retrieved from: <https://www.somervillema.gov/sites/default/files/everett-tobacco-regulations.pdf>

	tobacco stores.				bars and adult-only retail tobacco stores.
Fairhaven, MA ⁴⁹	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product.	Jan 1, 2015	No.	Yes.	No.
Fitchburg, MA ⁵⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Mar 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Gardner, MA ⁵¹	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Mar 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Gill, MA ⁵²	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Sep 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Grafton, MA ⁵³	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Sep 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Granby, MA ⁵⁴	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Feb 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Greenfield, MA ⁵⁵	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Jul 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Groton, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Oct 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Great Barrington, MA ⁵⁶	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product or tobacco product containing characterizing flavor except in smoking bars and adult only retail tobacco stores.	Sep 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco

⁴⁹ Fairhaven, Massachusetts. Board of Health Regulations. Retrieved from: http://fairhaven-ma.gov/Pages/FairhavenMA_Health/BOH%20REGULATIONS-June%202017.pdf

⁵⁰ The Fitchburg Board of Health Regulation Restricting the Sale of Tobacco Products. Retrieved from: <http://www.ci.fitchburg.ma.us/DocumentCenter/Home/View/594>

⁵¹ Regulation of the Gardner Board of Health Restricting the Sale of Tobacco Products & Nicotine Delivery Products. Retrieved from: <http://www.gardner-ma.gov/DocumentCenter/Home/View/2371>

⁵² Regulation of the Gill Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: <http://www.gillmass.org/pdfs/BOH/2015-0526-Gill-BOH-Tobacco-Regulations-effective-2015-0901.pdf>

⁵³ Regulation of the Grafton Board of Health Restricting the Sale of Tobacco Products. Retrieved from: https://www.grafton-ma.gov/sites/graftonma/files/uploads/restricting_sale_tobacco_products_effective_9.1.16_0.pdf

⁵⁴ Regulation of the Town of Granby Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: http://www.granby-ma.gov/Pages/GranbyMA_Health/regulations/RegSalTabPro

⁵⁵ Regulation of the Greenfield Board of Health Restricting the Sale of Tobacco Products. Retrieved from: http://greenfield-ma.gov/files/Board_of_Health_-_Regulation_Restricting_the_Sale_of_Tobacco.pdf

⁵⁶ Regulation of the Great Barrington Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: http://www.townofgb.org/pages/gbarringtonma_health/gbboh%20restricting%20sale%20of%20tobacco%20products-%20adopted%206.2.16.pdf

					stores.
Hadley, MA ⁵⁷	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Mar 15, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Halifax, MA ⁵⁸	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars retail tobacco stores.	Mar 15, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Hamilton, MA ⁵⁹	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in adult-only retail tobacco stores.	Oct 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Hatfield, MA ⁶⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Jan 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Holden, MA ⁶¹	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in adult-only retail tobacco stores.	July 31, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Holyoke, MA ⁶²	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Nov 3, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Lanesborough, MA ⁶³	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Mar 9, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Leominster, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco	Mar 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking

⁵⁷ Regulation of the Hadley Board of Health Restricting the Sale of Tobacco Products. Retrieved from: http://www.hadleyma.org/pages/HadleyMA_Health/S02368769-0236879B.1/Restricting%20the%20Sale%20of%20Tobacco%20Products.pdf

⁵⁸ Town of Halifax Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: http://www.town.halifax.ma.us/Pages/HalifaxMA_Health/PoliciesRegs/Tobacco.Smoking/Restricting.pdf

⁵⁹ Regulation of the Hamilton Board of Health Restricting the Sale of Tobacco Products and Nicotine Delivery Products. Retrieved from <https://www.hamiltonma.gov/wp-content/uploads/2017/01/Hamilton-Regulation-Restricting-the-SALE-of-Tobacco-Products-and-Nicotine-Delivery-Products-Amended-63016-EFFECTIVE-10116.pdf>

⁶⁰ Regulation of the Hatfield Board of Health Restricting the Sale of Tobacco Products. Retrieved from: http://www.townofhatfield.org/Pages/HatfieldMA_Bcomm/BOH/TobaccoRegs.pdf

⁶¹ Regulation of the Holden Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: http://www.holdenma.gov/sites/holden/files/file/file/signed_boh_regulations_restricting_the_sale_of_tobacco_products.pdf

⁶² Regulation of the Holyoke Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: <http://www.holyoke.org/wp-content/uploads/2012/12/new-tobacco-regulations-nov-3-2016.pdf>

⁶³ Regulation of the Lanesborough Board of Health Restricting the Sale of Tobacco Products. Retrieved from: [http://www.lanesborough-ma.gov/vertical/sites/%7B35069B63-55EF-4033-982E-FE5C4BF36433%7D/uploads/Tobacco_Regulations_MAR_10_2015\(1\)\(1\).pdf](http://www.lanesborough-ma.gov/vertical/sites/%7B35069B63-55EF-4033-982E-FE5C4BF36433%7D/uploads/Tobacco_Regulations_MAR_10_2015(1)(1).pdf)

	stores.				bars and retail tobacco stores.
Leverett, MA ⁶⁴	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Mar 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Lowell, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in retail tobacco stores.	Oct 1, 2016	No.	Yes.	Yes. The policy does not apply to retail tobacco stores.
Ludlow, MA ⁶⁵	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Jun 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Lynnfield, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Aug 15, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Marblehead, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any Flavored Tobacco Product at retail, except in Smoking Bars and Retail Tobacco Stores.	Jul 1, 2016	No.	Yes.	Yes. The policy does not apply to Smoking Bars and Retail Tobacco Stores.
Marlborough, MA ⁶⁶	No person shall sell or distribute, or cause to be sold or distributed, any flavored tobacco product in Marlborough, except in smoking bars and retail tobacco stores.	Sep 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Marshfield, MA ⁶⁷	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Sep 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Maynard, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Sep 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Medfield, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Jan 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Medford, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in adult-only retail tobacco stores.	Jul 10, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Melrose, MA ⁶⁸	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product or nicotine delivery device, except in retail tobacco stores.	Jan 4, 2016	No.	Yes.	Yes. The policy does not apply to retail tobacco stores.

⁶⁴ Regulation of the Leverett Board of Health Restricting the Sale of Tobacco Products. Retrieved from: http://www.leverett.ma.us/files/Leverett_Board_of_Health_Tobacco_Sales_Regulation_2015-01-21.pdf

⁶⁵ Regulation of the Ludlow Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: http://www.ludlow.ma.us/reports/health/Regulations/sale_of_tobacco.pdf

⁶⁶ Marlborough Board of Health Regulation Restricting the Sale of Tobacco Products. Retrieved from: http://www.marlborough-ma.gov/gen/MarlboroughMA_BoardHealth/BOH%20REG%20Restricting%20the%20Sale%20of%20Tobacco%20Products.pdf

⁶⁷ Town of Marshfield Board of Health. Tobacco Control Regulations. Retrieved from: https://www.marshfield-ma.gov/sites/marshfieldma/files/uploads/tobacco_control_regulations.pdf

⁶⁸ Regulation of the Melrose Board of Health Restricting the Sale of Tobacco Products. Retrieved from: http://www.cityofmelrose.org/wp-content/uploads/2014/06/Tobacco_Reg_Sales2015.pdf

Methuen, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Sep 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Middleton, MA ⁶⁹	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Oct 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Millis, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Nov 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Montague, MA ⁷⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Jul 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Natick, MA ⁷¹	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Sep 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Needham, MA ⁷²	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Jul 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Newton, MA ⁷³	No retailer, or other individual or entity shall sell or distribute or cause to be sold or distributed or offer for sale any flavored tobacco or nicotine delivery product to a consumer. This provision shall not apply to a retail tobacco store or retail nicotine delivery product store.	Sep 22, 2014	No.	Yes.	Yes. The policy does not apply to retail tobacco stores or retail nicotine delivery product stores.
North Adams, MA ⁷⁴	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Aug 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
North Andover, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Feb 2, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
North Attleboro, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Jul 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Northampton,	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, with the exception of a permitted	Jan 1, 2017	No.	Yes.	Yes. The policy does not apply to permitted

⁶⁹ Regulation of the Middleton Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: <http://www.townofmiddleton.org/DocumentCenter/Home/View/215>

⁷⁰ Regulation of the Montague Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: http://www.montague.net/pages/MontagueMA_BComm/Health/Tobacco%2021%20Signed%20Regulation%2005062015.pdf

⁷¹ Chapter XIX. Regulation of the Natick Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: <http://www.natickma.gov/DocumentCenter/View/2270>

⁷² Regulation Affecting Smoking and the Sale and Distribution of Tobacco Products in Needham. Board of Health. Article 1. Retrieved from: <http://www.needhamma.gov/DocumentCenter/View/15088>

⁷³ Newtown, Massachusetts City Ordinance. Chapter 20. Article I. Smoking, Tobacco Products And Alcoholic Beverages. Retrieved from: <http://www.newtonma.gov/civicax/filebank/documents/74132>

⁷⁴ Regulation of the North Adams Board of Health Restricting the Sale of Tobacco Products. Retrieved from: http://www.northadamsma.gov/UserFiles/Image/Board_of_Health_2016_Draft_Tobacco_Regulations.pdf

MA ⁷⁵	Tobacconist Establishment in which said establishment is also in possession of a valid City of Northampton Tobacco and Nicotine Delivery Product Sales Permit.				Tobacconist Establishments in which said established is also in possession of a valid City of Northampton Tobacco and Nicotine Delivery Product Sales Permit.
North Reading, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Sep 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Norwell, MA ⁷⁶	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Mar 31, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores. ^{Error!} Bookmark not defined.
Orange, MA ⁷⁷	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Aug 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Orleans, MA ⁷⁸	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product.	Nov 1, 2016	No.	Yes.	No.
Pittsfield, MA ⁷⁹	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco products except in smoking bars and Adult Only retail tobacco stores.	Nov 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and Adult Only retail tobacco stores.
Provincetown, MA ⁸⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, as defined herein, except in retail tobacco stores.	Mar 1, 2016	No.	Yes.	Yes. The policy does not apply to retail tobacco stores.
Reading, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product at retail, except in smoking bars and retail tobacco stores.	Aug 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Salem, MA ⁸¹	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail	Mar 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking

⁷⁵ Regulation of the City of Northampton. Board of Health. Restricting the Sale of Tobacco Products and Nicotine Delivery Products. Retrieved from: <http://www.northamptonma.gov/DocumentCenter/View/6594>

⁷⁶ Regulation of the Norwell Board of Health. Restricting the Sale of Tobacco Products. 2015. Retrieved from: https://www.townofnorwell.net/sites/norwellma/files/uploads/regulation_-_sale_of_tobacco_products.pdf

⁷⁷ Regulation of the Orange Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: https://www.townoforange.org/sites/orangema/files/uploads/orange_tobacco_sales_regs_2017.pdf

⁷⁸ Board of Health Regulations. Chapter 185. Sale and Use of Tobacco and Nicotine Delivery Products. Retrieved from: https://www.town.orleans.ma.us/sites/orleansma/files/file/file/2016-07-21_approved_amendments_to_sale_and_use_of_tobacco_products.pdf

⁷⁹ Regulation of the Pittsfield Board of Health Restricting the Sale of Tobacco & Nicotine Delivery Products. Retrieved from: http://www.cityofpittsfield.org/city_hall/health_and_inspections/docs/Pittsfield%20BOH%20YA%20regulations%20Aug%202016%20FINAL.pdf

⁸⁰ City of Provincetown, MA. City Ordinance. PART IX. Article 2. Tobacco Product Sales Regulation. Retrieved from: <http://www.provincetown-ma.gov/DocumentCenter/View/4379>

⁸¹ Regulation 24 of the City of Salem Board of Health. Restricting the Sale and Use of Tobacco Products. Retrieved from: http://www.salem.com/sites/salemma/files/uploads/regulation_24_tobacco_effective_3-1-17.pdf

	tobacco stores.				bars and adult-only retail tobacco stores.
Sandwich, MA ⁸²	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Jun 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Saugus, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Jul 5, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Shelburne, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Nov 15, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Sherborn, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco or nicotine delivery product.	Jun 1, 2014	No.	Yes.	No.
Somerville, MA ⁸³	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Mar 15, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Southampton, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Mar 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
South Hadley, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Jun 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Spencer, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Jan 1, 2018	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Stow, MA ⁸⁴	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Jun 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Sudbury, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Jul 1, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Sunderland, MA ⁸⁵	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail	Apr 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking

⁸² Town of Sandwich Board of Health Regulations, Policies and Clarification of Policies.

Retrieved from: <http://sandwichmass.org/PublicDocuments/Board%20of%20Health%20Regs%2011-28-2016.pdf>

⁸³ Regulation of the Somerville Board of Health Restricting the Sale of Tobacco Products. Retrieved from: <https://www.somervillema.gov/sites/default/files/somerville-tobacco-regulations.pdf>

⁸⁴ Regulation of the Stow Board of Health Restricting the Sale of Tobacco Products. Retrieved from: <https://www.stow-ma.gov/sites/stowma/files/uploads/tobaccoregulations6.1.17.pdf>

	tobacco stores.				bars and adult-only retail tobacco stores.
Templeton, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Oct 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Tewksbury, MA ⁸⁶	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Jun 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Townsend, MA ⁸⁷	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Sep 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and adult-only retail tobacco stores.
Tyngsborough, MA ⁸⁸	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product at retail, except in retail tobacco stores and smoking bars.	Nov 1, 2016	No.	Yes.	Yes. The policy does not apply to retail tobacco stores and smoking bars.
Wakefield, MA ⁸⁹	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product or nicotine delivery device, except in retail tobacco stores.	Jan 1, 2016	No.	Yes.	Yes. The policy does not apply to retail tobacco stores.
Walpole, MA ⁹⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Jul 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Wareham, MA ⁹¹	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	April 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars and retail tobacco stores.
Watertown, MA ⁹²	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product (except tobacco, menthol, mint or wintergreen flavors) at retail except in retail tobacco stores and/or smoking bars	Jun 22, 2016	No.	Yes.	Yes. The policy does not apply to retail tobacco stores and/or smoking bars.

⁸⁵ Regulation of the Sunderland Board of Health Restricting the Sale of Tobacco Products. Retrieved from: http://www.townofsunderland.us/Pages/SunderlandMA_Bcomm/Health/Regulation%20Restricting%20Tobacco%20Sale%20of%20Products.pdf

⁸⁶ The Tewksbury Board of Health Regulations. Chapter 11: Restricting the Sale of Tobacco Products. Retrieved from: http://www.tewksbury-ma.gov/sites/tewksburyma/files/file/file/tobacco_regulations_-_chapter_11_revisions_2016-04-25.pdf

⁸⁷ Regulation of the Townsend Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: http://www.townsend.ma.us/Pages/TownsendMA_Health/FormsDocs/2016%20Draft%20Tobacco%20Regulations%20Townsend.docx

⁸⁸ Regulation of the Tyngsborough Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: <http://www.tyngsboroughma.gov/wp-content/uploads/2009/10/Tyngsborough-Tobacco-Reg-T21.pdf>

⁸⁹ The Wakefield Board of Health. Regulations Restricting the Sale of Tobacco Products. Retrieved from: www.wakefield.ma.us/health-department/files/tobacco-sales

⁹⁰ Regulation of the Walpole Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: http://www.walpole-ma.gov/sites/walpolema/files/walpole_tobacco_regulations_2015.pdf

⁹¹ The Town of Wareham. Regulations. Section 5. Smoking Regulations. Retrieved from: http://www.wareham.ma.us/sites/warehamma/files/uploads/boh_reg_sec_5_smoking_regs2016.pdf

⁹² Regulation Regarding Smoking and the Sale and Use of Tobacco Products. Retrieved from: <http://www.ci.watertown.ma.us/DocumentCenter/View/23163>

West Boylston, MA ⁹³	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Mar 14, 2017	No.	Yes.	Yes. The policy does not apply to smoking bars or adult-only retail tobacco stores.
Westford, MA ⁹⁴	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and adult-only retail tobacco stores.	Jul 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars or adult-only retail tobacco stores.
Whately, MA ⁹⁵	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Sep 1, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars or retail tobacco stores.
Williamstown, MA ⁹⁶	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, other than menthol, mint, or wintergreen, at retail, except in smoking bars or retail tobacco stores.	Jan 5, 2015	No.	Yes.	Yes. The policy does not apply to smoking bars or retail tobacco stores.
Winchendon, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product, except in smoking bars and retail tobacco stores.	Oct 1, 2016	No.	Yes.	Yes. The policy does not apply to smoking bars or retail tobacco stores.
Winchester, MA ³⁰	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco products.	Jul 1, 2015	No.	Yes.	No.
Yarmouth, MA ⁹⁷	No person shall sell or distribute or cause to be sold or distributed any flavored tobacco product at retail.	Jul 1, 2014	No.	Yes.	No.

⁹³ Regulation of the Whately Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: https://www.whately.org/sites/whatelyma/files/uploads/whately_boh_tobacco_sales_7-1-15_final.pdf

⁹⁴ Tobacco Regulations Affecting Smoking and the Sale, Vending and Distribution of Tobacco in Westford. Retrieved from: <https://westfordma.gov/DocumentCenter/Home/View/4413>

⁹⁵ Regulation of the West Boylston Board of Health. Restricting the Sale of Tobacco Products. Retrieved from: <https://www.westboylston-ma.gov/sites/westboylstonma/files/uploads/boh2017tobaccoregs.pdf>

⁹⁶ Town of Williamstown, MA. Code Chapter 158: Smoking and Tobacco Products. Retrieved from: <https://ecode360.com/10816800>

⁹⁷ Town of Yarmouth. Regulation of the Town of Yarmouth Board of Health. Restricting the Sale and Use of Tobacco Products. Retrieved from: <http://www.yarmouth.ma.us/DocumentCenter/View/4254>

Appendix VI: Community Characteristics of Locations with Flavored E-cigarette Sales Restrictions

Table 1. Characteristics of Localities with Flavored E-cigarette Sales Restrictions (n=121)

Location	Population Number	% Under 18	% NH White	Median Household Income	% Below poverty line	% High school or higher	Adult Smoking Prevalence	% Voters for the Democratic Party	Effective Year
California									
Berkeley, CA	121,241	14	55	78,121	16.1	97.1	9.9	79.3	2017
Contra Costa County, CA	1,135,127	23	44	91,045	8.6	89.3	10.6	68.9	2018
El Cerrito, CA	24,418	17	51	88,737	9.1	93.8	10.6	68.9	2018
Hayward, CA	158,969	21	18	75,352	10.5	80.6	9.9	79.3	2014
Manhattan Beach, CA	35,603	25	75	143,527	4.0	97.8	11.7	71.4	2016
Oakland, CA	419,987	19	28	68,060	18.9	80.8	10	79.3	2018
San Francisco, CA	870,887	14	41	103,801	10.1	87.9	9.9	85.5	2018
San Leandro, CA	90,460	19	26	65,963	10.2	82.4	10	79.3	2018
Santa Clara County, CA	1,919,402	23	32	111,069	9.4	87.3	11.5	73.7	2017
Sonoma, CA	10,897	17	80	62,516	10.4	92.9	11.6	70.7	2015
Yolo County, CA	215,802	21	47	64,904	20.2	84.9	11.9	68.1	2017
Illinois									
Chicago, IL	2,704,965	21	33	53,006	19.1	84.4	14.6	74.4	2016
Minnesota									
Minneapolis, MN	413,645	20	61	56,255	20.4	89.6	13.0	63.8	2018
Shoreview, MN	25,951	21	85	79,252	5.3	96.3	15.9	65.7	2017
St. Paul, MN	302,403	25	52	54,085	19.2	86.2	15.9	65.7	2016
Rhode Island									
Barrington, RI	16,280	27	92	108,776	2.2	96.3	17.3	51.9	2017
Central Falls, RI	19,378	29	21	29,108	33.2	55.5	15.6	58.5	2015
Johnston, RI	29,095	18	86	58,592	8.1	86.1	15.6	58.5	2017
Middletown, RI	16,057	23	79	64,423	9.6	92.9	13.1	57	2017
Providence, RI	179,214	23	33	40,335	24.7	80.9	15.6	58.5	2012
Massachusetts									
Amherst, MA	39,482	9	73	48,059	34.7	95.4	15.3	66.3	2015
Andover, MA	8,783	18	82	72,375	10.7	95.3	14.6	58.5	2017
Arlington, MA	44,128	22	82	93,787	5.0	95.9	11.8	66.3	2015
Ashland, MA	17,159	24	83	102,911	3.9	96.1	11.8	66.3	2016
Athol, MA	8,427	23	91	42,013	21.9	83.3	17.2	51.7	2016

Attleboro, MA	43,953	24	84	67,736	10.1	88.3	17.3	51.9	2016
Avon, MA	4,453	18	75	76,065	3.2	88.6	11.8	61.2	2015
Belmont, MA	25,337	24	79	110,685	4.5	97.0	11.8	66.3	2015
Beverly, MA	40,670	18	92	72,837	8.0	94.1	14.6	58.5	2017
Billerica, MA	41,956	20	89	96,316	5.4	93	11.8	66.3	2016
Boston, MA	672,840	16	45	63,621	21.0	86.2	14.1	79.5	2016
Brockton, MA	95,623	26	33	50,034	19.8	76.8	16.2	50.7	2016
Brookline, MA	59,132	19	71	95,518	12.1	96.6	11.8	61.2	2017
Buckland, MA	1,797	14	99	56,875	7.2	95.1	15.0	64.2	2015
Cambridge, MA	110,644	12	57	86,657	14.8	93.2	11.8	66.3	2015
Carver, MA	11,562	21	94	74,375	3.6	89.5	16.2	50.7	2015
Charlemont, MA	1,107	17	95	53,750	12.3	89.4	15.0	64.2	2015
Chelsea, MA	37,581	26	24	47,733	20.9	65.4	14.1	79.5	2016
Clinton, MA	7,386	20	75	52,519	13.7	86.5	17.2	51.7	2017
Cohasset, MA	8,281	27	98	113,843	51.0	96.6	11.8	61.2	2016
Concord, MA	19,271	23	84	134,036	5.6	94	11.8	66.3	2014
Dedham, MA	25,224	20	51	83,438	4.8	94.1	11.8	61.2	2016
Deerfield, MA	900	27	74	119,688	7.7	99.5	15.0	64.2	2017
Duxbury, MA	1,375	26	95	150,481	3.3	99.1	16.2	50.7	2015
Easthampton, MA	16,060	16	86	56,527	9.2	94.6	15.3	66.3	2018
Easton, MA	23,583	23	89	96,059	3.8	96.7	17.3	51.9	2015
Essex, MA	1,613	21	98	105,208	3.8	98.7	14.6	58.5	2015
Everett, MA	43,885	23	51	50,762	14.9	79.8	11.8	66.3	2017
Fairhaven, MA	16,027	17	92	61,274	10.3	85.6	17.3	51.9	2015
Fitchburg, MA	40,462	23	66	48,724	19.4	82.2	17.2	51.7	2017
Gardner, MA	20,306	21	85	43,905	19.1	84.4	17.2	51.7	2017
Gill, MA	1,641	13	89	73,750	10.3	96.2	15.0	64.2	2015
Grafton, MA	18,219	24	83	88,712	5.9	95.3	17.2	51.7	2016
Granby, MA	1,431	16	89	74,167	3.6	88.3	15.3	66.3	2015
Great Barrington, MA	2,344	15	67	48,378	12.2	84.8	14.5	54.0	2016
Greenfield, MA	17,514	19	88	49,612	14.2	91.4	15.0	64.2	2015
Groton, MA	1,081	14	85	118,041	8.4	97.8	11.8	66.3	2017
Hadley, MA	5,324	15	91	65,625	6.9	96.1	15.3	66.3	2016
Halifax, MA	7,684	22	94	64,013	3.4	97.2	16.2	50.7	2016
Hamilton, MA	8,102	28	88	109,500	7.4	97.3	14.6	58.5	2016
Hatfield, MA	1,506	18	95	65,903	5.6	97.4	15.3	66.3	2015

Holden, MA	18,053	24	93	98,630	3.1	95.6	17.2	51.7	2017
Holyoke, MA	40,342	24	43	36,608	28.8	77.3	15.3	66.3	2016
Lanesboro, MA	3091	18	95	67,679	5.7	85.7	14.5	67.5	2015
Leominster, MA	41,176	21	75	58,955	13.1	86.5	17.2	51.7	2017
Leverett, MA	1,993	20	93	83,333	7.7	94.9	15.0	64.2	2015
Lowell, MA	110,572	23	51	55,383	19.6	83.8	11.8	66.3	2016
Ludlow, MA	21,348	19	91	63,548	4.9	83.9	18.2	55.1	2016
Lynnfield, MA	12,270	22	91	118,828	1.6	97.2	14.6	58.5	2015
Marblehead, MA	20,270	24	94	102,993	4.9	97.8	14.6	58.5	2016
Marlborough, MA	39,425	21	73	71,790	7.3	89.1	11.8	66.3	2015
Marshfield, MA	4,362	20	92	73,036	7.9	94.2	16.2	50.7	2015
Maynard, MA	10,459	21	86	88,333	9.0	95.5	11.8	66.3	2016
Medfield, MA	6,322	28	92	106,700	5.4	96.7	11.8	61.2	2016
Medford, MA	57,136	15	74	76,445	10.8	91.5	11.8	66.3	2017
Melrose, MA	27,681	22	89	85,521	3.4	94.3	11.8	66.3	2016
Methuen, MA	48,607	23	70	71,392	9.8	88.7	14.6	58.5	2015
Middleton, MA	9,436	20	82	108,622	5.2	91.2	14.6	58.5	2016
Millis, MA	8,051	24	92	92,042	6.8	97.8	11.8	61.2	2015
Montague, MA	8,357	19	88	52,283	16.1	88.0	15.0	64.2	2015
Natick, MA	34,892	25	83	100,469	4.1	97.3	11.8	66.3	2015
Needham, MA	29,853	27	85	132,237	3.4	98.0	11.8	61.2	2017
Newton, MA	89,041	24	74	135,646	4.1	96.4	11.8	66.3	2014
North Adams, MA	13,459	16	92	38,490	18.5	84.8	14.5	54.0	2016
North Andover, MA	29,271	23	85	100,286	5.2	96.5	14.6	58.5	2015
North Attleboro, MA	28,712	21	90	91,230	4.5	93.1	17.3	51.9	2016
North Reading, MA	15,396	22	89	123,103	3.4	96.9	11.8	66.3	2016
Northampton, MA	28,602	17	81	59,274	17.1	94.4	15.3	66.3	2017
Norwell, MA	10,740	28	96	111,628	3.2	96.3	16.2	50.7	2016
Orange, MA	4,160	23	96	36,333	19.3	86.2	15.0	64.2	2017
Orleans, MA	1,669	6	93	34,604	7.9	99.4	11.9	54.0	2016
Pittsfield, MA	43,926	20	85	43,916	17.2	89.6	14.5	54.0	2016
Provincetown, MA	2,744	5	85	40,160	12.4	92.5	11.9	54.0	2016
Reading, MA	25,357	25	90	107,654	2.8	96.8	11.8	66.3	2017
Salem, MA	42,499	18	74	60,690	14.4	90.9	14.6	58.5	2017
Sandwich, MA	2,988	14	94	67,857	6.9	94.9	11.9	54.0	2017
Saugus, MA	27,620	18	88	77,371	6.6	90.1	14.6	58.5	2016

Shelburne, MA	1,962	14	97	54,474	9.3	92.3	15.0	64.2	2015
Sherborn, MA	4,245	28	93	155,956	1.3	98.6	11.8	66.3	2014
Somerville, MA	81,324	11	70	93,343	12.6	90.5	11.8	66.3	2016
South Hadley, MA	17,763	15	86	60,427	9.8	92.3	15.3	66.3	2016
Southampton, MA	6,022	20	96	79,858	5.4	92.7	15.3	66.3	2016
Spencer, MA	5,578	21	89	45,750	16.9	80.6	17.2	51.7	2018
Stow, MA	6,957	27	92	137,551	4.5	99.3	11.8	66.3	2017
Sudbury, MA	18,397	30	87	165,745	1.6	98.6	11.8	66.3	2017
Sunderland, MA	3,680	12	80	47,688	21.2	92.7	15.0	64.2	2016
Templeton, MA	8,120	22	90	65,194	10.4	90.3	17.2	51.7	2016
Tewksbury, MA	30,115	21	93	90,484	4.8	93.9	11.8	66.3	2016
Townsend, MA	1,294	32	91	63,125	8.1	92.5	11.8	66.3	2016
Tyngsboro, MA	11,292	31	89	84,014	4.7	93.7	11.8	66.3	2016
Wakefield, MA	26,157	20	91	85,573	4.8	93.7	11.8	66.3	2016
Walpole, MA	5,881	24	95	79,615	1.1	93.9	11.8	61.2	2015
Wareham, MA	22,360	20	86	58,728	11.8	90.8	16.2	50.7	2016
Watertown, MA	33,350	17	76	87,409	8.5	94.0	11.8	66.3	2016
West Boylston, MA	7,834	14	83	68,673	8.5	88.7	17.2	51.7	2017
Westford, MA	23,232	29	81	121,591	3	97.4	11.8	66.3	2016
Whately, MA	1,391	18	96	73,229	3.6	95.3	15.0	64.2	2015
Williamstown, MA	4,437	13	76	73,667	10.4	93.0	14.5	67.5	2015
Winchendon, MA	3,369	18	93	38,564	19.9	84.8	17.2	51.7	2016
Winchester, MA	22,075	29	83	143,017	3.4	97.3	11.8	66.3	2015
Yarmouth, MA	23,581	15	92	57,569	7.5	93.9	11.9	54.0	2014

Appendix VII: Human Subjects Protection



1204 Marie Mount Hall
College Park, MD 20742-5125
TEL 301.405.4212
FAX 301.314.1475
irb@umd.edu
www.umresearch.umd.edu/IRB

DATE: May 1, 2017

TO: Cen Chen

FROM: University of Maryland College Park (UMCP) IRB

PROJECT TITLE: [1025243-1] Flavored E-Cigarette Use And Smoking Cessation Among Young Adult Cigarette Smokers in the U.S.

REFERENCE #:

SUBMISSION TYPE: New Project

ACTION: APPROVED

APPROVAL DATE: May 1, 2017

EXPIRATION DATE: April 30, 2018

REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # 7

Thank you for your submission of New Project materials for this project. The University of Maryland College Park (UMCP) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

Prior to submission to the IRB Office, this project received scientific review from the departmental IRB Liaison.

This submission has received Expedited Review based on the applicable federal regulations.

This project has been determined to be a Minimal Risk project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of April 30, 2018.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Unless a consent waiver or alteration has been approved, Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others (UPIRSOs) and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

Please note that all research records must be retained for a minimum of seven years after the completion of the project.

If you have any questions, please contact the IRB Office at 301-405-4212 or irb@umd.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Maryland College Park (UMCP) IRB's records.



UNIVERSITY OF MARYLAND

INSTITUTIONAL REVIEW BOARD

1204 Marie Mount Hall
College Park, MD 20742-5125
TEL 301.405.4212
FAX 301.314.1475
irb@umd.edu
www.umresearch.umd.edu/IRB

DATE: September 21, 2016

TO: Cen Chen, MPP

FROM: University of Maryland College Park (UMCP) IRB

PROJECT TITLE: [962503-1] Flavored E-cigarette Use Among Young Adult Cigarette Smokers-
A Secondary Data Analysis Study

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF NOT HUMAN SUBJECT RESEARCH

DECISION DATE: September 21, 2016

Thank you for your submission of New Project materials for this project. The University of Maryland College Park (UMCP) IRB has determined this project does not meet the definition of human subject research under the purview of the IRB according to federal regulations.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact the IRB Office at 301-405-4212 or irb@umd.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Maryland College Park (UMCP) IRB's records.



UNIVERSITY OF MARYLAND

INSTITUTIONAL REVIEW BOARD

1204 Marie Mount Hall
College Park, MD 20742-5125
TEL 301.405.4212
FAX 301.314.1475
irb@umd.edu
www.umresearch.umd.edu/IRB

DATE: December 15, 2017

TO: Cen Chen
FROM: University of Maryland College Park (UMCP) IRB

PROJECT TITLE: [1168830-1] Restricting the Sale of Flavored E-cigarettes in the U.S.— An Examination of Local Regulations

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF NOT HUMAN SUBJECT RESEARCH
DECISION DATE: December 15, 2017

Thank you for your submission of New Project materials for this project. The University of Maryland College Park (UMCP) IRB has determined this project does not meet the definition of human subject research under the purview of the IRB according to federal regulations.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact the IRB Office at 301-405-4212 or irb@umd.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Maryland College Park (UMCP) IRB's records.

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