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Effect of Electronic Cigarette Messages on Young-Adult Behavioral Dispositions Towards Use

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Effect of Electronic Cigarette Messages on Young-Adult Behavioral
Dispositions Towards Use

by

Idan Ariel

A dissertation submitted in partial fulfillment
Of the requirements for the degree of
Doctor of Philosophy in Psychology
Department of Psychology
With a concentration in Clinical Psychology
College of Arts and Sciences
University of South Florida

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DEDICATION

To my parents, Yoav and Raya Ariel, I could not have done this without your unwavering love and support. To my dear friend Ovadia Ezra, your courage is and will always be an inspiration.

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ABSTRACT

Over the last decade, electronic cigarettes (e-cigarettes) have emerged as novel and popular nicotine delivery devices. Although many smokers use e-cigarettes, evidence suggests these products are also growing in popularity among young adult non-smokers. It is therefore important to examine factors that may contribute to onset of electronic cigarette use among young adult non-smokers. Critics and supporters of electronic cigarettes have been disseminating anti and pro e-cigarette messages (respectively) and it is currently unclear what effect, if any, these messages exert on young adult non-smokers. Critics of electronic cigarettes advocate caution towards these products, while supporters of electronic cigarettes argue these products can serve as healthier replacements for conventional cigarettes. The present study sought to investigate the influence of caution and replacement messages on young adult non-smokers' dispositions towards future e-cigarette use. Two hundred and four young-adult non-smokers participated in a between subjects single session design where they viewed one of three possible audiovisual presentations (a caution message, replacement message or control message). After viewing the presentation, participants completed measures and tasks assessing their likelihood of future e-cigarette use, including willingness and intention to try e-cigarettes, as well as a measure of e-cigarette outcome expectancies. Results indicated the caution message decreased self-reported willingness to use e-cigarettes and was associated with higher negative and lower positive e-cigarette expectancies. The replacement message did not influence self-reported willingness and intention to use e-cigarettes but was associated with decreases in negative e-cigarette expectancies. These findings suggest that public health e-

cigarette messages could be developed to simultaneously advocate using e-cigarettes as a smoking alternative and caution against e-cigarette use for individuals not already dependent on nicotine.

INTRODUCTION

Cigarettes are the leading cause of preventable death in the world today and smoking has been consistently linked to the development of lung cancer, heart disease and other serious negative health effects (U.S. Department of Health and Human Services, 2014; Doll, Peto, Boreham & Sutherland, 2004). Due to cigarettes' addictive properties, many individuals continue using these products despite their negative effects on health. Indeed, cigarettes contain nicotine, a substance that induces physical dependence when consumed on a regular basis. In addition to the chemical dependence induced by nicotine, the physical act of smoking provides strong behavioral reinforcement for smokers, thereby helping maintain dependence (Shahan, Bickel, Madden & Badger, 1999).

Over the years, tobacco companies have tried marketing allegedly safer tobacco products (e.g. low-tar cigarettes, chewing tobacco), but research shows these products still elevate risk of cancer (Harris, Thun, Mondul & Calle, 2004; Hatsukami, Lemmonds & Tomar, 2004). In contrast, the pharmaceutical industry has successfully developed several safer nicotine replacement products (e.g. nicotine gum, patches), but these products have been largely under-utilized by smokers due to perceptions of high-cost and concerns regarding the products' safety and efficacy (Cummings & Hyland, 2005). In recent years, electronic cigarettes (e-cigarettes) have emerged as ostensibly safer cigarette alternatives that are generally well liked by smokers.

E-cigarettes are handheld electronic devices that deliver vaporized nicotine (rather than smoke). Users of e-cigarettes puff on the device and inhale vaporized nicotine, visually similar to smoke. These products are designed to closely mimic the

experience of smoking cigarettes. Indeed, e-cigarettes seem to be the first group of tobacco replacement products to replicate central elements of the behavioral aspect of smoking.

E-cigarettes work by vaporizing a solution of nicotine, propylene glycol, vegetable glycerin and flavourants. Because nicotine does not vaporize well by itself, propylene glycol is added to the mixture and serves as a carrier agent for the nicotine. The flavourants are added to increase the palatability of the product, because nicotine by itself is flavorless. E-cigarettes are available in many flavors, including both tobacco flavors and non-tobacco flavors such as vanilla, mint and berry. The availability of e-cigarettes in a wide variety of flavors likely adds to the popularity of these products, especially among younger populations (Kong, Morean, Cavallo et al., 2015).

At present, it is unclear whether e-cigarettes cause any of the serious health effects associated with conventional cigarette use, such as increased risk of cancer and heart disease. Research on e-cigarettes is still in its nascent stages and it will likely take several years before the long-term effects of these products are well understood. However, increasing numbers of researchers and public health advocates believe these products are far less dangerous than conventional cigarettes.

Indeed, Public Health England (a government agency dedicated to the improvement of England's national health) recently conducted an evidence-based review of e-cigarettes and concluded that using these products carried "a fraction of the risk" of using cigarettes. This agency recommended the development of e-cigarettes specifically for the purpose of smoking cessation, which could then be prescribed by the English public healthcare system (National Health Services) to help smokers quit (Health & Wellbeing Directorate, Public Health England, August 2015; Polosa, 2015).

In contrast, the U.S. Food and Drug Administration (FDA) recently deemed e-cigarettes as meeting the statutory definition of "tobacco products", making these

products subject to FDA regulations under the Federal Food, Drug and Cosmetic ACT (Food and Drug Administration, 2016). Although these regulations have not yet gone into effect, they are expected to greatly restrict the manufacturing, distribution and sales of e-cigarettes in the future.

Electronic cigarette popularity

Despite the relative lack of information regarding the safety of e-cigarettes, these products have gained great popularity. National sales rates reflect this popularity, as 2013 sales of all e-cigarette device types have shown substantial growth in comparison to previous years (Loomis, Rogers, King, et al., 2016) and were estimated at 1-1.7 billion dollars (Robehmed, 2013). An online survey conducted between 2011-2012 showed a rise in e-cigarette popularity, with awareness of the products' existence growing from 38.5% to 57.9% and ever-use rates growing from 3.3% to 6.2% (King, Alam, Promoff, Arrazola & Dube, 2013). Survey data collected during the following year (i.e. 2013) show continued growth in both rates of ever-use and current use, with 2013 rates of general population ever-use estimated at 13% and current-use (i.e. within the last 30 day period) estimated at 6.8% (Mcmillen, Gottlieb, Shaefer, Winickoff & Klein, 2015). Data from the 2014 Tobacco Products and Risk Perceptions Survey (conducted by the Georgia State University Tobacco Center of Regulatory Science; TCORS) indicate e-cigarette awareness has risen to 91.9%, e-cigarette ever-use has increased to 14.9% and past 30-day use was estimated at 4.9% (Weaver, Majeed, Pechacek, Nyman et al., 2016).

E-cigarette manufacturers claim that their products are intended for smokers seeking alternatives to cigarettes and data do suggest that smokers use these products at higher rates; A 2010-2011 survey of approximately 1,500 current and past smokers in the US indicated that almost 15% of surveyed individuals reported e-cigarette ever use and 3% reported current use (Adkison, O'Connor, Bansal-Travers et al., 2013). Survey data obtained during the latter half of 2014 shows even greater use by smokers, with

50% of current smokers indicating they have tried e-cigarettes and over 20% reporting current use. However, the same data indicated that 10% of current e-cigarette users in the survey were never-smokers (Weaver, Majeed, Pechacek, Nyman, Gregory and Eriksen, 2015), showing that a non-trivial portion of e-cigarette users began using these products without previously being regular cigarette users.

The fact that a small yet noteworthy subset of e-cigarette users are also never-smokers is particularly relevant to the young-adult population (i.e. adults aged 18-24), as 2013 survey data show that members of this age-group exhibit the largest rates of e-cigarette current-use (as compared to all surveyed age groups), with over 14% of young-adult respondents reporting current-use (Mcmillen, Gottlieb, Shaefer, Winickoff & Klein, 2015). Although e-cigarette use is far more common among smokers, ex-smokers and ever-smokers, several studies have documented consistent rates of e-cigarette experimentation by younger non-smokers. In a 2009 web survey of over 4,000 US college students, approximately 200 respondents reported ever use of e-cigarettes and 12% of these e-cigarette ever-users reported being never-smokers (Sutfin, McCoy, Morell, et al. 2013). In 2012, the CDC estimated that as many as 160,000 young never-smokers the United States have tried e-cigarettes (Corey, Wang, Johnson, et al., 2013). A more recent survey of college students in four U.S. universities, conducted in 2013, indicated approximately 10% of never-smokers reported previous e-cigarette use. Therefore, it appears that although e-cigarettes are used most frequently by smokers, there is also cause for concern that younger non-smokers are consistently experimenting with these products (Saddleson, Kozlowski, Giovino, Hawk, Murphy, MacLean et al., 2015).

Electronic cigarettes and young adults

The potential use of e-cigarettes by young-adult non-smokers is particularly concerning. Current evidence suggests e-cigarettes are less dangerous than

conventional cigarettes because at worst, the vapor they produce contains only a small fraction of the toxicants and carcinogens found in cigarette smoke (Hajek, Etter, Benowitz, Eissenberg, and McRobbie, 2014). Therefore, smokers who switch to e-cigarettes are replacing a dangerous behavior with a plausibly safer alternative. In contrast to current smokers, non-smokers who begin using e-cigarettes are not replacing a dangerous behavior. Rather, their use of e-cigarettes constitutes an initiation of recreational nicotine use and carries with it the risk of developing nicotine dependence. Onset of e-cigarette use in non-smokers therefore carries with it a larger degree of relative risk.

There is also reason for concern when it comes to young adults and potential substance use. It has been reliably demonstrated that young adults tend to engage in risky behaviors at a relatively high frequency (e.g. Steinberg, 2007; Deakin, Aitken, Robbins, & Sahakian, 2004; Chaubey, 1974) and that they possess traits associated with risk taking and substance abuse such as impulsivity and sensation seeking (Gardner & Steinberg, 2005; Harden & Tucker-Drob, 2011). Neuroimaging studies have shed additional light on these observations by showing that young adults do not display full development of prefrontal brain areas associated with planning and inhibition. The ability to plan and inhibit actions serves as a protective factor from drug abuse and risk taking and the lack of full development of relevant brain areas suggests that young adults are at greater risk for the development of addictive behaviors (Steinberg, 2008).

The evidence suggests young adult non-smokers are both more likely to engage in e-cigarette use (compared to the general population) and more likely to suffer negative consequences from such use (due to the higher degree of relative risk involved). For these reasons, young adult non-smokers should be considered a unique at-risk population for potential e-cigarette use. The current study focused on this population with the goal of examining factors influencing potential onset of e-cigarette

use. More specifically, the study examined how young adult non-smokers were affected by contrasting messages regarding e-cigarettes.

Messages regarding electronic cigarettes: Overview

As suggested by Duke et al. (2014), there is an increased need to develop evidence-based public health messages to educate youth and young adults regarding e-cigarettes. The authors examined rates of exposure to televised e-cigarette advertisements from 2011 to 2013 and found an increase of more than 300% in exposure of young adults to this type of content. Evidence of increased exposure to e-cigarette commercials is particularly concerning given recent data from an experimental study that showed exposure to e-cigarette advertisements increased intention to try e-cigarettes among younger e-cigarette never-users (Farrelly, Duke, Crankshaw, et al., 2015). Taken together, these findings highlight a pressing need for the study of the effects of e-cigarette messages on younger populations.

More specifically, it is necessary to explore the effects of exposure to different types of e-cigarette message content on young adult and adolescent's likelihood of future e-cigarette use. To date, only one such study has been published: Sanders-Jackson, Schleicher, Fortmann and Henriksen (2015) showed young adult participants pre-existing e-cigarette television commercials that had been modified to contain warning statements regarding e-cigarettes. The authors found that adding warnings to these commercials served to decrease participants' self-reported cravings and e-cigarette purchase intent.

The three studies described above all focused on e-cigarette messages within the context of advertisements for these products and are therefore somewhat limited in scope. Though these findings are highly informative, it is necessary to conduct additional research focused on examining the effects of public health-oriented e-cigarette messages so as to inform the creation of future prevention and intervention efforts. The

present study aimed to examine the effects of widely disseminated public-health oriented e-cigarette messages as a first step in this research direction.

E-cigarettes' rise to popularity has generated much public discussion. In broad terms, those speaking/writing on the topic tend to take a stance (either explicit or implied) for or against the use of e-cigarettes. Individuals participating in this ongoing discussion come from diverse backgrounds/professions (e.g., researchers, physicians, public health advocates, public figures and laymen). The platforms for the e-cigarette debate are as diverse as the participants, and opinions/reports of e-cigarettes are widely disseminated across a variety of communication channels such as television shows, internet videos, websites and newspaper and magazine articles. Indeed, one analysis of adolescents' routes of contact with e-cigarettes showed that adolescent participants learned of e-cigarettes from a variety of sources, including the internet, books, television and friends (Ho, Shin & Moon, 2011).

Many print/written news agencies have been publishing articles warning against e-cigarettes. Prominent examples can be seen in several suggestively titled pieces in the New York Times such as "selling poison by the barrel" (Richtel, 2014) and "A Bolder Effort by Big Tobacco on E-cigarettes" (Richtel, 2014). On the other side of the debate, the well-known international magazine "The Economist" has published several articles in support of e-cigarettes (e.g. Call it quits: E-cigarettes really do help smokers give up the demon weed, 2014; No smoke. Why the fire?, 2013).

Messages regarding e-cigarettes have also proliferated into television broadcasts. For example, on separate appearances, popular television personalities Rachael Ray and Dr. Mehmet Oz conveyed disdain and suspicion of e-cigarettes (Annino, 2010; Fox 29 News, 2014, respectively). However, other television programs have presented e-cigarettes in a more positive light. For example, e-cigarettes were featured on the list of "top 10 health trends of 2009" the CBS show "The Doctors"

(McGraw, 2009) and actress Katherine Heigl spoke of the virtues of e-cigarettes during an appearance on the “Late Show with David Letterman” (Morton, Lassally, Burnett & Gaines, 2010).

In addition, much of the e-cigarette debate has taken place on the internet and it appears that a substantial portion of individuals who are aware of e-cigarettes learned about the existence of these products through the internet (e.g. Ho, Shin and Moon, 2011; McQueen, Tower & Sumner, 2011). For example, several researchers have devoted blogs to advocating their position on e-cigarettes (blogs endorsing use of e-cigarettes as cigarette replacements: Farsalinos, 2013-present; Seigel 2005-present; blogs cautioning against use of e-cigarettes: Glantz, 2010-present). In addition, other groups have created more thorough descriptions of their positions, like the New-Jersey Global Advisors Smokefree Policy organization, which published an extensive “white paper” detailing the health risks of e-cigarettes (2014).

Online criticism and support of e-cigarettes can also be seen in the form of videos uploaded to Youtube (or similar websites). The popular website “Buzzfeed” published a video slideshow titled “17 facts about e-cigarettes that might surprise you”, where they present many of the views frequently cited by critics of e-cigarettes. But many other internet videos endorse the opposite view. One popular trend is for self-reported ex-smokers to post videos explaining the virtues of e-cigarettes and documenting their process of quitting cigarettes.

Overall, both sides are making great efforts to communicate their messages to the general population. Although some messages about e-cigarettes are only relevant to specific segments of the population (e.g. messages in favor of e-cigarettes as quit-aids are most relevant to current smokers), the broad dissemination of these messages likely reaches diverse populations, including both smokers and non-smokers. Furthermore, there is ample reason to suspect that exposure to such messages can affect onset of e-

cigarette use. For example, research has shown that smoking initiation positively correlates with exposure to cigarette advertisements (Capella, Webster & Kindard, 2011) and negatively correlates with exposure to anti-smoking advertisements (Wakefield, Flay, Nichter & Giovino, 2003). It is therefore necessary to determine whether messages regarding e-cigarettes affect young-adult non-smokers' disposition towards e-cigarettes. The present study will examine the effects of typical pro and anti e-cigarette messages on young adult non-smokers' perception of these products as well as their willingness and intention to use e-cigarettes in the future.

Messages regarding electronic cigarettes: Caution and replacement messages

Although messages regarding e-cigarettes vary in specific content, two message themes seem to recur consistently. The messages criticizing e-cigarettes usually take a cautionary tone, emphasizing potential risk and encouraging both smokers and non-smokers to avoid using e-cigarettes. In contrast, messages in favor of e-cigarettes tend to follow a replacement theme, where e-cigarettes are presented as viable and healthier alternatives for conventional cigarettes and are therefore recommended primarily for smokers.

The current study was intended as an initial step towards determining the effects of e-cigarette caution and replacement messages on young adult non-smokers. To this end, young adult non-smokers were recruited and exposed to caution, replacement, or control messages (containing only factual information regarding e-cigarettes) in a between-subjects design that sought to examine message effects on several relevant variables. To enable examination of message effects in a controlled manner, short (approximately 5 minutes) audiovisual slide presentations were created for each message type. Presentations for the caution and replacement messages were created based on the contents of messages disseminated by advocates on both sides of the debate. Both replacement and caution-oriented messages usually address two central

issues: The safety of e-cigarettes and the efficacy of these products as smoking cessation and/or harm reduction products.

Safety of electronic cigarettes

Proponents of cautionary messages warn that not enough is known about the safety of e-cigarettes and assert that consumers should abstain from these products until they are unequivocally established as safe (e.g. Yamin, Bitton & Bates, 2010). More specifically, they warn that propylene glycol has not been determined as safe for prolonged daily inhalation and that it may be toxic when inhaled (Henningfield & Zaatari, 2010). Furthermore, they warn of the inherent risk in using products containing a substance as strongly addictive as nicotine (Cobb & Abrams, 2011).

According to this view, claims that e-cigarettes are safer than combustible cigarettes are unsubstantiated, and should not be endorsed (Pearson, Richardson, Niaura, Vallone & Abrams, 2012). Moreover, those who endorse a cautionary approach express alarm that misinformation about the safety of e-cigarettes is spreading through the population, despite the absence of evidence establishing these products as safe (Choi & Forster, 2013).

Supporters of the replacement message counter that although there is still a need for further research, there is no indication of harmful effects from exposure to the standard chemicals found in these products (Polosa et al., 2013). These claims are bolstered by findings that nicotine itself, while addictive, has little to no negative long-term effects (Benowitz 1998). Furthermore, supporters of the replacement message argue that concerns regarding inhalation of propylene glycol are not warranted given findings on the effects of this chemical (Wagener, Siegel & Borrelli, 2012). Overall, supporters of the replacement message suggest that e-cigarettes are in all likelihood safer than conventional cigarettes (e.g. Cahn & Siegel, 2011).

Efficacy of electronic cigarettes as cessation tools

The two opinion camps also disagree regarding the value of e-cigarettes as smoking cessation or harm reduction tools. Proponents of the caution message claim there is little evidence for the efficacy of e-cigarettes as cessation tools (Yamin, Bitton & Bates, 2010). Some even predict e-cigarettes will not prove useful for smoking cessation and assert that smokers should avoid these products and instead use pharmaceutical nicotine replacement products that are deemed safe and effective for this purpose (Cobb & Abrams, 2011).

Advocates of cautionary messages warn of dual use, where individuals use both e-cigarettes and conventional cigarettes, and suggest that this pattern of use may have a negative impact on cessation (Pearson, Richardson, Niaura, Vallone & Abrams, 2012). These claims are partially supported by survey findings that certain populations of e-cigarette users practice dual use without intending to quit smoking cigarettes (Sutfin, McCoy, Morrell, Hoepfner & Wolfson, 2013). One of the chief concerns regarding dual use is that e-cigarettes are used as “bridge products” (i.e. products that can be used where conventional cigarettes cannot) that effectively help smokers maintain their addiction. Therefore, those who caution against these products view e-cigarettes as harmful to smoking cessation efforts (Yamin, Bitton & Bates, 2010; Cobb & Abrams, 2011).

In contrast, replacement advocates cite survey data to suggest that most e-cigarette users are indeed using these products to quit smoking (Etter & Bullen, 2011; Dockrell, Morrison, Bauld, & McNeill, 2013). Furthermore, they believe that e-cigarette use is a viable harm reduction technique (Britton & Bogdanovica, 2013) and that e-cigarettes can be as useful for harm reduction as other approved nicotine replacement products (Palazzolo, 2013). Indeed, the only randomized clinical trial to date that

examined the efficacy of e-cigarettes in smokers wishing to quit found that e-cigarettes were as effective as nicotine patches (Bullen et al. 2013).

Supporters of the replacement message explain there is a need for nicotine replacement products that are liked by smokers since smokers often report that conventional nicotine replacement products are not rewarding, are often ineffective and produce unpleasant side-effects (Caldwell, Sumner & Crane, 2012). For these reasons, replacement advocates believe that e-cigarettes are viable candidates for smoking cessation (Fagerström & Bridgeman, 2014).

Supporters of the caution and replacement messages make highly contrasting claims regarding the risks and benefits of e-cigarette use and exposure to these messages likely exerts some influence on future e-cigarette use. Indeed, a large literature has shown that exposure to messages can influence both behavior and disposition towards a behavior (e.g. outcome expectancies, attitudes, motives etc.) (See Latimer, Brawley & Bassett, 2010). It is therefore important to study the effects of these messages to understand what role they may play in the emergence of e-cigarette use among young-adult non-smokers.

Assessment of message effects

This study examined the effects of commonly distributed e-cigarette messages on young-adult non-smokers who have never tried e-cigarettes. Actual use of e-cigarettes was not studied directly due to ethical concerns regarding introducing members of the target population to e-cigarette use (which is potentially addictive). In lieu of direct assessment of the behavior of interest, the study investigated the effect of messages on the estimated likelihood of performing the behavior in the future. To that end, the study examined several variables that likely mediate onset of e-cigarette use.

Variables were selected based on potential value as indicators of future behavior. Elements from two pertinent theories of behavior were utilized to help with identification

of relevant variables (The Theory of Reasoned Action: Ajzen & Fishbein, 1980; The Prototype-Willingness Model: Gibbons, Gerrard, Blanton & Russell, 1998). Selection of additional variables was informed by research findings in related fields.

Primary dependent variables: Intention and willingness

The Theory of Reasoned Action (TRA; Ajzen & Fishbein, 1980) holds that intention to perform a given behavior strongly influences the likelihood an individual will perform it. Several meta-analyses have examined the relationship between specific intentions and behavior (e.g. condom use), and found them to be reliably correlated (e.g. Armitage & Connor, 2000; Sheeran, Abraham & Orbell, 1999; Albarracín, Johnson, Fishbein & Muellerleile, 2001). Indeed, a 2002 meta-analysis of ten meta-analysis papers reviewed the relationship between a variety of intentions and behaviors in over 400 studies and found that intention accounted for an average of 28% of variance in behavior (Sheeran 2002). Although some researchers have suggested that intention may not be as centrally important to behavior as originally proposed by Ajzen and Fishbein (Vitória, Salgueiro, Silva & de Vries, 2011), the work cited above clearly shows a consistent association between intention and future behavior. This relationship between intention and future behavior is further supported by the findings of a 2006 meta-analysis, which showed that inducing change in intention results in change in behavior (Webb & Sheeran, 2006). Therefore, intention was selected to serve as one likely predictor of future behavior.

The study also incorporated elements from the Prototype-Willingness Model (PWM; Gibbons, Gerrard, Blanton, & Russell, 1998), a model designed to supplement Ajzen and Fishbein's TRA. The PWM conceptualizes many behaviors as resulting from an individual's willingness to perform a behavior, rather than their explicit intent to do so. Holding an intention to perform a given behavior is tantamount to deciding to engage in said behavior, whereas being willing to perform the behavior denotes a more general

inclination towards the behavior without necessarily deciding to perform it. The construct of willingness is therefore better suited for predicting reactive behaviors, i.e. behaviors performed in response to a specific situation (in contrast to behaviors performed because the individual has previously decided to do so).

The distinction between reactive and pre-meditated behaviors depends on the circumstances surrounding performance of the behavior, rather than the nature of the behavior itself. An individual's first-time use of an e-cigarette could constitute either a pre-planned behavior (if the individual had previously decided to try an e-cigarette) or a reactive behavior (if the individual had not previously decided to try an e-cigarette but instead was first given the opportunity to try it and subsequently decided to do so). The assessment of Willingness was included in this study to detect dispositions towards potential reactive e-cigarette use, because reactive behavior is not strongly influenced by intent (Gibbons, Gerrard, Blanton, & Russell, 1998; Webb & Sheeran, 2006).

Implicit measurement

Although explicit assessment of willingness and intention should predict onset of e-cigarette use, self-report can be unreliable due to experimental demand (Fazio, Jackson, Dunton & Williams, 1995). More importantly, some of the factors influencing behavior might not be accessible through explicit assessment. To address this issue, many researchers use more implicit measures. Indeed, a meta-analysis on studies that conducted implicit and explicit assessments of alcohol expectancies has found implicitly assessed expectancies accounted for unique variance in drinking behavior (Reich, Below & Goldman, 2010). To indirectly assess disposition towards e-cigarette use, the present study employed a paper-format variant of the Implicit Association Test (IAT; Greenwald, McGhee & Schwartz, 1998; Lemm, Lane & Sattler et al., 2008).

Behavioral assessment of willingness

A behavioral measure of disposition towards e-cigarettes was also included as a

relevant outcome in the present study. Because direct assessment of e-cigarette use was not possible due to ethical concerns, the study assessed a proxy behavior that may be indicative of willingness to use e-cigarettes without necessitating direct contact with such products. The proxy behavior selected for this study was participants' agreement (or disagreement) to sign up for a future study that involved receiving an e-cigarette for at-home use, as that behavior could ostensibly suggest behavioral manifestations of willingness to try e-cigarettes.

Additional relevant constructs

E-cigarette outcome expectancies were also assessed to more thoroughly characterize disposition towards e-cigarettes. Outcome expectancies refer to specific consequences that one believes will result from the performance of a specific behavior (e.g. "smoking will make me look cool"). Outcome expectancies have been established as important determinants of substance use behavior (e.g. Jaffe & Kilbey, 1994; Wetter et al., 1994; Wood, Sher & Strathman, 1996) and should therefore provide important information regarding the effects of caution and replacement messages regarding e-cigarettes.

Individual differences

Disposition towards e-cigarettes is likely also influenced by certain individual variables. A specific personality trait, sensation seeking, may be related to greater likelihood of intending to or being willing to use e-cigarettes. Sensation seeking can be defined as the drive to seek out new and exciting experiences, and it has been strongly associated with smoking behaviors in younger populations (e.g. Harmsen, Bischof, Brooks, Hohagen & Rumpf, 2006; Balevich, Wein & Flory, 2013). Sensation seeking may therefore influence how messages regarding e-cigarettes are perceived.

Message effects may also be influenced by individual difference in rebelliousness. Rebelliousness describes the inclination to act in a way that defies the

requirements set by an external agency (McDermott, 1988). Individuals with such rebellious tendencies are prone towards resisting doing what is required or suggested of them in the absence of external motivation to do so. In other words, defiant behavior is more of an ends than a means for these individuals. A high degree of rebelliousness may lead participants to purposefully ignore message content. Therefore, the present study assessed rebelliousness as a potential personality factor that could influence message affects.

Additional individual variables may influence participants' responses to the messages in the study. One such variable is the "need for cognition", a construct that describes a predisposition towards engaging in effortful cognitive activity (Cacioppo et al. 1996). An earlier definition of the construct describes it as a need to understand one's experiences in a structured, meaningful and reasonable manner (Cohen, Stotland & Wolfe, 1955). The two definitions compliment each other and describe a general type of a cognitive style. Individuals high in need for cognition tend to respond more favorably to logically sound arguments (e.g. Brett, Lang & Wong, 2004) while individuals low on need for cognition are more susceptible to persuasion methods less dependent on logic or strength of argument (e.g. source credibility: Kaufman, Stasson & Hart, 1999; Use of humor: Zhang, 1996).

Because there is currently little evidence regarding both the risks and benefits of e-cigarettes, messages endorsing or opposing e-cigarettes have limited facts from which to draw their arguments. Therefore, both the arguments for and against e-cigarettes are relatively weak. It stands to reason that individuals high in need for cognition would be more likely to critically evaluate the rationale behind the messages. Accordingly, the caution and replacement messages may have a reduced effect on individuals high in need for cognition.

In addition to personality traits, individuals' personal history may also influence likelihood of future e-cigarette use. Exposure to and familiarity with cigarettes is known to correlate with smoking behavior (e.g. Titus-Ernstoff et al. 2008, Hill et al. 2005). Due to their similarity to cigarettes, it is tenable that familiarity with e-cigarettes may increase likelihood of intention or willingness to try e-cigarettes in the future. In addition, past experience smoking cigarettes or consuming other products containing nicotine may predict intention or willingness to try e-cigarettes. Although this study recruited only non-smokers who have never been regular nicotine users, individuals with minimal tobacco/nicotine use history were permitted to enroll in this study. The inclusion of these individuals enabled examination of the degree to which past occasional nicotine use moderated the effects of the caution and replacement messages on participants' willingness and intention to use e-cigarettes in the future.

Evaluation of Messages Used in Study

This study involved the creation of audiovisual slideshow presentations for the purpose of examining the effects of different e-cigarette message types on young-adult non-smokers. The slideshow presentations were created based on pre-existing caution and replacement messages widely disseminated by critics and supporters of e-cigarettes, respectively. The presentations were not tailored to the study's population, rather, they were made to reflect the general themes emerging from common caution and replacement messages (since these messages are widely distributed and likely reach young adult non-smokers regardless of the intended target population).

Because this is the first study to directly evaluate e-cigarette caution and replacement messages, the prospective effects of message exposure were largely unknown. For this reason it was decided to assess participants' subjective experience of viewing each message. To that end, study sessions concluded with an evaluation of participants' subjective viewing experience consisting of both a close-ended self-report

questionnaire and an open-ended questionnaire exploring participants' impression of the presentation they viewed. This evaluation procedure was designed to allow for interpretation of null or unexpected manipulation effects as well as general evaluation of the strengths and weaknesses of the presentations.

Study goal and significance

This study explored the effects of caution and replacement messages regarding e-cigarettes on young-adult non-smokers in a single session between-subjects design. This was the first carefully controlled experimental study of caution and replacement oriented messages regarding e-cigarettes. Therefore, this study focused on a basic aspect of these messages' influence — their acute effects. Acute message effects may be distinct from the effects of ongoing message exposure (i.e. the type of message exposure that individuals encounter in their daily lives); however, the two types of effects are conceptually related. The exploration of acute message effects has been frequently used to investigate different aspects of message creation, including framing (Goodall & Appiah, 2008; Moorman & van den Putte, 2008) tailoring (York, Brannon & Miller, 2012) and use of auditory and visual modalities (Schneider et al., 2001; Mannetti et al., 2010). Therefore, the examination of acute message effects in this study is conceptualized as a necessary first step in understanding the effects of ongoing message exposure in the “real world”.

Because relatively little is known about the long-term effects of e-cigarettes, both the caution and replacement messages lack the evidence necessary to make strong and undeniable claims. This lack of strongly compelling rationale casts doubt on whether or not either message is convincing enough to influence individuals' opinion, especially within the context of an acute single-exposure study model. The present study sought to establish the acute effects of these messages and determine whether (and to what degree) message exposure led to both intended and unintended effects.

Ostensibly, the lack of evidence to support message claims is a temporary issue, as more and more research is being aimed at determining whether e-cigarettes are safe for long-term use and effective for smoking cessation. But despite the exponential increase in e-cigarette research over the past several years, the issue of e-cigarettes' safety and efficacy has yet to be resolved and remains a hotly debated issue. Both critics and supporters of e-cigarettes will likely be slow to accept findings contradictory to their positions and in all likelihood, unequivocal evidence will be required before a general consensus regarding the risks and benefits of e-cigarettes can be reached. The production of such evidence will require multiple large-scale longitudinal studies and clinical trials with strong and clear findings. This process may take several years and in the meanwhile, active dissemination of caution and replacement messages can be expected to continue.

It is important to establish the effects of the caution and replacement messages in order to understand what role they may be playing in shaping attitudes towards e-cigarettes. As efforts to disseminate these messages develop, it is necessary to establish whether they achieve their intended effects and whether they exert any unintended effects. Once the public health community reaches a general agreement on a stance towards e-cigarettes, findings from this line of research will be necessary to inform intervention efforts (either to encourage smokers to switch to e-cigarettes or discourage the general population from using these products).

One possible future use for findings from this study could be to inform the creation of replacement messages for wide dissemination. If the public health community decides to promote e-cigarette use as an alternative to smoking, it would be necessary to develop messages that encourage e-cigarette use among smokers without encouraging it among non-smokers. Studies pursuing this line of research would then be needed to inform the message construction process.

Aims and hypotheses

The general aim of this study was to examine the effects of contrasting messages regarding e-cigarettes on young adult non-smokers. Findings should inform public health policy and future health communication efforts regarding dissemination of messages about e-cigarettes. More specifically, the aims of this study were as follows:

Aim 1 (primary): To determine the effect of cautionary and replacement messages on young-adult non-smokers' intent and willingness to use e-cigarettes, as well as other variables relevant to future use.

Hypothesis 1a (principal): Caution condition participants will endorse lower scores on explicit measures of intent and willingness to use e-cigarettes while replacement condition participants will endorse higher scores on explicitly assessed willingness (but not intention) to use e-cigarettes.

Hypothesis 1b (auxiliary): Replacement and caution condition participants will show stronger positive and negative dispositions towards e-cigarettes, respectively, as assessed by the paper-format IAT.

Hypothesis 1c (auxiliary): Participants exposed to the replacement and caution messages will be more and less likely to show disposition towards trying e-cigarettes on the behavioral willingness task, respectively (i.e. agree to be contacted for participation in a future study involving e-cigarette use).

Hypothesis 1d (auxiliary): Caution condition participants will report stronger negative expectancies regarding e-cigarettes while replacement condition participants will report stronger positive expectancies regarding e-cigarettes.

Aim 2 (exploratory): To investigate whether individual difference variables influence willingness and intention to use e-cigarettes either directly or through moderation of the effects of the caution and/or replacement messages.

Hypothesis 2a: Past exposure to e-cigarettes will predict higher willingness and intention to use e-cigarettes. Past exposure will also interact with condition and produce higher willingness and intention ratings among replacement condition participants who have experienced relatively greater exposure to e-cigarettes.

Hypothesis 2b: History of nicotine use will predict higher willingness and intention to use e-cigarettes. History of nicotine use will also interact with condition such that replacement condition participants with a history of nicotine use will produce higher willingness and intention ratings.

Hypothesis 2c: Sensation seeking will predict ratings of willingness and intention to use e-cigarettes, such that individuals high on sensation seeking will provide higher ratings of willingness and intent. Degree of sensation seeking will also interact with condition, so that individuals high on sensation seeking will display higher rates of willingness and intent when exposed to the replacement condition while individuals low on sensation seeking will display lower willingness and intent when exposed to the caution condition.

Hypothesis 2d: Message exposure effects will be attenuated by individual participants' need for cognition, such that the manipulation effects predicted in hypothesis 1a will show smaller effect sizes for individuals high in Need for Cognition and larger effect sizes for individuals lower in Need for Cognition.

Hypothesis 2e: The manipulation will be less effective for individuals high in rebelliousness, such that the manipulation effects predicted in hypothesis 1a will show smaller effect sizes for individuals high in rebelliousness.

Aim 3 (exploratory): To investigate the relationship between explicit, implicit and behavioral assessment of likelihood of future e-cigarette use.

Hypothesis 3: Explicitly assessed willingness and intent to use e-cigarettes, implicitly assessed approach attitudes towards e-cigarettes and responses on the

behavioral willingness task will all show low-moderate positive correlations with one another. These measures will also show low-moderate negative correlations with implicitly assessed avoidance attitudes.

Aim 4 (exploratory): To inform future development of e-cigarette health intervention messages by evaluating participants' subjective impression of the presentations, using both quantitative and qualitative measures.

METHODS

Sample size

Sample size was determined with the goal of powering the study to detect effects for hypothesis 1a, the principal hypothesis of the primary aim (i.e. that compared to control condition participants, caution condition participants will endorse lower scores on explicit measures of intention and willingness while replacement condition participants will endorse higher scores on explicitly assessed willingness). Because of the lack of previous research on the topic and because of the range of outcomes that were examined, the anticipated effect size could not be estimated with confidence. Furthermore, prior studies that have examined the effects of different messages on intent/willingness to smoke cigarettes usually compared different message elements to one another (e.g. Gain and loss framing: Cornacchione & Smith, 2012; Use of different picture types: Verhiac, Chappé & Meyer, 2011), rather than compare effects of message to a control condition.

In lieu of established effect sizes for this research topic and manipulation type, it was decided to recruit a number of participants sufficient to detect a medium sized effect for the study's primary hypothesis (hypothesis 1a), as smaller effects would not be theoretically noteworthy or practically useful. To examine hypothesis 1a, separate ANCOVAs will be run to examine manipulation effects on each of the two dependent variables (willingness and intention), with pre-message ratings for each measure as covariates. The study's target sample size was set for one hundred and eighty-nine

participants (n=63 per group), so as to power the study to detect a medium effect size in two separate analyses ($f=.25$ at $\alpha=.025$, $(1-\beta)=.8$).

Participants

Participants were undergraduate students between the ages of 18 to 24. Individuals were allowed to enroll in the study only after completing an online survey and indicating: a) Never using an electronic-cigarette; b) having used other nicotine products less than 100 times in their lives; c) denying use of any nicotine product within 30 days of completing the survey; and d) denying ever having a period of a week or more where they used a nicotine product at least once a day.

Three hundred and twenty-seven participants were recruited for this study. The majority of participants were recruited from undergraduate classes and completed the pre-study screening survey through the USF SONA system (N=320). Seven participants were recruited independently of SONA and paid \$25 for their participation; these participants completed the pre-study screening survey through an online survey hosting website (surveymonkey.com).

Of the 327 individuals who were recruited into the study, 123 were disqualified. One hundred and nine participants were disqualified due to reports of past e-cigarette use and 14 participants were disqualified due to reports of more than 100 lifetime uses or recent use of nicotine products (i.e. within the last month) and/or reporting having had a period of a week or more where they used nicotine products everyday. A total of 204 eligible participants (approximately 75% females) completed the study and participated in one of three conditions: Replacement message (N=68, 55 females); Caution message (N=71, 53 females); and Control message (N=65, 47 females).

Measures

Pre-manipulation measures

Carbon monoxide screening: To confirm non-smoking status, a carbon monoxide (CO) screening was administered to participants at the start of the study. As per the recommendation of the Society for Nicotine and Tobacco Research (SRNT), a cut off level of 8 ppm was used to confirm non-smoker status (Benowitz et al., 2002).

Demographic questionnaire: A demographic questionnaire was used to record participant age, gender, race/ethnicity and year in college (See Appendix A).

Brief Sensation Seeking Scale (BSSS): The BSSS (Hoyle et al., 2002) is a short uni-dimensional measure of sensation seeking based on the Sensation Seeking Scale V (SSS-V; Zuckerman, 1994). The SSS-V and BSSS have different factor structures (the SSS-V contains four subscales while the BSSS is uni-dimensional). However, the BSSS does evaluate the main constructs in the SSS-V through the use of four item pairs reflecting each of the four SSS-V subscales: Experience Seeking, Boredom Susceptibility, Thrill and Adventure Seeking, and Disinhibition. The BSSS has been successfully used to predict onset of marijuana use among adolescents (Hoyle et al., 2002). In older samples (18-30), the BSSS has shown correlations with smoking intentions, lifetime cigarette use and frequency and quantity of alcohol consumption (Stephenson, et al. 2007). Participants were asked to report whether they agree or disagree with the statements made in each of the eight items. Items were coded as either “1” for “disagree” or “2” for “agree”, thereby producing a total score ranging from 8-16, with higher scores reflecting a greater degree of sensation seeking (See Appendix B).

Exposure to Electronic cigarettes: Only one prior study has assessed individuals' degree of exposure to e-cigarette use by others. To assess exposure to/familiarity with e-cigarettes, a 4-item e-cigarette exposure measure was administered. Items in this

measure included a modification of an item used by Pepper, Reiter, McRee et al. (2013; “Have you ever seen someone using an e-cigarette?”) as well as three original items: 1. How many times have you seen someone using an e-cigarette?; 2. How many times have you seen commercials for e-cigarettes on tv, on the internet or anywhere else?; 3. How many of your friends use e-cigarettes?; and 4. How many of your close relatives (parents, siblings etc.) use e-cigarettes? (See Appendix C).

History of Nicotine Use: Participants were asked to report on their past experiences using the following types of nicotine products: 1) cigarettes, 2) electronic-cigarettes/e-hookahs/vape-pens, 3) cigars/cigarillos/filtered cigars/tobacco pipes, 4) hookah, 5) snus pouches/dissolvable tobacco/chewing tobacco/snuff, and 6) nicotine patches/nicotine gum/nicotine inhaler/nicotine nasal spray/nicotine lozenge. Participants were asked to estimate how many times they’ve used nicotine products from each of the six categories, with the following response options given: 0, 1, 2-5, 6-10, 11-20, 21-50, 51-99 and 100 or more times. Two additional questions were asked for each of the six types of nicotine products: “have you used any of these products in the past 30 days?” and “has there ever been a time when you used any of these products every day of the week, for an entire week?” (See Appendix D).

Need for Cognition: The Need for Cognition Scale (NCS; Cacioppo, Petty & Kao 1984) is an 18-item uni-dimensional measure assessing the degree to which individuals are drawn towards effortful cognitive activity. Items on the NCS are rated on a 1 to 5 scale (“strongly disagree” to “strongly agree”) and can be summed together to produce a total score ranging from 18 to 90. Scores on the NCS are associated with different tendencies towards processing information, with individuals high in need for cognition requiring strong logical arguments to be convinced of a given point or (Brett, Lang & Wong, 2004; see Appendix E).

Rebelliousness: The Proactive Negativism subscale of the Negativism-Dominance Scale (NDS; McDermott, 1988a) was administered to assess trait-like rebelliousness. The NDS was validated in samples of high school students in both the United Kingdom and the United States (McDermott, 1988b). The Proactive Negativism subscale of the NDS is a 7-item self-report measure that assesses degree of gratuitous rebellious behavior (e.g. “If you are asked particularly not to do something, do you feel an urge to do it?”). For each item, participants were asked to endorse one of three responses: “no, hardly ever” (coded as 1); “not sure” (coded as 2); and “yes, often” (coded as 3). Coded responses were summed to create a total score ranging from 7 to 21, with higher scores reflecting a greater degree of rebelliousness (See Appendix F).

Primary dependent variables

Intention to use electronic cigarettes: A 3-item measure assessing intention to use electronic cigarettes was created for this study. Two of the three items were modified from Vitoria et al.’s assessment of intentions to smoke (2011): “Do you intend to use e-cigarettes in the future?” and “Do you intend to use e-cigarettes in the next year?” A third reverse-scored item was added to assess specific avoidance intention (“Do you intend to avoid using e-cigarettes?”). Participants rated each of the three items on a 5-point Likert-type scale (ranging from 1-“definitely no” to 5-“definitely yes”), with the intention of creating a total score ranging from 3-15, with higher scores reflecting greater degrees of intention to use e-cigarettes in the future (see Appendix G).

Willingness to use electronic cigarettes: A 4-item measure of willingness to use e-cigarettes (i.e. receptiveness to the notion of potentially trying e-cigarettes under the right circumstances) was created for this study. Questions 1-3 on this measure asked participants to imagine three scenarios where they are offered an e-cigarette and report on the perceived likelihood that they would accept the offer: 1) Suppose you were with a close friend and they offered you to try their e-cigarette, would you accept? (modified

from Gibbons et al., 1998), 2) Suppose you were at a party or a concert with a group of friends, and someone offered you to try their e-cigarette, would you try it? 3) Suppose you were at a gas station, and the clerk told you they were giving free samples of e-cigarettes as a promotional offer, would you accept a free e-cigarette? The fourth item on this measure asked participants to estimate their willingness to try an e-cigarette in general (“Do you think you might be willing to try electronic cigarettes, under the right circumstances?”)

Participants rated each of the four items on a 5-point Likert-type scale (ranging from 1-“definitely no” to 5-“definitely yes”), to create a total score ranging from 4-20, with higher scores reflecting a greater degree of willingness to use e-cigarettes in the future (see Appendix H).

Post-manipulation measures

Electronic cigarette outcome expectancies: A measure designed to evaluate electronic cigarette outcome expectancies among smoking and non-smoking college students (Pokhrel, Little, Fagan et al., 2014) was used to assess message effects on e-cigarette expectancies. Pokhrel et al. report two of the measure’s subscales (Social enhancement and Affect regulation) predict intention to use e-cigarettes and one subscale (Negative health consequences) predicts willingness to use e-cigarettes. However, all seven subscales of this measure were administered in the present study, including: Social enhancement (12 items, $\alpha=.94$); Affect regulation (7 items, $\alpha=.94$); Negative health consequences (4 items, $\alpha=.94$); Addiction concern (3 items, $\alpha=.87$); Positive sensory experience (3 items, $\alpha=.91$); Negative sensory experience (3 items, $\alpha=.93$); and Negative appearance (2 items, $\alpha=.77$). Items were rated from 1-unlikely to 10-likely (See Appendix I).

Implicit Association Test (IAT): A paper format IAT task was used to indirectly assess approach and avoidance attitudes towards e-cigarettes in a group setting. The paper IAT differs from the computer-based IAT in what is specifically measured (the computerized IAT measures response latencies while the paper IAT measures number of correct responses within a limited time-frame). However, both IATs operate under the same principle: Requiring participant to use only two response options to classify stimuli from four conceptually distinct categories. The paper-format IAT has been successfully used to indirectly evaluate attitudes towards race (e.g. Lowery, Harding & Sinclair, 2001) and body weight (e.g. Teachman & Brownell, 2001) and has been shown to have good test-retest reliability and correlate well with computer-administered IAT results (Lemm, Lane, Sattler, et al., 2008).

The administration of the paper IAT consists of two trials. In the first trial, participants view a list of words, with each word belonging to one of four categories. Participants are asked to select the appropriate category for each word by marking a circle either on the left or the right of the word (left and right responses each correspond with two of the four categories). In the subsequent trial, the order of two of the category words is switched and participants are then asked to categorize the same words again in accordance with the new category arrangement. The central idea behind the IAT is that when closely associated categories share a response option, the task will be easier to complete, leading to better performance. Therefore, greater rates of accurate responses in one of the trials is taken as an indication of stronger association between the category pairings for that trial.

Participants in this study first completed a practice paper IAT where they were asked to classify words into four categories (Avoid, Approach, Flower and Insect) in two trials.

After having practiced the process of completing the paper IAT, participants completed an e-cigarette IAT. The e-cigarette paper IAT required participants to classify

each word into one of the following categories: Cigarette (e.g. tobacco, flame, smoke), e-cigarette (e.g. e-liquid, battery, vapor), approach (e.g. forward, advance, etc.) and avoid (e.g., away, withdraw, etc.). The first trial paired “e-cigarette” words and “approach” words under the left response option and “cigarette” words and “avoid” words under the right response option. The category organization was switched for the second trial, such that “cigarette” words and “approach” words were paired under the left response option and “e-cigarette” words and “avoid” words were paired under the right response option. In this manner, the paper IAT used in this study was designed to allow for comparison between e-cigarette/approach and cigarette/approach attitudes as well as cigarette/avoid and e-cigarette/avoid attitudes (See Appendix J).

Message Rating Questionnaire: An original 11-item self-report measure was created to assess participants’ impression of the message they viewed. This measure was created based on video evaluation questions asked by Majid et al. (2012), Roye and Hudson (2003) and Hillen et al. (2013). The measure assesses perceived relevance of the presentation (2 items), the presentation’s ability to maintain viewer attention (3 items), perceived credibility of presentation (3 items) and how compelling/convincing the presentation was (3 items). Participants rated each item on a 4-point Likert-type scale (ranging from 1-“not at all” to 4-“very much”) (See Appendix K).

Message Impression Open-Ended Questionnaire (qualitative measure): To further explore participants’ impression of the message they viewed, an additional measure containing five open-ended questions was administered following completion of the Message Rating Questionnaire. The creation of these questions was partially informed by video evaluation process used in past studies (Majid et al., 2012; Roye & Hudson, 2003; Hillen et al., 2013) as well as consideration of the specific needs of the study. The five questions were: 1. In your opinion, what was the main message of the presentation?, 2. Did you learn anything new from the presentation or did it make you

reconsider any of your opinions about e-cigarettes? Please describe., 3. What, if anything, did you like about the presentation?, 4. What, if anything, did you dislike about the presentation?, and 5. How could the presentation be improved? (See Appendix L).

Behavioral willingness task: Because this study evaluated the effects of e-cigarette messages on individuals who have never used e-cigarettes, ethical concerns prohibited the direct examination of whether the manipulation led to actual use of e-cigarettes (e.g. offering participants e-cigarettes and recording whether or not they accepted it). In lieu of examining the effect of the manipulation on e-cigarette use, a proxy for the behavior was used. Upon completion of all other study measures, participants were informed about a fictitious study that would involve accepting an e-cigarette for at-home/personal use. Participants read about the proposed experiment and then indicated in writing whether or not they would be willing to be contacted about participating in this study. Affirmative responses were interpreted as a behavior reflecting willingness to try e-cigarettes (See Appendix M).

Message development

Three brief powerpoint-based audiovisual presentations were created to serve as the independent variable in this study. Each presentation focused on a specific message type: 1. A “caution” presentation warning e-cigarettes may be as harmful as regular cigarettes and should be avoided by smokers and non-smokers alike (length: 5 minutes, 36 seconds), 2. A “replacement” presentation describing the relative safety of e-cigarettes and endorsing their use as an alternative to cigarettes (length: 5 minutes, 19 seconds) and 3. A control condition message containing only neutral and descriptive information about e-cigarettes (length: 5 minutes, 21 seconds) (See Appendix N).

The powerpoint-based audiovisual format was chosen, rather than a video presentation, as filming introduces many variables that are difficult to balance across separate presentations (e.g. actor tone and delivery, visual idiosyncrasies in how a

scene is captured on camera). Therefore the audiovisual presentation format allowed for the creation of tightly controlled and stylistically balanced presentations (e.g. amount of text presented, type and number of graphics/visual aids used, etc.) Furthermore, the choice of this presentation format is supported by past research showing that the slideshow modality has been successful in communication of health messages (e.g. Williams et al., 2014; Stein & Reichert, 1990).

The slide-based audiovisual presentations featured written text along with graphic elements (i.e. pictures and animations) and narration of slide content by a male speaker. The Caution and Replacement messages were designed to capture the essential elements of the arguments espoused by critics and proponents of e-cigarettes. Both message types were framed as informational presentations intended to communicate important details concerning e-cigarettes. To lend additional credibility and support, each message contained a quote from an established scientific researcher (supporting the presentation's message) and a reference to the FDA's position on e-cigarette (framed to support the different narratives). The Control condition presentation was balanced to match the Caution and Replacement presentations on length, narration and use of graphic elements. However, the Control condition presentation featured only neutral factual information regarding e-cigarettes (e.g. types of e-cigarettes, further detail regarding e-cigarette components, etc.) and was designed with the intention of discussing e-cigarettes without influencing viewers' opinions one way or another.

At the time these messages were created, no study had modeled construction of messages regarding e-cigarettes and a valid set of guidelines for developing such messages was not available. The development of the study's audiovisual presentations was therefore informed by resources not specifically designed for this purpose. Relevant segments from the guidelines provided by the National Cancer Institute's (NCI) Stages in Health Communication Model were used to guide the message creation process

(Making Health Communication Programs Work, 2008). Table 1 outlines the 4-stage presentation development process, based on relevant NCI recommendations.

Table 1. Presentation development stages

Stage	Goal	Steps
1. Communicative Brief	Create broad plan for construction of presentation	<ul style="list-style-type: none"> a. Define communication goals b. Identify key elements to include in presentation c. Decide on stylistic aspects (e.g. tone) of presentation d. Review communicative brief with at least two committee members e. Revise as necessary
2. Message Development	Design specific messages to be used in presentations	<ul style="list-style-type: none"> a. Use communicative brief to guide creation of specific messages b. Present messages to two groups of 3-5 research assistants aged 18-24 and solicit feedback c. Revise as necessary
3. Creation of Presentation	Create initial audiovisual presentations	<ul style="list-style-type: none"> a. Write slide content b. Select stylistic elements to be used including graphics, narration etc. c. Compile materials to create presentation
4. Presentation editing/revision	Gather feedback and revise presentations as necessary	<ul style="list-style-type: none"> a. Show presentations to two groups of 3-5 research assistants aged 18-24 and solicit feedback b. Show presentations to at least two committee members and solicit feedback c. Integrate feedback from committee members and research assistants d. Edit presentations and generate additional content as necessary

In stage 1 (communicative brief), a communicative brief was created and reviewed with two committee members. The communicative brief served to broadly outline the content to be used in the presentations (e.g. quotes representing expert opinion) and identify goals for each presentation (e.g. definitions of behavior targeted by each presentation). In stage 2 (message development stage) brainstorming sessions were conducted with research assistants within the age range of the target population

(i.e. young adults). The research assistants were shown messages under consideration for inclusion (e.g. “e-cigarettes are not well-studied and could be damaging to your health”) and were asked to rate how convincing and credible each message was. The messages under consideration were also discussed and further developed with the help of two committee members.

In stage 3 (creation of presentation), feedback from committee members and undergraduate research assistants was used to develop first drafts for the Caution and Replacement messages. In stage 4 the drafts of the two presentations were shown to both committee members and two separate groups of undergraduate research assistants. Feedback from committee members and undergraduate research assistants was then used to revise the two presentations. Final versions of these presentations were then reviewed and approved by two committee members. After finalizing the Replacement and Caution messages, the Control message presentation was developed to match the two experimental condition messages on length and stylistic elements.

Procedure

Prior to the study, participants completed an online screening survey through either the USF SONA system or through a survey posted on surveymonkey.com (for the seven paid participants). Only individuals who reported never using e-cigarettes and having smoked less than 100 cigarettes in their lifetime were admitted to the study. After signing up for the study, participants were randomly assigned to one of three conditions that differed only in type of message viewed (i.e. caution, replacement or control) using small block randomization, such that each sequential block of six groups contained each condition twice. Participants were run individually or in small groups of up to 10 participants in classrooms at the USF psychology building.

Upon arrival of all scheduled participants, the experimenter distributed consent forms, allowed participants time to read through the forms, verbally summarized their

content and then inquired whether the participants had any questions before signing. After all participants read and signed the consent forms, the experimenter administered the CO screening to all participants. Participants were then given a packet containing the pre-manipulation measures in the following order: Demographic questions, the Brief Sensation Seeking Scale, e-cigarette willingness and intention questionnaires, exposure to electronic cigarettes measure, history of nicotine use questionnaire, the Need for Cognition scale, and the Proactive Negativism subscale of the Negativism-Dominance Scale (rebelliousness).

After completion of the pre-manipulation measures, participants viewed their condition's messages on a large screen at the front of the classroom. Following the presentation, participants were given a packet containing the willingness and intention questionnaires (again), as well as the electronic cigarette expectancy outcome questionnaire. After all participants completed this packet, the experimenter proceeded with the administration of the paper IAT. The experimenter distributed packets containing the flower/insect practice IAT as well as the e-cigarette/cigarette IAT, verbally summarized the IAT instructions (also written on the IAT form itself) and checked for understanding. All participants completed the paper IAT at the same time, with the experimenter keeping track of time and letting participants know when to start and stop completing each IAT trial.

Following administration of the paper IAT, the experimenter distributed the last questionnaire packet containing the following measures (in order): Message Rating Questionnaire, Message Impression Open-Ended Questionnaire and the behavioral willingness task. After all participants completed all measures, the experimenter proceeded to debrief participants and then concluded the study. Study sessions typically lasted between 35-50 minutes, depending on number of participants in the group and the speed with which individual participants completed the measure packets.

DATA ANALYSIS

Missing data

Out of the 204 individuals who completed the study and were not later disqualified, five participants did not complete one of the administered measures. Different single participants did not complete The Brief Sensation Seeking Scale, pre-test intention scale, and ethnicity questions. Two additional participants did not complete the Behavioral Willingness task. Because the five participants with missing data each had completed 12 out of the 13 measures/tasks, data from these participants with missing data were not excluded from analyses. Rather, participants with missing data for a particular set of analyses were excluded through listwise deletion and sample size was allowed to vary across analyses (between N=202 and N=204).

Analysis of data from newly-developed measures

History of Nicotine Use: Data from the History of Nicotine Use measure was used to create estimates of participants' total number of lifetime uses of nicotine products by summing the middle of the five ranges of use frequency endorsed for each product (e.g. 2-5, 6-10, etc.).

Exposure to E-Cigarettes: The exposure to e-cigarettes measure showed poor reliability ($\alpha=.53$) as well as poor inter-item correlations for the four items in the measure (ranging from .15 to .36). Therefore, a total score was not computed for the exposure to e-cigarettes measure. Instead, separate chi square analyses were performed on participants' responses to the four questions to explore for any between-condition differences prior to message exposure.

Willingness and Intention to use e-cigarettes: The four-item Willingness measure showed good reliability at both pre-manipulation ($\alpha=.93$) and post-manipulation ($\alpha=.90$). Therefore, the measure's four items were added together to create a total Willingness score to be used in subsequent analyses. Reliability for the three-item Intention measure was below acceptable levels (pre-manipulation: $\alpha=.36$, post-manipulation: $\alpha=.38$), due to item 3 ("do you intend to avoid using electronic cigarettes?") correlating poorly with the other two items. Because the first two items correlated well with one another on both pre-manipulation ($r=.92$, $p<.05$) and post-manipulation ($r=.85$, $p<.05$), data for question 3 was removed from analysis and total pre- and post-manipulation Intention scores were computed by adding participants' ratings on questions 1 and 2.

Alpha correction

Where relevant, Holm's sequential Bonferroni procedure (Holm, 1979) was used to adjust alpha levels for the group of analyses performed in each hypothesis. In Holm's sequential Bonferroni procedure, all analyses within a given family of tests are organized by p value from smallest to largest. The first (i.e. smallest) p value is then evaluated based on the adjusted significance level of $.05/X$, where X is the number of analyses in the family of tests. If the first p value examined remains significant at the adjusted α value of $.05/X$, the next smallest p-value is examined at the adjusted significance level of $.05/(X-1)$. This procedure is repeated until none of the remaining p values meet the adjusted significance levels.

Non-normal distribution of primary variables

Willingness and Intention pre-and post-manipulation total scores were non-normally distributed (see table 2). To explore potential methods for addressing skewness and kurtosis in this study's dataset, a log transformation was conducted on Willingness and Intention total scores at both pre- and post-manipulation and the analyses for hypothesis 1a (i.e. the primary hypothesis) were re-run to examine if transforming the

variables led to different results. Skewness and Kurtosis decreased with the transformation but both raw and transformed data led to highly similar findings. Therefore, the original untransformed data was used for the analyses in this study.

Table 2. Willingness and intention skewness and kurtosis values

	Intention (Pre)	Intention (Post)	Willingness (Pre)	Willingness (Post)
Skewness (SE)	3.07 (.17)	2.88 (.17)	2.62 (.17)	2.71 (.17)
Kurtosis (SE)	9.15 (.34)	8.21 (.34)	7.26 (.34)	7.82 (.34)

Aim 1

The primary aim of this study focused on separately comparing the effects of the two experimental conditions (i.e. Caution and Replacement) to the effects of the control message on the dependent variables (i.e. Willingness, Intention, IAT approach and avoidance attitudes and e-cigarette outcome expectancies).

Hypothesis 1a

A total of four analyses were performed (two sets of two ANCOVAs, separately comparing the Caution and Replacement conditions to the Control condition) as part of hypothesis 1a. The Holm-Bonferroni alpha correction was applied to these four analyses, setting the initial alpha level for hypothesis 1a at .0125.

Hypothesis 1b

To examine IAT data, summary variables were created to represent each participants' number of correct word categorizations for the four category pairs examined in this study: avoid/e-cigarettes, avoid/cigarettes, approach/e-cigarettes and approach/cigarettes. The summary variables were then used to compute estimates of participants' strength of implicit approach and avoidance attitudes to e-cigarettes using

two of the seven potential paper-IAT analysis procedures described by Lemm et al. (2008): The “Product: Square root of difference” and the “simple difference” procedure.

In the “Product: Square root of difference”, IAT scores were calculated as $(X/Y) \times \sqrt{X - Y}$, where X is the greater of two association scores. For example, if a participant accurately categorized nine words in the “avoid/e-cigarettes” category pair (i.e. X=9) and five words in the “avoid/cigarettes” category pair (i.e. Y=5), the process for calculating their “Product: Square root of difference” score would be: $(9/5) \times \sqrt{9-5} = 3.6$. In the “simple difference” procedure, difference scores were calculated by simply subtracting Y from X. Using the same X and Y values from the example above, the “simple difference” score would be: $9-5=4$.

The two scoring procedures yielded separate sets of IAT scores, each of which was used to examine between condition differences using independent samples t-tests. A total of eight analyses were performed as part of hypothesis 1b (two sets of four independent samples t-tests). The Holm-Bonferroni alpha correction was applied to the analyses in hypothesis 1b, setting the initial alpha level at .00625.

Hypothesis 1d

Responses on the e-cigarette outcome expectancy questionnaire were used to calculate total scores for the seven factors evaluated in this measure. Two separate sets of independent samples t-tests were run to compare e-cigarette expectancies between Caution and Control and between Replacement and Control, yielding a total of 14 analyses for hypothesis 1d and leading to an adjusted alpha level of .0035.

Aim 2

Linear regressions were used to examine for direct effects of individual difference variables on pre-manipulation Willingness and Intention for hypotheses 2a-2c. In addition, all aim 2 hypotheses (i.e. hypotheses 2a-2e, exploring the effects of exposure to e-cigarettes, history of nicotine use, sensation seeking, need for cognition and

rebelliousness, respectively) predicted an interaction between an individual difference variable and the message condition on post-manipulation Willingness and Intention scores. Hierarchical regressions were used to investigate whether any of these five individual difference variables interacted with condition and influenced post-manipulation Willingness and Intention scores.

These five sets of hierarchical regressions each followed the same structure, with the following variables entered into four successive regression models: 1. Pre-manipulation Willingness or Intention (entered as a covariate), 2. Condition effects (represented by two dummy variables, with one of the experimental conditions coded as “1” and the other two conditions coded as “0”), 3. The individual difference variable for a given hypothesis, and 4. Interaction terms between the individual difference variable and the two condition dummy variables. The addition of dummy variables representing each of the two experimental conditions into the regression model serves to create an omnibus test of all conditions (reflected in the R^2 change statistic). In addition, the regression coefficient for the two experimental condition dummy variables represents a test of each respective group compared against the control condition.

The Holm-Bonferroni alpha correction was applied to hypotheses 2a-2e, with each set of analyses for a given hypothesis treated as a separate family of tests. Different initial alpha levels were set for each of the hypotheses, depending on the number of analyses performed for that hypothesis (see Table 3).

Aim 3

Nine variables were entered into the bivariate correlation matrix (Pre- and post-manipulation Willingness and Intention, the Behavioral Willingness Task, IAT approach and avoidance scores for both the “Product: Square root of difference” and the “simple difference” procedures) leading to a total of 36 correlations: $(9^2-9)/2=36$. Therefore, initial adjusted alpha level for hypothesis 3 was set .0013.

Table 3. Alpha correction for aim 2 hypotheses

	# of analyses	Description of analyses	Adjusted α value
Hypothesis 2a (Exposure to e-cigarettes)	16	2 linear and 2 hierarchical regressions performed for each of the 4 questions	.0031
Hypothesis 2b (History of nicotine use)	4	2 linear and 2 hierarchical regressions	.0125
Hypothesis 2c (Sensation seeking)	4	2 linear and 2 hierarchical regressions	.0125
Hypothesis 2d (Rebelliousness)	2	2 hierarchical regressions	.025
Hypothesis 2e (Need for cognition)	2	2 hierarchical regressions	.025

RESULTS

Sample characteristics

A total of 338 participants completed the study's online screening survey and were deemed eligible to participate based on their reporting of no previous e-cigarette use, no history of nicotine dependence and only limited past use of nicotine products. However, 134 responders' answers on the History of Nicotine Use questionnaire (completed in person) indicated previous history of e-cigarette or nicotine use that would have disqualified them had they reported it on the screening survey. Therefore, these 134 responders did not meet eligibility criteria for the study and their data was consequently removed from analysis.

Of the original 338 individuals recruited, 204 participants (155 females) completed the study and did not disqualify based on their in-session responses to the History of Nicotine Use questionnaire. Each participant group was randomly assigned to one of three conditions: Replacement message (N=68, 55 females); Caution message (N=71, 53 females); and Control message (N=65, 47 females). Chi-square analysis revealed no significant differences on gender distribution between conditions (see Table 4). Mean age was 19.4 (SD 1.3) and a one-way ANOVA found no significant differences on age across conditions (see Table 4). The study sample was ethnically diverse. Approximately 38% of participants self-reported as White, 23% self-reported as Hispanic/Latino, 16% self-reported as Black, 13% self-reported as Asian and 9% self-reported as "other" (including one participant who did not complete the race/ethnicity

question). Chi-square analysis were performed on ethnicity across conditions and revealed no significant differences between groups (see Table 4).

Table 4. Sample characteristics (n's unless otherwise indicated) by condition

	Replacement	Caution	Control	Total
Males	13	18	18	49
Females	55	53	47	155
Age (mean/sd)	19.4 (1.2)	19.4 (1.5)	19.4 (1.3)	19.4 (1.3)
White	20	28	30	78
Hispanic/Latino	23	15	10	48
Black	12	12	8	32
Asian	6	8	13	27
Other / N/A	7	8	4	19

History of nicotine use and exposure to electronic-cigarettes

Lifetime uses of nicotine products in this study's sample ranged from 0 to 45 (mean= 1.5 (SD=4.6); Median=0). Lifetime uses of nicotine products was non-normally distributed, with skewness of 5.86 (SE=.17) and kurtosis of 47.8 (SE=.34). Thus, the sample had minimal use of nicotine products overall. A one-way ANOVA analysis revealed no significant differences in total lifetime uses of nicotine products between conditions. Means and standard deviations for number of lifetime uses of nicotine products across conditions were: Replacement (Mean: 1.46; SD: 3.79), Caution (Mean: .91 SD: 2.13) and Control (Mean: 2.22 SD: 6.75).

Participants reported low levels of exposure to e-cigarettes overall, especially with regards to the two items inquiring about participants' number of friends and family members who use e-cigarettes (See Table 5). Chi square analyses revealed no significant differences between groups for all four e-cigarette exposure questions.

Table 5: E-cigarette exposure across conditions

	Replacement (Mode/Median)	Caution (Mode/Median)	Control (Mode/Median)
# of occasions seeing others use e-cigarettes	1-5 / 6-10	1-5 / 6-10	11-20 / 20+
# of e-cigarette commercials seen	1-5 / 6-10	1-5 / 1-5	1-5 / 1-5
# of friends using e-cigarettes	0 / 0	0 / 0	1-5 / 0
# of family members using e-cigarettes	0 / 0	0 / 0	0 / 0

Aim 1 findings

Hypothesis 1a: Caution condition participants will endorse lower scores on explicit measures of intent and willingness to use e-cigarettes while replacement condition participants will endorse higher scores on explicitly assessed willingness (but not intention) to use e-cigarettes

At baseline (i.e. pre-manipulation), total Willingness scores ranged from 4-16 (mean=5 (SD=2.28); median=4) and total Intention scores ranged from 2-6 (mean=2.22 (SD=.65); median=2). The majority of participants endorsed the minimum possible score on the pre-manipulation Willingness (minimum possible score- 4; N=153) and Intention (minimum possible score- 2; N=181) baseline questionnaires.

One-way ANOVAs were performed to examine potential group differences on pre-manipulation Willingness and Intention and no significant differences were found. Two sets of two ANCOVAs were performed to test hypothesis 1a, comparing message effects on post-manipulation Willingness and Intention (while controlling for pre-manipulation Willingness and Intention) between Replacement and Control conditions

and between Caution and Control conditions. A significant difference in post-manipulation Willingness was detected between Caution and Control conditions ($F(1,133)=9.94$; $p<.0125$), indicating that Caution participants reported lower Willingness to try e-cigarettes after viewing the Caution message (See Figure 1). No differences were detected in post-manipulation Willingness scores between Replacement and Control conditions. No differences in post-manipulation Intention were found between conditions (See Figure 2).

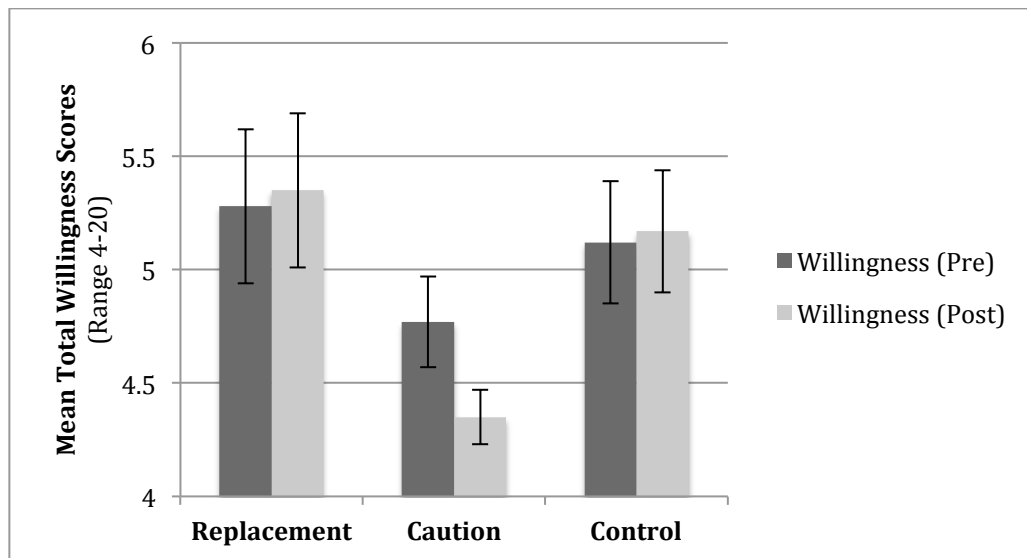


Figure 1. Willingness scores across conditions

Hypothesis 1b: Replacement and caution condition participants will show stronger positive and negative dispositions towards e-cigarettes, respectively, as assessed by the paper-format IAT.

Two separate scoring procedures (the “Product: Square root of difference” procedure and the “simple difference” procedure) were used to produce two distinct sets of IAT approach and avoidance scores. Scores for the IAT were compared across conditions using four independent samples t-tests (one for each of the IAT scores). Two

sets of four independent samples t-tests were performed, separately comparing IAT scores between Replacement and Control conditions and between Caution and Control conditions.

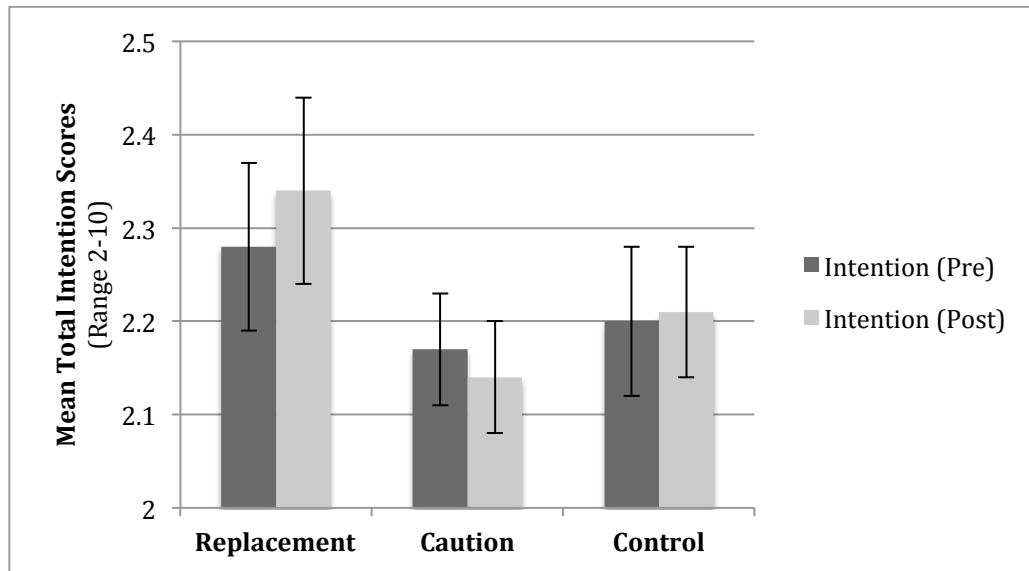


Figure 2. Intention scores across conditions

Independent samples t-tests comparing “Product: Square root of difference” IAT approach and avoidance scores revealed no significant differences between the two experimental conditions and the Control condition (see Figure 3). Independent samples t-tests comparing “simple difference” IAT approach and avoidance scores revealed no significant differences at the adjusted α level of .00625. However, one significant difference was found at the traditional α level of .05: Replacement condition participants showed less avoidance of e-cigarettes (mean=2.69, sd=2.23) as compared to controls (Mean=3.68, sd=2.7; $t(131)=-2.26$, $p=.025$).

Hypothesis 1c: Compared to controls, participants in the replacement and caution conditions will show higher and lower rates, respectively, of agreeing to be contacted for participation in a future study involving e-cigarette use.

Chi-square analyses were used to determine whether rates of agreement on the Behavioral Willingness Task differed across conditions. Approximately 21% of participants agreed to be contacted about the fictitious study in the future (44 out of 204) and no significant differences were found between conditions (See Table 6).

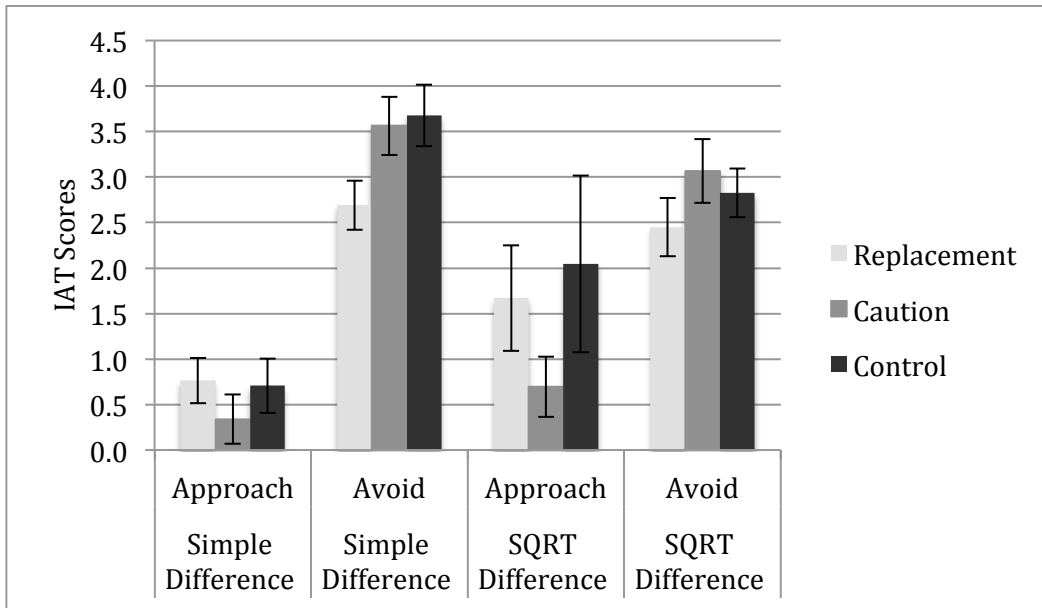


Figure 3. IAT Approach and avoidance scores across conditions

Table 6. Behavioral Willingness across conditions

	Replacement*	Caution	Control*	Total
No	55	54	49	158
Yes	12	17	15	44

* One participant in this condition did not complete the task

Hypothesis 1d: Caution condition participants will report stronger negative expectancies regarding e-cigarettes while replacement condition participants will report stronger positive expectancies regarding e-cigarettes.

Independent samples t-tests were performed comparing participants' scores on the seven factors of the e-cigarette outcome expectancies questionnaire between the

Caution and Control conditions and between the Replacement and Control conditions. Compared to Control condition participants, Replacement condition participants endorsed significantly lower expectancies relating to Negative Health Consequences ($t(131)=-4.18$, $p<.0035$; See Table 7). Independent samples t-tests comparing expectancy factor scores between the Caution and Control conditions did not reveal significant differences at the adjusted α level of .0038 (α levels adjusted from .05/14 to .05/13). However, several significant differences were found at the traditional α level of .05. Compared to Control condition participants, Caution condition participants endorsed significantly lower expectancies regarding Positive Sensory Experience ($t(134)=-2.43$, $p=.016$), higher expectancies of Negative Sensation Experience ($t(134)=2$, $p=.047$), and higher expectancies of Addiction Concern ($t(134)=2.64$, $p=.009$; See Table 7).

Table 7. E-cigarette expectancies across conditions

	Replacement (N=68)	Caution (N=71)	Control (N=65)
Social Enhancement	13.51 (7.31)	13.63 (7.12)	15.02 (9.39)
Affect Regulation	19.43 (12.82)	21 (22.19)	22.6 (14.4)
Positive Sensation Expectancies	7.06 (12.21)	5.55 (3.92)*	7.43 (5.07)
Negative Health Consequences	24.51 (10.58)**	32.66 (7.42)	31.42 (8.26)
Negative Appearance	12.94 (5.54)	13.35 (5.17)	12.42 (5.65)
Addiction Concern	11.21 (5.39)	13.83 (5.29)*	11.35 (5.64)
Negative Sensation Expectancies	20.29 (8.83)	23.77 (6.71)*	21.31 (7.64)

*Significantly different from controls, $p<.05$

** Significantly different from controls, $p<.0035$

Aim 2 findings

Hypothesis 2a: Past exposure to e-cigarettes will predict higher willingness and intention to use e-cigarettes. Past exposure will also interact with condition and produce higher willingness and intention ratings among replacement condition participants who have experienced a relatively substantial exposure to e-cigarettes.

Linear and hierarchical regressions were performed to explore for the influence of exposure to e-cigarettes on pre- and post-manipulation Willingness and Intention, respectively. No significant effects were found for e-cigarette exposure on either pre- or post-manipulation Willingness or Intention at the adjusted α level of .0031.

However, several significant relationships were found at the traditional α level of .05 for question 3 (How many of your friends use e-cigarettes?). Linear regressions revealed that number of friends using e-cigarettes was a significant predictor of pre-manipulation Intention ($F(1,201)=4.03$, $\beta = .14$, $p=.046$) and trended towards significant prediction of pre-manipulation Willingness to use e-cigarettes ($F(1,202)=3.63$, $\beta=.133$, $p=.058$). Hierarchical regressions revealed a significant regression model for number of friends using e-cigarettes on post-manipulation intention ($F(4,198)=40.3$, R^2 change=.013, $p=.031$; See Table 8) as well as post-manipulation willingness ($F(4,199)=148.5$, R^2 change=.006, $p=.026$; See Table 9).

Having friends who use e-cigarettes was associated with greater Willingness and Intention to use e-cigarettes at both pre- and post-manipulation (at the traditional $\alpha = .05$ level). It is important to note the observed post-manipulation effects of number of friends using e-cigarettes were not a function of specific condition but rather seem to result from exposure to any of the three message types.

Table 8. Summary of hierarchical regression analysis for # of friends using e-cigarettes predicting post-manipulation Intention to try e-cigarettes

Variable	R ²	R ² Δ	β
Step 1	.428	.428*	
Intention (pre-manipulation)			.654*
Step 2	.435	.007	
Intention (pre-manipulation)			.639*
Caution Condition			-.042
Replacement Condition			.052
Step 3	.448	.013*	
Intention (pre-manipulation)			.632*
Caution Condition			-.029
Replacement Condition			.067
# of friends using e-cigarettes			.117*
Step 4	.454	.006	
Intention (pre-manipulation)			.623*
Caution Condition			-.034
Replacement Condition			.066
# of friends using e-cigarettes			.034
Interaction term 1: Caution condition by # of friends			.067
Interaction term 2: Replacement condition by # of friends			.094

*p<.05

Table 9: Summary of hierarchical regression analysis for # of friends using e-cigarettes predicting post-manipulation Willingness to try e-cigarettes

Variable	R ²	R ² Δ	β
Step 1	.727	.727*	
Willingness (pre-manipulation)			.853*
Step 2	.743	.016*	
Willingness (pre-manipulation)			.841*
Caution Condition			-.118*
Replacement Condition			.013
Step 3	.749	.006*	
Willingness (pre-manipulation)			.831*
Caution Condition			-.11*
Replacement Condition			.023
# of friends using e-cigarettes			.081*
Step 4	.749	-	
Willingness (pre-manipulation)			.832*
Caution Condition			-.11*
Replacement Condition			.022
# of friends using e-cigarettes			.065
Interaction term 1: Caution condition by # of friends			.022
Interaction term 2: Replacement condition by # of friends			.009

*p<.05

Hypothesis 2b: History of nicotine use will predict higher willingness and intention to use e-cigarettes. History of nicotine use will also interact with condition such that replacement condition participants with a history of nicotine use will produce higher willingness and intention ratings.

Linear and hierarchical regressions were performed to explore for the influence of History of Nicotine Use on pre- and post-manipulation Willingness and Intention, respectively. No significant effects were found for History of Nicotine Use on either pre- or post-manipulation Willingness or Intention at the adjusted α level of .0125. However, a significant relationship at the traditional α level of .05 was detected for the linear regression of number of lifetime nicotine uses on pre-manipulation willingness ($F(1,202)=4.88$, $\beta=.154$, $p=.028$), indicating that having previous experiences using nicotine products was associated with greater pre-manipulation Willingness to try e-cigarettes in this sample (at the traditional $\alpha = .05$ level).

Hypothesis 2c: Sensation seeking will predict ratings of willingness and intention to use e-cigarettes, such that individuals high on sensation seeking will provide higher ratings of willingness and intention. Degree of sensation seeking will also interact with condition, so that individuals high on sensation seeking will display higher rates of willingness and intent when exposed to the replacement condition while individuals low on sensation seeking will display lower willingness and intent when exposed to the caution condition.

A one-way ANOVA was performed to examine potential group differences on the Brief Sensation Seeking Scale, no significant differences were found. Linear and hierarchical regressions were performed to explore for the influence of Sensation Seeking on pre- and post-manipulation Willingness and Intention, respectively. No significant effects were found for Sensation Seeking on either pre- or post-manipulation

Willingness or Intention at the adjusted α level of .025. Therefore, hypothesis 2c was not supported by the findings of this study.

Hypothesis 2d: Need for cognition will interact with manipulation effects such that individuals low in need for cognition will display greater manipulation effects (i.e. greater reductions in post-manipulation Willingness and Intention in the Caution condition and greater increases in post-manipulation Willingness and Intention in the Replacement condition).

A one-way ANOVA was performed to examine potential group differences on the Need for Cognition scale at baseline, no significant differences were found. Hierarchical regression models examining the effects of Need for Cognition total scores on post-manipulation willingness and intention did not reveal significant regression models at the adjusted α level for hypothesis 2d (.025). However, the hierarchical regression model for the effects of Need For Cognition on post-manipulation intention was significant at the traditional α level of .05 ($F(4, 198)=40.04$, $\beta=-.111$ $p=.037$; See Table 10). These results do not support hypothesis 2d because they indicate that higher Need for Cognition was associated with lower post-manipulation intention independent of a condition-specific interaction.

Hypothesis 2e: Rebelliousness will interact with manipulation effects such that individuals high in rebelliousness will display lesser manipulation effects (i.e. Lesser reductions in post-manipulation Willingness and Intention in the Caution condition and lesser increases in post-manipulation Willingness and Intention in the Replacement condition).

A one-way ANOVA was performed to examine potential group differences on the Rebelliousness scale at baseline, no significant differences were found. Hierarchical regressions examining direct and indirect effects on post-manipulation Willingness and Intention did not produce significant models and no significant interaction effects were

found for Rebelliousness and either of the experimental conditions. Therefore, hypothesis 2e was not supported by the findings of this study.

Table 10. Summary of hierarchical regression analysis for Need For Cognition predicting Intention to try e-cigarettes

Variable	R ²	R ² Δ	β
Step 1 (R ² =.428*)	.428	.428*	
Intention (pre-manipulation)			.654*
Step 2 (R ² =.435)	.435	.007	
Intention (pre-manipulation)			.639*
Caution Condition (dummy variable)			-.042
Replacement Condition (dummy variable)			.052
Step 3 (R ² =.447*)	.447	.012*	
Intention (pre-manipulation)			.645*
Caution Condition (dummy variable)			-.044
Replacement Condition (dummy variable)			.056
Need For Cognition			-.111*
Step 4 (R ² =.453)	.453	.006	
Intention (pre-manipulation)			.644*
Caution Condition (dummy variable)			-.042
Replacement Condition (dummy variable)			.057
Need For Cognition			-.068
Interaction_1 (Caution by Need For Cognition)			.01
Interaction_2 (Replacement by Need For Cognition)			-.088

*p<.05

Aim 3 findings

Hypothesis 3: Explicitly assessed willingness and intent to use e-cigarettes, implicitly assessed approach attitudes towards e-cigarettes and responses on the behavioral willingness task will all show low-moderate positive correlations with one another. These measures will also show low-moderate negative correlations with implicitly assessed avoidance attitudes.

Bivariate correlations were performed to examine the relationship between pre- and post-manipulation Willingness and Intention, the Behavioral Willingness Task and

the IAT “Product: Square root of difference” procedure approach and avoidance scores and the “simple difference” procedure approach and avoidance scores (see Table 11). Willingness and Intention total scores showed strong correlations with each other both at pre-manipulation ($r=.85$, $p<.001$) and at post-manipulation ($r=.72$, $p<.001$). Responses on the Behavioral Willingness task showed low positive correlations with pre-manipulation Willingness ($r=.27$, $p<.001$), post-manipulation Willingness ($r=.21$, $p<.0021$; α levels adjust to $.05/23$ as this was 14th smallest p value out of 36 analyses conducted under hypothesis 3) and pre-manipulation Intention ($r=.26$, $p<.001$). These positive correlations support the hypothesis and show inter-relatedness among the measures described above. However, participants’ IAT Approach and Avoidance scores did not show positive correlations with Willingness, Intention, or the Behavioral Willingness Task. Contrary to the hypothesis, one significant negative correlation was detected between “simple difference” IAT approach scores and pre-manipulation intention to try e-cigarettes ($r=-.176$, $p=.012$).

Aim 4 (exploratory) findings:

In contrast to analytic procedures in aims 1 and 2, participant responses on aim 4 measures were compared between all conditions to enable the juxtaposition of subjective effects of viewing the three different message types used in this study. A one-way ANOVA was conducted to compare participants’ unstandardized ratings of the eleven items on the Message Rating Questionnaire between conditions and the Tukey HSD post-hoc test was used to further examine significant between-condition effects.

Overall, unstandardized mean item scores indicated that participants had generally positive impressions of most aspects of the presentation they viewed (see Table 12). Significant between-condition differences were detected for seven of the Message Rating Questionnaire items (out of eleven). The Tukey HSD post-hoc test revealed six items were rated higher (i.e. more positively) by Caution participants as

compared to Control participants. Of these six items, four items were also rated higher by Caution participants as compared to Replacement participants. One reverse-scored item was rated lower (i.e. more positively) by Replacement participants as compared to Control participants (see Table 12).

Table 11. Willingness, Intention, Behavioral Willingness and IAT correlations

	Willingness (pre)	Willingness (post)	Intention (pre)	Intention (post)	Behavioral Willingness	IAT Approach (SQRT)	IAT Avoid (SQRT)	IAT Approach (Simple)	IAT Avoid (Simple)
Willingness (pre)	-	.853***	.730***	.594***	.270***	-0.064	0.076	-0.103	0.042
Willingness (post)		-	.657***	.716***	.214**	-0.042	0.051	-0.092	0.021
Intention (pre)			-	.654***	.258***	-0.123	0.059	-.176*	0.01
Intention (post)				-	.098	-0.066	0.137	-0.102	0.028
Behavioral Willingness					-	0.01	-0.054	0.045	0.045
IAT Approach (SQRT)						-	-.353***	-.395***	.724***
IAT Avoid (SQRT)							-	.858***	-.401***
IAT Approach (Simple)								-	-.422***

Note: SQRT= "Product: Square root of difference" IAT scores; Simple= "Simple difference" IAT scores

*p< 0.05

**p<.0021

***p< 0.001

In addition, Message Rating Questionnaire total scores were calculated to allow for between-condition comparisons of overall impression of the presentation viewed. A total score could not be computed

based on unstandardized item values for the measure's 11 items due to poor reliability ($\alpha=.24$). Therefore, a logarithmic transformation of item ratings was conducted and yielded improved reliability for the measure ($\alpha=.75$). The transformed item ratings were then used to create total message rating scores that were compared between conditions using a one-way ANOVA.

Table 12. Message Rating Questionnaire scores across conditions (rated 1 “not at all” to 4 “very much”)

	Replacement (N=68)	Caution (N=71)	Control (N=65)
Relevant	1.82 (0.93)	2.13 (1.05) ^a	1.66 (0.82)
Useful	2.69 (0.98)	3.15 (0.77) ^{a,b}	2.68 (1)
Hold Attention	2.88 (0.91)	3.17 (0.7) ^{a,b}	2.86 (0.79)
Easy to follow	3.63 (0.57)	3.77 (0.45)	3.75 (0.5)
Interesting	2.8 (0.92)	2.96 (0.73)	2.83 (0.8)
Misleading ¹	3.2 (0.87) ^c	3.4 (0.75)	3.6 (0.65)
Honest	3.18 (0.73)	3.27 (0.83)	3.45 (0.69)
Credible	2.94 (0.9)	3.07 (0.82)	3.15 (0.75)
Good points	3.29 (0.69)	3.54 (0.53) ^a	3.31 (0.64)
Important	3.56 (0.58)	3.73 (0.48) ^{a,b}	2.94 (0.83)
Convincing	2.85 (0.93)	3.35 (0.7) ^{a,b}	2.86 (0.88)

^a Caution condition ratings significantly higher than Control condition ratings at $p<.05$

^b Caution condition ratings significantly higher than Replacement condition ratings at $p<.05$

^c Replacement condition ratings significantly higher than Control condition ratings at $p<.05$

¹ Reverse scored, higher values indicate lower rates of perceived misleading

Significant differences in standardized Message Rating Questionnaire total scores were detected between conditions ($F(2,201)=6.68$; $p=.002$). A post-hoc Tukey HSD test showed Caution condition mean ratings (12.4, $SD=1.5$) were significantly higher than mean ratings for both the Control condition (11.3, $SD=1.9$) and the Replacement condition (11.3, $SD=2.4$, $p<.05$).

Analysis of open-ended questionnaire

Responses to questions 1-4 were coded by two raters. A third rater examined cases where the original two raters coded a given responses differently and made a final

decision regarding coding. Coding guidelines varied depending on the nature of each question.

Question 1: "In your opinion, what was the main message of the presentation?"

Responses to question 1 were coded to indicate whether or not participant responses captured some or all of the central ideas in the presentation they viewed, with participants' responses coded as "correct", "correct with errors" and "incorrect". The majority of participant responses accurately reflected central ideas of the presentations they viewed and were coded as "correct". Other participant responses were coded as "correct with errors" because they captured the core meaning/intention of the message, but also included elements that were not explicitly stated in the message (See Table 13). For example, one Caution participant reported the main message of the presentation was that "e-cigarettes are just as harmful as regular cigarettes" whereas the message text used more indefinite phrasing, stating that using e-cigarettes "might even be as dangerous as smoking". A similar pattern of "correct answers with errors" emerged in the Replacement condition, with participants making absolute statements such as "e-cigarettes are a healthy and safe alternative" as opposed to the Replacement message text's statement that e-cigarettes are a "far safer alternative to smoking".

In addition, question 1 responses that failed to correctly address the central theme of the message viewed were coded as "incorrect". Eight responses were coded as incorrect in the Replacement condition, where the most common type of incorrect response described the presentation's comparison of e-cigarettes to conventional cigarettes, but failed to reflect that the presentation was encouraging use of e-cigarettes as a replacement to smoking (e.g. "The main message was about the differences between e-cigarettes and regular cigarettes and common misconceptions between the two"). Fifteen responses were coded as incorrect in the Control condition, where the most common type of incorrect response failed to recognize the neutral tone of the

presentation and depicted the presentation as being either anti e-cigarettes (e.g. “that e-cigarettes are just as bad”) or pro e-cigarettes (e.g. “prove that e-cigs aren’t as bad as they make them out to be”). Only four responses were coded as incorrect in the Caution condition. Of these four responses, two did not answer the question, as one participant provided an incomplete answer (“e-cigarettes”) and another seems to have commented on the overall study rather than the presentation itself (“to evaluate views on e-cigs before and after information was presented on them”). Of the remaining two incorrect answers in the Caution condition, one included too extreme a simplification of the main message (“not smoke, e-smoke at all”) while the other failed to note the cautionary tone of the message (“whether to try e-cigarettes or not and the use of them”).

Table 13. Observed understanding of messages across conditions

	Caution (N=71)	Replacement (N=68)	Control (N=65)
Correct answer	44 (62%)	49 (72%)	50 (77%)
Correct answer with errors	23 (32%)	11 (16%)	0
Incorrect answer	4 (6%)	8 (12%)	15 (23%)

Question 2: Did you learn anything new from the presentation or did it make you reconsider any of your opinions about e-cigarettes?

Responses to question 2 were coded to separately evaluate whether or not participants reported learning new information from the message they viewed and whether they experienced a change of opinion regarding e-cigarettes after viewing the message. The majority of answers in each condition detailed one or more pieces of information participants learned from the presentation, though only a small proportion of answers indicated opinion change (see Table 14).

In all conditions, participants reported learning new information about the function/components of e-cigarettes and the contents of e-juice. In addition, participant responses in each condition reflected newly learned information specific to that

condition’s presentation. Caution condition participants reported learning that the chemicals used in e-juice were never properly tested for long-term inhalation, e-cigarettes were as harmful as regular cigarettes and that e-cigarettes were not helpful for quitting. Replacement participants reported learning that e-cigarettes were relatively safe compared to regular cigarettes, that nicotine was not proven to cause cancer and that e-cigarettes can be useful for quitting. Control condition participants, who viewed a presentation containing mainly superficial information regarding e-cigarettes, reported learning about the existence of nicotine-free e-cigarettes and the availability of e-cigarettes in many flavors.

Table 14. Rates of participants reporting novel information and opinion change

	Caution (N=71)	Replacement (N=68)	Control (N=65)
Reported new information learned	57 (80%)	44 (65%)	48 (74%)
Reported opinion change	5 (7%)	12 (17%)	3 (4%)

Question 3: “What, if anything, did you like about the presentation?”

Responses to question 3 were coded to indicate whether participants identified one or more elements of the presentation that they liked (Caution: 63, 89%; Replacement: N=63, 92%; Control: N=62, 95%). The majority of participants in each condition reported liking at least one aspect of the presentation. In addition, several messaging aspects were recurrently mentioned in participants’ responses to each condition’s message (See Table 15). The presentation elements most frequently mentioned by participants in all three conditions were the message’s clarity and conciseness and the inclusion of detailed information regarding e-cigarettes. Participants also consistently reported liking the featured graphic elements (especially the use of a diagram depicting the components of a typical e-cigarette) and the message’s unbiased and balanced discussion of both sides of the e-cigarette debate. Finally, several

participants in the Caution condition also reported they liked viewing a message that was critical of e-cigarettes (See Table 15).

Table 15. Frequency of messaging aspects liked by participants

	Caution (N=71)	Replacement (N=68)	Control (N=65)
Clear/Concise/Easy to follow	28	20	17
Informational	18	19	30
Graphic elements	6	10	6
Unbiased/Balanced	6	8	4
Criticism of e-cigarettes	7	N/A	N/A

Question 4: “What, if anything, did you dislike about the presentation?”

Responses to question 4 were coded to indicate whether participants identified one or more elements of the presentation that they disliked, with the majority of participants in each condition reporting disliking at least one aspect of the presentation (Caution: 47, 66%; Replacement: N=48, 70%; Control: N=44, 68%). The presentation element most frequently mentioned by participants in all three conditions was the message’s monotone and/or “boring” narration style. Participants in both the Caution and Replacement conditions also frequently reported disliking that the message was biased. Another consistent (though less frequent) element disliked by participants in all three conditions was the message’s central point (i.e. representation of e-cigarettes perceived either overly positive or negative). Participants in the Control and Caution conditions also mentioned disliking the message’s lack of citations/references for the information presented (See Table 16).

Question 5: “How could the presentation be improved?”

Responses to question 5 were not coded because data from this question was not intended for between-condition comparisons. Rather, responses to question 5 were examined for the purpose of identifying participant responses that contained content-

oriented suggestions for improving the presentation they viewed, so as to inform future message development efforts. Therefore, only Caution and Replacement participants' responses were examined.

In both the Caution and Replacement conditions, participants suggested the presentation could be improved by including the following: More detailed information, references to credible sources, testimonials from e-cigarette users and making the message more balanced/less biased by including information supporting the opposing side of the argument.

Table 16. Frequency of messaging aspects disliked by participants

	Caution (N=71)	Replacement (N=68)	Control (N=65)
Boring/monotone narration	21	19	21
Biased/not credible	19	12	0
Disliking/disagreeing with central message	2	6	6
Lack of citations	5	0	2

DISCUSSION

The primary aim of the study was to determine the effects of widely disseminated Caution and Replacement messages on young-adult non-smokers' disposition towards future e-cigarette use. The study focused on young-adult non-smokers because e-cigarette use by members of this population poses a greater relative health risk since it is not replacing an ostensibly more dangerous behavior (i.e. smoking). Separate and unique goals motivated the examination of Caution and Replacement messages' effects. The Caution message was examined to determine whether and to what degree this message achieved its intended effect (i.e. discouraging e-cigarette use) on young adult non-smokers. The Replacement message (designed to emulate messages encouraging smokers to use e-cigarettes instead of conventional cigarettes) was examined to determine whether message exposure exerted unintended effects on young-adult non-smokers' dispositions towards e-cigarettes (i.e. encouraging e-cigarette use).

It should be noted that some of the findings discussed below did not meet criteria for significance under the adjusted alpha levels set for the relevant family of tests, though they were significant at the traditional alpha level of .05. Although not meeting significance at the corrected alpha level, these findings are described below in the interest of thorough discussion of this study's results and their potential implications. Findings that were only significant at the alpha level of .05 (and not the adjusted alpha level) are denoted as such in subsequent paragraphs of this section.

Aim 1

The primary aim of this study sought to determine the effect of Caution and Replacement messages on young-adult non-smokers' dispositions towards future e-cigarette use. Exposure to the Caution message was successful in decreasing willingness to try e-cigarettes in this study's sample. Decreases in willingness can be expected to decrease the likelihood of future e-cigarette use, given that past research has shown willingness is predictive of future smoking behavior (e.g. Gerrard, Gibbons, Stock, Vande Lune & Cleveland, 2005; Hukkelberg & Dykstra, 2009). However, longitudinal research is necessary to determine whether these decreases in willingness remain stable over time and to confirm that such decreases in willingness do in fact relate to decreased probability of future e-cigarette use.

Caution participants' ratings on the e-cigarette expectancy questionnaire showed significant differences at the $\alpha=.05$ level (though not at the adjusted α level for this set of analyses) from Control participants' ratings on three e-cigarette expectancy questionnaire factors. Because these observed differences were not significant at the adjusted alpha level they should be interpreted with caution. Nevertheless, these observed differences are worthy of further discussion, as they may be helpful in identifying targets for further research exploration.

Viewing the Caution message was associated with higher ratings of the addiction expectancies factor, which was congruent with the Caution message's content, specifically addressing the addictive potential of e-cigarettes. In addition, viewing the Caution message was associated with greater negative sensation expectancies and lesser positive sensation expectancies. The differences in Caution participants' positive and negative sensation expectancies were not anticipated because the Caution message did not discuss any sensory experiences related to e-cigarette use. Therefore, it is possible that viewing the Caution message exerted non-specific effects on

participants and led to overall increases in negative valuation and decreases in positive valuation of e-cigarettes.

Caution participants' decrease in positive sensation expectancies is especially notable because positive expectancies are considered strong predictors of future smoking behavior among younger samples (e.g. Stacy, Dent, Sussman, Raynor, Burton and Flay, 1990; Bauman and Chenoweth, 1984) and decreasing these expectancies may lead to decreases in likelihood of future use. Caution participants' ratings on the Willingness questionnaire and on three factors of the e-cigarette outcome expectancy questionnaire therefore suggest that it is feasible to create a caution-themed message that would reduce the likelihood of future e-cigarette use among younger populations.

Compared to the Caution message, the effects of the Replacement message were less pronounced as no changes were observed in participants' Willingness and Intention to try e-cigarettes. However, Replacement participants' ratings of the e-cigarette outcome expectancies questionnaire did show significant differences for the negative health consequence factor. These observed differences were consistent with Replacement message content that specifically addressed e-cigarettes' relative safety as compared to conventional cigarettes. The risk involved in unintentionally lowering non-smokers' negative expectancies of e-cigarettes is considered relatively low because it is positive, rather than negative, expectancies that are most frequently found to predict future smoking behavior (e.g. Wahl, Turner, Mermelstein & Flay, 2005; Hine, McKenzie-Richer, Lewko, Tilleczek and Perreault, 2002; Anderson, Pollak and Wetter, 2002).

Replacement participants also showed significantly lower e-cigarette avoidance scores on the IAT at the $\alpha=.05$ level, suggesting that Replacement message exposure may have reduced implicitly assessed tendencies to avoid e-cigarettes. Similar to the observed differences on the e-cigarette outcome expectancy measure, these differences in IAT scores show that exposure to the Replacement message seems to have

decreased implicitly assessed negative valuation of these products. Although these findings were significant at the $\alpha=.05$ level and not at the adjusted α level for this set of analyses, they still underscore a potential cause for concern that Replacement message exposure could increase risk of future e-cigarette use by decreasing implicitly assessed avoidance of these products. Therefore, it would be prudent for future replacement-themed messages to balance conveying the relative safety of e-cigarettes with factual information regarding potential negative health effects, so as to avoid undue influence and emphasize to viewers that e-cigarettes are only considered to be safe in relation to cigarettes.

Due to the lack of evaluation of IAT and e-cigarette expectancies at pre-manipulation (as well as IAT scores only meeting significance at the $\alpha=.05$ level), these between condition differences should be cautiously interpreted. It is important to note that Replacement message effects reflected through IAT and also expectancy scores were consistent with the proposed hypotheses. However, the lack of pre-manipulation expectancy assessment precludes our ability to verify that these differences were a direct result of message exposure.

Overall, the effects of the Replacement condition were far more constrained than the effects of the Caution condition, as the Replacement message did not induce change in either of the two primary variables and only influenced scores of one of the seven expectancy factors examined in this study. Although lack of findings should always be cautiously interpreted, the limited effects of the replacement message are noteworthy given the observed effects of the Caution message, as both messages followed a highly similar format and contained identical slides in the first half of the presentations (See Appendix N). These findings lend initial support to the notion that a Replacement message can be designed to convince smokers of the benefits of switching to e-

cigarettes while simultaneously minimizing potential unintended influence on non-smokers, should they become exposed to such a message.

The absence of observed message effects on Intention scores is surprising in light of the strong positive correlation observed between total scores for the Intention and Willingness measures. One possible explanation for this lack of finding is that baseline intention scores observed in this sample were close to the minimum possible score, thereby producing a floor effect and making it difficult to observe changes in the downward direction (such as the changes observed for the Willingness ratings of participants in the Caution condition). This pattern of minimal responding on the Intention measure could be a product of this study's sample. The participants in this study were individuals who were very unlikely to initiate e-cigarette use in the future; therefore, the questions on the Intention measure may have been largely irrelevant to this group of participants.

However, the observed change in Willingness scores without change in Intention scores also fit well with the Prototype-Willingness Model, which suggests that risky behaviors are not strongly influenced by intent (PWM; Gibbons, Gerrard, Blanton & Russell, 1998). The PWM conceptualizes risky behaviors as frequently occurring in a reactive manner, i.e. as a response to a given context rather than as a result of a premeditated decision. According to this model, risk-taking among younger populations often occurs in environments that facilitate, but don't demand, risky behaviors, and in these circumstances the individual's willingness to take a risk will be more predictive of future behavior (e.g. Gerrard, Gibbons, Stock, Vande Lune & Cleveland, 2005). First time e-cigarette use by young-adult non-smokers can be seen as risky behavior due to elevated levels of relative risk, and this view is further supported by findings from this study. Therefore, assessing intention may be more useful for assessment of message

effects on individuals who are regular nicotine users or are more likely to use e-cigarettes due to greater risk factors.

No differences between conditions were found on the Behavioral Willingness Task, which was intended to serve as a proxy for offering e-cigarettes to participants and observing whether or not they accepted the offer. Due to ethical concerns regarding potentially influencing nicotine-naïve individuals to use nicotine products, the Behavioral Willingness Task was constructed in a way that was several steps removed from hypothetical acceptance of an e-cigarette (i.e. participants were asked to indicate whether they would be willing to be contacted about participating in a study that would involve receiving an e-cigarette to take home with them). This question may have been too far removed from actual acceptance of an e-cigarette and therefore not an accurate behavioral indication of willingness to use e-cigarettes. However, the finding that responses on the Behavioral Willingness Task showed small positive correlations with Willingness and Intention ratings suggest the central idea behind this measure (i.e. evaluating whether participants would be hypothetically willing to try and/or accept an e-cigarette at the time of the study) may hold merit for evaluating unique aspects of dispositions towards e-cigarette use.

The IAT data produced only one difference between conditions (out of eight analyses that were performed). The IAT used in the present study assessed approach and avoidance attitudes and it is possible this design was not optimally suited for the purposes of this study. Future investigations of implicitly assessed attitudes towards e-cigarettes may benefit from employing IAT designs using the categories of “good” and “bad” (rather than “approach” and “avoid”), as these categories are more general and may capture more diffuse message effects (such as the effects observed for participant expectancies in the Caution condition).

Aim 2

Aim 2 was an exploratory aim that sought to investigate whether potentially relevant individual difference variables exerted pre- or post-manipulation effects on willingness and intention to try e-cigarettes. Due to the exploratory nature of this aim the analyses for aim 2 hypotheses were underpowered and consequently, no effects were detected at the corrected α level for the relevant hypotheses. However, several significant findings were detected at the traditional $\alpha=.05$ level.

Previous experience using nicotine products and number of friends using e-cigarettes predicted higher rates of pre-manipulation Willingness and Intention, suggesting these variables may influence overall positive dispositions towards future e-cigarette use. Number of friends using e-cigarettes was also associated with greater post-manipulation Willingness and Intention, which fits in with previous research showing that familiarity with cigarettes is correlated with smoking behavior (e.g. Titus-Ernstoff et al. 2008, Hill et al. 2005). This finding suggests that regardless of specific condition, message exposure led individuals with a greater number of friends who use e-cigarettes to report higher Willingness and Intention ratings (as compared to the remainder of participants). In addition, higher Need for Cognition was negatively associated with post-manipulation Intention scores in all conditions. Contrary to the hypothesis that Need for Cognition would produce different interactions with exposure to the Caution and Replacement messages, this finding suggests that individuals higher Need for Cognition reported lower Intention ratings (as compared to the remainder of participants) regardless of specific condition.

Sensation seeking and rebelliousness were examined as part of aim 2 and no significant effects were observed for these variables. Sensation seeking was expected to predict willingness and intention due to its consistent association with smoking behaviors in adolescents (e.g. Urbán, 2010; Pokhrel, Sussman and Stacy, 2014). Because

sensation seeking has been shown to predict onset of smoking behavior in the past (e.g. de Leeuw, Sargent, Stoolmiller, Scholte, Engels, and Tanski, 2011; Spillane, Muller, Noonan, Goins, Mitchell and Manson, 2012), it was thought that the construct would be useful in predicting Willingness and Intention to engage in first-time e-cigarette use. However, the association between smoking and sensation seeking has been primarily observed in adolescents and the construct may be less relevant in predicting onset of nicotine use among older populations, such as young adults.

The hypotheses that individuals high on self-reported rebelliousness would exhibit reduced manipulation effects were not supported by the data; thus, it appears that this construct did not interact with the effects of the e-cigarette messages examined in this study. Because mean ratings of Intention and Willingness were generally low and negatively skewed, it is also possible manipulation effects were too small to detect significant interaction with Rebelliousness.

Aim 3

Aim 3 explored the inter-relatedness of the explicit and implicit measures used to assess dispositions towards e-cigarettes (i.e. pre- and post-manipulation Willingness and Intention, the Behavioral Willingness Task and IAT approach and avoidance scores). As hypothesized, Willingness, Intention and Behavioral Willingness responses all showed positive correlations with one another. Although no condition effects were detected for the Intention questionnaire and the Behavioral Willingness Task, these measures correlated with one another and with Willingness scores, indicating an inter-relatedness of the three constructs. Contrary to the hypothesis for aim 3, implicitly assessed approach and avoidance attitudes measured through the paper format IAT did not correlate well with Willingness, Intention and the Behavioral Willingness Task. This lack of substantial correlation may be explained by the fact that explicit and implicit measures can account for unique variance in future behavior (Reich, Below and

Goldman, 2010). However, given the previously discussed concern that the specific IAT format used in this study was not effective for capturing message exposure effects on participants, it is also possible that the IAT task used in this study did not capture dispositions relevant to future use and did not correlate well with the other measures for this reason.

Aim 4

Aim 4 was an exploratory aim intended to inform future message development efforts by characterizing participants' subjective impressions of the messages they viewed. Participants' responses on the message rating questionnaire indicated acceptable ratings for all three messages but also showed the Caution message was more well-liked than the Control message. In contrast, the Replacement message was not rated more positively than the Control message. These findings merge well with the findings that the Caution message influenced participants' disposition towards trying e-cigarettes (i.e. Willingness) whereas the Replacement message did not. However, because participants completed the post-manipulation Willingness questionnaire prior to the message rating questionnaire, it is possible that answering the Willingness measure influenced participants' later responses on the message rating questionnaire.

Participants' responses to open-ended questions shed further light on how the information in the Caution and Replacement messages was received by participants. The Caution and Replacement messages used potentially misleading phrasing common to the messages of critics and supporters of e-cigarettes, including use of insinuation through reference to what "could" or "may" be true in a manner strongly suggesting the statement was indeed true (e.g. "all the evidence suggests e-cigarettes are much safer than regular cigarettes" or "e-cigarettes... might even be as dangerous as smoking"). The influence of these insinuations can be seen in participants' reporting of the central message in the presentation they viewed. A subset of participants in both the Caution

and Replacement conditions remembered the message themes in absolute terms (e.g. “e-cigarettes are safe” or “e-cigarettes are just as bad as smoking”). Overgeneralization of message content was twice as common among participants in the Caution condition, adding to the observation that this message exerted the strongest effect on participants. These findings highlight the need for future message development initiatives to make a concerted effort to avoid insinuation and reduce message bias so as to responsibly communicate information regarding e-cigarette use and avoid further spreading of misinformation.

Responses to the open-ended questions inquiring what participants disliked about the presentation and what improvements they would recommend indicated participants frequently perceived the messages they viewed as biased and unbalanced and recommended improving these messages by having both sides of the debate more equally represented. In fact, participants in all conditions reported disagreement with the messages they viewed, and this was taken as evidence of the highly charged nature of the e-cigarette debate. Participants also recommended improving message credibility by including additional charts, statistics, and references to specific studies. These findings highlight the need for future messages to place greater emphasis on ensuring message credibility. It is therefore important that future message development efforts should not only contain factually correct information but should take pains to clearly and explicitly reference specific findings so as to dispel misunderstandings regarding these products.

Implications and future directions

Participants’ responses to the *Open-Ended Questionnaire* items (aim 4) highlight the prevalence of misinformation regarding e-cigarettes and support Duke et al.’s (2014) assertion that public health efforts should be made to educate the general public regarding the risks and benefits of e-cigarettes. It is essential to both warn non-smokers about the dangers of e-cigarette use and encourage smokers who are unable to quit to

replace smoking with e-cigarette use. With respect to younger populations, there is cause for optimism regarding dissemination of such messages, given that exposure to anti-smoking advertisements has been shown to negatively correlate with smoking initiation (Wakefield, Flay, Nichter & Giovino, 2003). The need for disseminating this information is made even greater with the FDA's recent deeming of e-cigarettes as subject to regulation as tobacco products (Food and Drug Administration, 2016). Although these upcoming regulations are expected to restrict the marketing, sale and distribution of e-cigarettes, they will also effectively cement e-cigarettes' place as widely available recreational nicotine products, removing the possibility these products will be taken off the market.

The findings that Caution message exposure exerted its intended effect while Replacement message exposure did not exert substantial unintended effects suggests that elements from both message types could be merged to create a message that would convey important information regarding e-cigarettes in a balanced and credible manner. Whether such a combined message would have the desirable effects is an empirical question that cannot be answered based on the data collected in this study. Nevertheless, these findings suggest the creation of such a message is a potentially fruitful research direction worthy of future exploration.

Such combined messages could still retain a focus on advocating caution or replacement (depending on the target audience), but also include elements from the other message type to create an honest and thorough characterization of these products. Cautionary messages meant to dissuade non-smokers from using e-cigarettes could benefit from the inclusion of replacement elements (such as the fact that most researchers believe using e-cigarettes is much less dangerous than smoking). This would help temper the caution message's severity and potentially curb the spread of misperceptions about e-cigarettes being as harmful as conventional cigarettes. Similarly,

Replacement messages meant to advocate e-cigarette use as an alternative to smoking could benefit from the inclusion of cautionary elements such as clarifying known risks of e-cigarette use (e.g. nicotine dependence) as well as the potential for other, currently unknown risks. Inclusion of these elements would prevent the message from creating an unrealistically positive impression of e-cigarettes and would thereby further reduce the risks of unintentionally motivating non-smokers to try these products.

Future message development efforts would also benefit from the development of multiple distinct messages to allow for investigation of repeated message exposure and increase external validity by more accurately reflecting real-world conditions (e.g. repeated viewings of a short prevention message aired on television during commercials). The effects of repeated message exposures should be investigated using thorough examination of dispositions towards e-cigarette use before and after these exposures, to accurately evaluate the strength and suitability of these messages for wide dissemination. Relatedly, message effects should be tested both directly after message viewing and at a later point (e.g. at a one week follow-up study session) to examine its short-term and long-term efficacy in communicating relevant information and influencing dispositions regarding future e-cigarette use.

As mentioned above, the finding that previous experience using nicotine products and having friends who use e-cigarettes led to higher willingness and intention to try e-cigarettes, while significant at the .05 level, did not meet the adjusted alpha criteria for those analyses. Nevertheless these findings suggest it may be useful to tailor prevention efforts to younger populations who are less likely to have been exposed to friends using e-cigarettes or to have previous experience using nicotine. In general, the development of e-cigarette messages for wide dissemination should involve thorough examination of message effects on all relevant populations including individuals from different age groups (i.e. adolescents, young-adults and older adults) as well as

individuals with different histories of nicotine product use (i.e. non-smokers, e-cigarette never users, current and past smokers, current and past e-cigarette users and dual users). Such an examination of message effects on members of different demographic groups would enable the creation of messages that are proven to exert the desired effects on specific populations without exerting unintended effects on members of other populations (which would inevitably be exposed to these messages as a result of wide dissemination efforts). It is especially important for future research efforts to explore which populations are at greatest risk for initiation of recreational e-cigarette use and to subsequently examine message effects on members of these at-risk populations.

Future examinations of e-cigarette message effects should emphasize the use of different assessment measures based on their relevance to the population being examined. Willingness and e-cigarette expectancy questionnaires were the most useful measures for characterizing the effects of this study's messages in a population of young adult non-smokers and e-cigarette never-users. However, the current study examined the effects of unique e-cigarette messages on a relatively narrow range of the population, and some of the observed effects may be specific to this study. Future investigations should further explore the utility of these measures in examining the effects of different e-cigarette messages on a more diverse sample.

Although data from the Intention questionnaire did not reveal significant differences between conditions in this study, assessment of intention still has the potential for detecting message effects under different circumstances. Individuals with previous experience using cigarettes and/or e-cigarettes are less likely to consistently report minimal intentions to use e-cigarettes, which could be reasonably expected to lead to greater variation in response range and thereby allow for detection of potential message effects.

Investigations of message effects among smokers and e-cigarette users could also benefit from direct assessment of participants' willingness to accept and/or use an e-cigarette at the conclusion of the study, as this would allow for direct observation of message effects on behavior. Future investigations of e-cigarette message effects would also benefit from the inclusion of open-ended questionnaires exploring participants' subjective opinion of the messages (e.g. message acceptability, message understanding etc.), as these questions were highly informative in this study and are likely to shed light on message effects regardless of the population in question.

Finally, the finding that exposure to the Caution and Replacement messages influenced participants' attitudes towards e-cigarette use (as seen in the differences on the Willingness and expectancy questionnaires as well as the IAT) begs the question: Which elements of these messages promoted this observed attitude change? Future investigations should employ content analysis of messages to determine what about the messages brought on observed changes. Investigating this aspect of message effects will help identify the most impactful components of messages under development and will help in the creation of more effective interventions in the future.

Limitations

The study had several limitations. One central limitation of this study was the examination of the effects of a single, rather than repeated, message exposure. Because this study was the first to investigate the influence of Caution and Replacement messages on young adult non-smokers, it was designed to maximize internal validity and indeed was successful in showing in-lab effects of message exposure. However, the study did not accurately replicate the sequence of message exposures experienced by individuals in real-world settings, and therefore external validity can be considered a weakness in the present study. As discussed above, future studies would benefit from

exploring effects of repeated message exposure and establishing whether such exposure yields lasting change in dispositions towards e-cigarettes.

In addition, the three messages examined in this study varied in number of slides and presentation time (see Appendix O). The lack of exact match on presentation time and slide number is a limitation of the study and reduces the study's internal validity. Future message development efforts should emphasize matching presentation length and slide number to ensure that observed presentation effects are not due to differences in the amount of exposure time between the messages.

Another study limitation was the focus on only exploring the effects of e-cigarette messages on young adult non-smokers. The focus on this population was intended as a first step towards determining if developing public health e-cigarette messages for wide dissemination was a viable possibility that would not cause more damage than it prevented (i.e. by influencing non-smokers to try e-cigarettes and thereby potentially contributing to the spread of nicotine dependency in the general population). While necessary for the goals of this study, the focus on young-adult non-smokers made it so the study may have captured a population at little to no risk of initiating recreational e-cigarette use or use of any other nicotine products. For this reason, the Replacement message may have been essentially irrelevant for participants in this study, which may explain the paucity of findings for participants in the Replacement condition.

Furthermore, study participants were predominantly females, limiting to some degree the ability to generalize this study's findings to male young adult non-smokers. Because the majority of participants in this study were volunteers recruited from psychology undergraduate classes (which typically have a larger proportion of female students), efforts to recruit equal numbers of male and female participants were unsuccessful. Future studies on this topic should therefore emphasize equal or near-

equal recruitment of individuals of both genders so as to produce more externally valid data.

In addition, the fact that male young-adults were underrepresented in this study may have led to more modest effect sizes, especially for the Replacement message, given that prevalence rates of tobacco use are typically higher among males than females (Higgins, Kurti & Redner et al., 2015). Focused research attention on male populations may be warranted as well given their higher risk for tobacco use.

The focus on young-adult non-smokers also led to the exclusion of individuals from other relevant populations, such as high school and middle school students. It is especially important for future research efforts to investigate the effects of e-cigarette messages on younger non-smoking populations and certify that exposure to these messages will not have the unintended effect of increasing their likelihood of future e-cigarette use.

Another study limitation was the potential for demand effects on the post-manipulation Willingness, Intention and expectancy measures. Given that two of the three message conditions took strong and explicit stances for or against e-cigarettes, it is possible that participants felt an expectation to respond to the post-manipulation measures in a manner consistent with the content of the message they viewed. Future evaluations of message effects should therefore take pains to avoid demand effects. To this end, it may be beneficial to conduct pre-manipulation assessment on a separate day, so as to avoid presenting participants with the same measures (i.e. Willingness and Intention questionnaires) immediately before and after viewing the e-cigarette messages. Presenting participants with separate Caution and Replacement messages within a single experimental session will likely reduce perceived experimental demand as well.

Finally, this study was partially exploratory in nature and therefore involved the examination of numerous hypotheses. The testing of multiple hypotheses frequently required adjustments of significance levels and several effects that were significant at the .05 level were rendered non-significant by these adjustments. Therefore, the study was underpowered to detect several of the hypothesized effects. This was especially true for the examination of between-condition differences in paper IAT scores (which are known to show only small effect sizes; Lemm, Lane & Sattler et al., 2008) and the use of regression analyses to examine interactions between individual difference variables and message effects (which frequently require much larger sample sizes than the one used in this study; Champoux & Peters, 1987). Therefore, several of the message effects reported in this study would require additional examination before they can be established as non-spurious effects. These include the between-condition differences observed for Replacement participants' IAT avoidance scores, Caution participants' expectancy factor scores as well as reported effects for the following individual difference variables: History of nicotine use, number of friends using e-cigarettes and Need for Cognition.

Conclusion

Given the wide prevalence of e-cigarette ever-use (e.g. McMillen, Gottlieb, Shaefer, Winickoff & Klein, 2015), there is a need to educate the general public about these products. It is also necessary to create tailored cautionary messages to adolescent and young-adults, as members of these populations are reporting using e-cigarettes at increasingly larger rates (e.g. McMillen, Gottlieb, Shaefer, Winickoff & Klein, 2015). On the one hand, there is a need to alert adolescent and young adult non-smokers that these products aren't benign and could cause nicotine addiction. On the other hand, there is a need to inform current smokers that e-cigarettes are currently considered far less harmful than conventional cigarettes and could serve as a healthier

alternative for smokers who are unable or unwilling to quit nicotine entirely (e.g. Hajek, Etter, Benowitz, Eissenberg, and McRobbie, 2014).

The findings from this study indicated that acute exposure to e-cigarette caution messages was successful in reducing willingness to use e-cigarettes while exposure to a replacement message only had minor unintended effects on participants' attitudes towards e-cigarettes. And so, it can be said that the Replacement message did not affect participants in a manner opposite to the Caution message's effect (and vice versa). It is therefore possible that Caution and Replacement message elements could be combined into a single message without detracting from each other's effects. Such a message would address the issue of e-cigarette use in a balanced and responsible manner, which could conceivably make the message more credible and effective. Future message development efforts may therefore benefit from creating and subsequently testing the effects of messages containing both caution and replacement themes.

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APPENDICES

Appendix A: Demographic questionnaire

1. What gender do you identify as?

- a. Male
- b. Female
- c. Other

2. What is your age?

3. What is your ethnicity?

- a. Caucasian
- b. African American
- c. Hispanic
- d. Asian
- e. Other

4. What year in college are you?

- a. First
- b. Second
- c. Third
- d. Fourth or higher

Appendix B: Brief sensation seeking scale (BSSS)

Experience seeking

1. I would like to explore strange places. (Agree / Disagree)
5. I would like to take off on a trip with no pre-planned routes or timetables. (Agree / Disagree)

Boredom susceptibility

2. I get restless when I spend too much time at home. (Agree / Disagree)
6. I prefer friends who are excitingly unpredictable. (Agree / Disagree)

Thrill and adventure seeking

3. I like to do frightening things. (Agree / Disagree)
7. I would like to try bungee jumping. (Agree / Disagree)

Disinhibition

4. I like wild parties. (Agree / Disagree)
8. I would love to have new and exciting experiences, even if they are illegal. (Agree / Disagree)

Appendix C: Exposure to electronic cigarettes

How many times have you seen someone using an e-cigarette?

0 1-5 6-10 11-20 More than 20

How many times have you seen commercials for electronic cigarettes on tv, on the internet or anywhere else?¹

0 1-5 6-10 11-20 More than 20

How many of your friends use electronic cigarettes?

0 1-2 3-5 6-10 More than 10

How many of your close relatives (parents, siblings etc.) use electronic cigarettes?

0 1-2 3-5 6-10 More than 10

Appendix D: History of nicotine use

How many cigarettes have you smoked in your life?

0 1 2-5 5-10 11-20 21-50 51-100 100+

Have you smoked a cigarette during the past 30 days? Yes No

Has there ever been a time when you smoked at least one cigarette a day, every day, for a week? Yes No

How many times have you used electronic-cigarettes, e-hookahs and/or vape-pens?

0 1 2-5 5-10 11-20 21-50 51-100 100+

Have you used any of these products during the past 30 days? Yes No

Has there ever been a time when used any of these products ate least once a day, every day, for a week? Yes No

How many times have you smoked cigars, cigarillos, filtered cigars and/or tobacco pipes?

0 1 2-5 5-10 11-20 21-50 51-100 100+

Have you used any of these products during the past 30 days? Yes No

Has there ever been a time when used any of these products ate least once a day, every day, for a week? Yes No

How many times have you smoked hookah?

0 1 2-5 5-10 11-20 21-50 51-100 100+

Have you smoked hookah during the past 30 days? Yes No

Has there ever been a time when you smoked hookah at least once a day, every day, for a week? Yes No

How many times have you used snus pouches, dissolvable tobacco, chewing tobacco and/or snuff?

0 1 2-5 5-10 11-20 21-50 51-100 100+

Have you used any of these products during the past 30 days? Yes No

Has there ever been a time when used any of these products ate least once a day, every day, for a week? Yes No

How many times have you used nicotine patches/nicotine gum/nicotine inhaler/nicotine nasal spray/nicotine lozenge?

0 1 2-5 5-10 11-20 21-50 51-100 100+

Have you used any of these products during the past 30 days? Yes No

Has there ever been a time when used any of these products ate least once a day, every day, for a week? Yes No

Appendix E: Need for cognition scale

For each of the following statements, please indicate whether or not the statement is characteristic of you. If the statement is extremely uncharacteristic of you (not at all like you) place a "1" on the line to the left of the statement. If the statement is extremely characteristic of you (very much like you) place a "5" on the line. You should use the following scale as you rate each of the statements.

1-----2-----3-----4-----5
extremely somewhat uncertain somewhat
extremely uncharacteristic characteristic
uncharacteristic characteristic

- _____ 1. I prefer complex to simple problems.
- _____ 2. I like to have the responsibility of handling a situation that requires a lot of thinking.
- _____ 3. Thinking is not my idea of fun.
- _____ 4. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities.
- _____ 5. I try to anticipate and avoid situations where there is a likely chance I will have to think in depth about something.
- _____ 6. I find satisfaction in deliberating hard for long hours.
- _____ 7. I only think as hard as I have to.
- _____ 8. I prefer to think about small daily projects to long-term ones.
- _____ 9. I like tasks that require little thought once I've learned them.
- _____ 10. The idea of relying on thought to make my way to the top appeals to me.
- _____ 11. I really enjoy a task that involves coming up with new solutions to problems.
- _____ 12. Learning new ways to think doesn't excite me much.
- _____ 13. I prefer my life to be filled with puzzles that I must solve.
- _____ 14. The notion of thinking abstractly is appealing to me.
- _____ 15. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.
- _____ 16. I feel relief rather than satisfaction after completing a task that required a lot of mental effort.
- _____ 17. It's enough for me that something gets the job done; I don't care how or why it works.
- _____ 18. I usually end up deliberating about issues even when they do not affect me personally.

Appendix F: The Negativism-dominance scale- proactive negativism subscale

When you are told that you are breaking a rule (for example, “no taking pictures”), is your first reaction to:

- a. Stop breaking the rule any further
- b. Go ahead and still break the rule
- c. not sure

“I enjoy the thrill I get from being difficult and awkward.” Do you

- a. agree
- b. disagree
- c. not sure

Do you find it exciting to do something “shocking”?

- a. Yes, often
- b. No, hardly ever
- c. not sure

If you are asked particularly NOT to do something, do you feel an urge to do it?

- a. No, hardly ever
- b. Yes, often
- c. not sure

Do you tease people unnecessarily just to have some fun at their expense?

- a. Yes, often
- b. No, hardly ever
- c. not sure

How often do you do something you shouldn't just to get some excitement?

- a. Not often at all
- b. often
- c. not sure

How often do others say that you are a difficult person?

- a. rarely
- b. often
- c. not sure

Appendix G: Intention to try electronic cigarettes

The following questions ask about your intentions to use or avoid e-cigarettes in the future. Please read the questions then circle the response that best represents your future intentions

1. Do you intend to use electronic cigarettes in the future?

1	2	3	4	5
Definitely No	Probably No	Maybe	Probably Yes	Definitely Yes

2. Do you intend to use electronic cigarettes in the next year?

1	2	3	4	5
Definitely No	Probably No	Maybe	Probably Yes	Definitely Yes

3. Do you intend to avoid using electronic cigarettes?

1	2	3	4	5
Definitely No	Probably No	Maybe	Probably Yes	Definitely Yes

Appendix H: Willingness to try electronic cigarettes

Suppose you were with a close friend and they offered you to try their electronic cigarette, would you accept?

1	2	3	4	5
definitely no	probably no	maybe	probably yes	definitely yes

Suppose you were at a party or a concert with a group of friends, and someone offered you to try their electronic cigarette. Would you try it?

1	2	3	4	5
definitely no	probably no	maybe	probably yes	definitely yes

Suppose you were at a gas station, and the clerk told you they were giving free samples of electronic cigarettes as a promotional offer, would you accept a free e-cigarette?

1	2	3	4	5
definitely no	probably no	maybe	probably yes	definitely yes

Do you think you might be willing to try electronic cigarettes, under the right circumstances?

1	2	3	4	5
definitely no	probably no	maybe	probably yes	definitely yes

10.	Have a good taste	1	2	3	4	5	6	7	8	9	10
11.	Have bad breath	1	2	3	4	5	6	7	8	9	10
12.	Have good breath	1	2	3	4	5	6	7	8	9	10
13.	Look cool	1	2	3	4	5	6	7	8	9	10
14.	Look awkward	1	2	3	4	5	6	7	8	9	10
15.	Become more popular	1	2	3	4	5	6	7	8	9	10
16.	Look unpleasant	1	2	3	4	5	6	7	8	9	10
17.	Damage your health	1	2	3	4	5	6	7	8	9	10
18.	Increase your chances of being liked by friends	1	2	3	4	5	6	7	8	9	10
19.	Increase your chances of being liked by members of the opposite sex	1	2	3	4	5	6	7	8	9	10
20.	Feel less stressed	1	2	3	4	5	6	7	8	9	10
21.	Feel less bored	1	2	3	4	5	6	7	8	9	10
22.	Hurt your lungs	1	2	3	4	5	6	7	8	9	10
23.	Feel relaxed	1	2	3	4	5	6	7	8	9	10

		10
24.	Burn your mouth	1 2 3 4 5 6 7 8 9 10
25.	Hurt your throat	1 2 3 4 5 6 7 8 9 10
26.	Make life less dull	1 2 3 4 5 6 7 8 9 10
27.	Look more sophisticated	1 2 3 4 5 6 7 8 9 10
28.	Become less popular	1 2 3 4 5 6 7 8 9 10
29.	Enjoy "smoking" indoors	1 2 3 4 5 6 7 8 9 10
30.	Feel controlled by e-cigarettes	1 2 3 4 5 6 7 8 9 10
31.	Have less spending money	1 2 3 4 5 6 7 8 9 10
32.	Enjoy the company of smokers without really smoking	1 2 3 4 5 6 7 8 9 10
33.	Have more spending money	1 2 3 4 5 6 7 8 9 10
34.	Look more attractive	1 2 3 4 5 6 7 8 9 10
35.	Belong to an exclusive group	1 2 3 4 5 6 7 8 9 10

36.	Die prematurely	1	2	3	4	5	6	7	8	9	10
37.	Make it harder to quit smoking	1	2	3	4	5	6	7	8	9	10
38.	"Smoke" with family members' approval	1	2	3	4	5	6	7	8	9	10
39.	Begin smoking tobacco cigarettes	1	2	3	4	5	6	7	8	9	10
40.	Fit in better with friends	1	2	3	4	5	6	7	8	9	10
41.	Increase your status	1	2	3	4	5	6	7	8	9	10
42.	Become addicted to e-cigarettes	1	2	3	4	5	6	7	8	9	10
43.	Get lung cancer	1	2	3	4	5	6	7	8	9	10
44.	Enjoy many different flavors	1	2	3	4	5	6	7	8	9	10
45.	Quit smoking	1	2	3	4	5	6	7	8	9	10
46.	Enjoy "smoking" without attracting negative attention	1	2	3	4	5	6	7	8	9	10
47.	Look embarrassing	1	2	3	4	5	6	7	8	9	10
48.	Feel healthier	1	2	3	4	5	6	7	8	9	10
49.	Improve your ability to perform physical activities	1	2	3	4	5	6	7	8	9	10
50.	Enjoy "smoking" without	1	2	3	4	5	6	7	8	9	10

	bothering others	10
51.	Make friends more easily	1 2 3 4 5 6 7 8 9 10
52.	Enjoy "smoking" in the company of non-smoking friends	1 2 3 4 5 6 7 8 9 10

Appendix J: Paper IAT- e-cigarette form

This task asks you to read each word in the list below and decide which category it belongs to. If the word is either related to e-cigarettes or if it is related to the word “approach”, put a check mark next to the circle on the left column. If the word is either related to cigarettes or if it is related to the word “avoid”, put a check mark next to the circle on the right column. Please wait until the experimenter asks you to begin, then categorize the words in order.

E-cigarettes Approach		Cigarettes Avoid
<input type="radio"/>	Propylene glycol	<input type="radio"/>
<input type="radio"/>	Retreat	<input type="radio"/>
<input type="radio"/>	Vape	<input type="radio"/>
<input type="radio"/>	Battery	<input type="radio"/>
<input type="radio"/>	Toward	<input type="radio"/>
<input type="radio"/>	Smoke	<input type="radio"/>
<input type="radio"/>	Away	<input type="radio"/>
<input type="radio"/>	E-juice	<input type="radio"/>
<input type="radio"/>	Coil	<input type="radio"/>
<input type="radio"/>	Withdraw	<input type="radio"/>
<input type="radio"/>	Forward	<input type="radio"/>
<input type="radio"/>	Escape	<input type="radio"/>
<input type="radio"/>	Closer	<input type="radio"/>
<input type="radio"/>	Arrive	<input type="radio"/>
<input type="radio"/>	Lighter	<input type="radio"/>
<input type="radio"/>	Advance	<input type="radio"/>
<input type="radio"/>	Tobacco	<input type="radio"/>
<input type="radio"/>	Leave	<input type="radio"/>
<input type="radio"/>	Carbon monoxide	<input type="radio"/>
<input type="radio"/>	Filter	<input type="radio"/>

E-cigarettes Approach		Cigarettes Avoid
<input type="radio"/>	Advance	<input type="radio"/>
<input type="radio"/>	Carbon monoxide	<input type="radio"/>
<input type="radio"/>	Arrive	<input type="radio"/>
<input type="radio"/>	Forward	<input type="radio"/>
<input type="radio"/>	Withdraw	<input type="radio"/>
<input type="radio"/>	Toward	<input type="radio"/>
<input type="radio"/>	E-juice	<input type="radio"/>
<input type="radio"/>	Away	<input type="radio"/>
<input type="radio"/>	Vape	<input type="radio"/>
<input type="radio"/>	Coil	<input type="radio"/>
<input type="radio"/>	Smoke	<input type="radio"/>
<input type="radio"/>	Filter	<input type="radio"/>
<input type="radio"/>	Tobacco	<input type="radio"/>
<input type="radio"/>	Retreat	<input type="radio"/>
<input type="radio"/>	Leave	<input type="radio"/>
<input type="radio"/>	Battery	<input type="radio"/>
<input type="radio"/>	Escape	<input type="radio"/>
<input type="radio"/>	Propylene glycol	<input type="radio"/>
<input type="radio"/>	Closer	<input type="radio"/>
<input type="radio"/>	Lighter	<input type="radio"/>

You will now categorize the same words again, but the location of the “e-cigarettes” and “cigarettes” categories has been switched. On this page, put a check mark next to the circle on the left column if the word is either related to cigarettes or if it is related to “approach”. Put a check mark next to the circle on the right column if the word is either related to e-cigarettes or if it is related to “avoid”. Please wait until the experimenter asks you to begin.

Cigarettes Approach		E- cigarettes Avoid
<input type="radio"/>	Tobacco	<input type="radio"/>
<input type="radio"/>	Carbon monoxide	<input type="radio"/>
<input type="radio"/>	Vape	<input type="radio"/>
<input type="radio"/>	Battery	<input type="radio"/>
<input type="radio"/>	Filter	<input type="radio"/>
<input type="radio"/>	E-juice	<input type="radio"/>
<input type="radio"/>	Toward	<input type="radio"/>
<input type="radio"/>	Withdraw	<input type="radio"/>
<input type="radio"/>	Arrive	<input type="radio"/>
<input type="radio"/>	Propylene glycol	<input type="radio"/>
<input type="radio"/>	Advance	<input type="radio"/>
<input type="radio"/>	Coil	<input type="radio"/>
<input type="radio"/>	Escape	<input type="radio"/>
<input type="radio"/>	Smoke	<input type="radio"/>
<input type="radio"/>	Forward	<input type="radio"/>
<input type="radio"/>	Retreat	<input type="radio"/>
<input type="radio"/>	Leave	<input type="radio"/>
<input type="radio"/>	Closer	<input type="radio"/>
<input type="radio"/>	Lighter	<input type="radio"/>
<input type="radio"/>	Away	<input type="radio"/>

Cigarettes Approach		E- cigarettes Avoid
<input type="radio"/>	Retreat	<input type="radio"/>
<input type="radio"/>	Vape	<input type="radio"/>
<input type="radio"/>	Coil	<input type="radio"/>
<input type="radio"/>	Forward	<input type="radio"/>
<input type="radio"/>	Closer	<input type="radio"/>
<input type="radio"/>	E-juice	<input type="radio"/>
<input type="radio"/>	Propylene glycol	<input type="radio"/>
<input type="radio"/>	Leave	<input type="radio"/>
<input type="radio"/>	Smoke	<input type="radio"/>
<input type="radio"/>	Away	<input type="radio"/>
<input type="radio"/>	Battery	<input type="radio"/>
<input type="radio"/>	Lighter	<input type="radio"/>
<input type="radio"/>	Tobacco	<input type="radio"/>
<input type="radio"/>	Advance	<input type="radio"/>
<input type="radio"/>	Escape	<input type="radio"/>
<input type="radio"/>	Toward	<input type="radio"/>
<input type="radio"/>	Arrive	<input type="radio"/>
<input type="radio"/>	Carbon monoxide	<input type="radio"/>
<input type="radio"/>	Withdraw	<input type="radio"/>
<input type="radio"/>	Filter	<input type="radio"/>

Appendix K: Message rating questionnaire

The following questions ask for your opinion of the presentation you saw. Please indicate your response to each question by circling the appropriate response on a scale of 1 (not at all) to 4 (very much)

		Not at all	Somewhat no	Somewhat yes	Very much
1	Was the presentation's message relevant to you?	1	2	3	4
2	Was the information in the presentation useful to you?	1	2	3	4
3	Did the presentation hold your attention?	1	2	3	4
4	Was the presentation easy to follow the?	1	2	3	4
5	Was the presentation interesting?	1	2	3	4
6	Did you feel any of the information in the presentation was inaccurate or misleading?	1	2	3	4
7	Do you feel like the presentation reported the facts in an honest and accurate manner?	1	2	3	4
8	Did the presentation seem credible to you?	1	2	3	4
9	Do you feel like the presentation made good points overall?	1	2	3	4
10	Do you feel like the issues brought up in the presentation were important?	1	2	3	4
11	Was the presentation convincing?	1	2	3	4

Appendix M: Behavioral willingness task

Future Research Opportunity

Thank you for your participation in this study. We would like to know if you are willing to participate in a future study regarding e-cigarettes. This new study would involve receiving an e-cigarette for at-home use, though actual use of the e-cigarette will be optional. Please indicate below whether you would be willing to be contacted about participating in this new study. Because the study is still under development, we do not yet know when it will begin or what compensation will be provided.

Please circle one of the options below:

1. Yes I agree to be contacted about the study

2. I would rather not be contacted about this study

Appendix N: Audiovisual presentation text and slides


Control Slides 1-6

Electronic Cigarettes



1

- Over the past decade, new products called electronic cigarettes or “e-cigarettes” have become available for purchase in the United States
- This presentation is meant to describe and explain the variety of products known as “e-cigarettes”





2

- E-cigarettes are known by several names including “vape-pens”, “vape pipes”, “e-hookas” and “hooka pens”
- These terms all describe the same broad type of product, a battery-powered device that produces nicotine vapor


3

- E-cigarette users, or “vapers”, inhale the vapor much like cigarette smoke
- Because of this, using e-cigarettes is called “vaping”



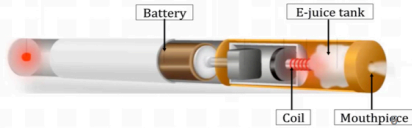
4

- The term “e-cigarette” describes a large category of products
- Different kinds of e-cigarettes vary in shape, size and design



5

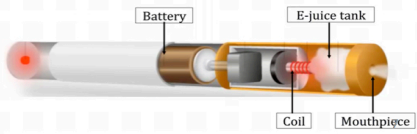
- However, all e-cigarettes work on the same principle: creating vapor by heating a liquid nicotine solution called “e-juice”
- This process can be seen in the diagram below



6

Control Slides 7-12

- The battery activates the coil, which heats up inside the e-juice tank
- The heat turns the e-juice into vapor, which is then inhaled through the mouthpiece



- E-juice usually contains four ingredients:
 - Nicotine
 - Propylene glycol
 - Vegetable glycerin
 - Flavor additives



8

- E-juice is available in a wide selection of nicotine strengths, usually ranging from 3 to 24 mg of nicotine
- However, e-juice doesn't have to contain nicotine and most e-juice and e-cigarette brands sell zero nicotine e-juice as well

9

- Because nicotine does not vaporize well by itself, e-juice also contains propylene glycol and vegetable glycerin
- These additional ingredients help the vaporization process



10

- Nicotine, propylene glycol and vegetable glycerin are mostly flavorless, so food-grade flavoring is usually added to e-juice
- E-juice is available in many flavors, including tobacco, drink and food flavors

11

E-cigarettes fall into two broad categories: disposable e-cigarettes and rechargeable e-cigarettes



12

Control Slides 13-18

- Disposable e-cigarettes come pre-filled with e-juice and last about a day
- Many disposable e-cigarettes are made to look like regular cigarettes and are sometimes called "cig-a-likes"



13

- However, not all cig-a-likes are disposable and some companies produce rechargeable cig-a-likes
- As suggested by their name, the batteries in these products can be recharged, and so rechargeable e-cigarettes last longer than disposables



14

- In addition, rechargeable e-cigarettes are not pre-filled with e-juice
- Rechargeable e-cigarette users purchase e-juice separately and fill their e-cigarette with it on their own



15

- Rechargeable and disposable e-cigarettes are made of the same basic parts: a battery, e-juice tank and heating coil
- But rechargeable e-cigarettes can be taken apart and vapers separately purchase and replace the battery, tank and heating coil in their e-cigarette



16

Vapers who use rechargeable e-cigarettes select parts from a large variety of batteries, e-juice tanks and heating coils



17

Batteries for rechargeable e-cigarettes vary in size, how long they last and how much voltage or "power" they can produce



18

Control Slides 19-22

- Rechargeable e-cigarettes also require vapers to select an e-juice tank, or “cartomizer”, from a large variety of available products
- Different cartomizers vary in how much e-juice they can hold and in volume and density of vapor they produce



19

- Rechargeable e-cigarettes also require vapers to select the type of heating coils they use
- Coils are available in an assortment of designs that fit into different types of e-juice tanks
- Coils also vary in how much heat they produce



20

- In summary, there is a great deal of variety in the different products that can be called “e-cigarettes”
- These products vary in design, how long they can be used for and in the volume, density and taste of the vapor they produce

21

Thank you for watching

We hope this presentation has been informative and helpful to you



22

Replacement Slides 1-6

Electronic Cigarettes
A safe alternative to smoking or a dangerous new product?




1

Cigarettes are the cause of nearly half a million deaths in the US each year




2

Although the dangers of smoking are well-known, over 40 million US adults still smoke





3

- Smoking can be difficult to quit
- The nicotine in cigarettes is highly addictive



4

Nicotine replacement products like patches and gum were developed to help smokers quit



5

- Electronic-cigarettes (often called e-cigarettes, vape-pens or e-hookas) recently emerged as another possible alternative to smoking
- But these products are very controversial



6

Replacement Slides 7-12

- Supporters of e-cigarettes believe these products are safe smoking alternatives that can help millions quit




- Critics of e-cigarettes believe these products are unsafe and ineffective for quitting



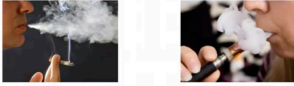
7

Before deciding what you think of e-cigarettes, it is important to understand how these products work




8

- E-cigarettes are battery-powered devices that produce nicotine vapor
- E-cigarette users, or “vapers”, inhale the vapor much like cigarette smoke
- Because of this, using e-cigarettes is called “vaping”



9

E-cigarettes come in different shapes and sizes, but they all work on the same principle; creating nicotine vapor by heating a liquid nicotine solution called “e-juice”



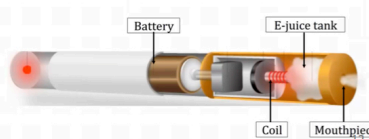
10

- E-juice contains two additional ingredients that help vaporize the nicotine:
 - Propylene glycol
 - Vegetable glycerin



11

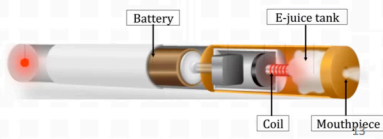
This is a diagram of the inside of one type of e-cigarette



12

Replacement Slides 13-18

- The battery activates the coil, which heats up inside the e-juice tank
- The heat turns the e-juice into vapor, which is then inhaled through the mouthpiece



- Because e-cigarettes are new and have not been studied for very long, many critics fear that e-cigarettes could have negative effects that have not been discovered yet
- Some critics even warn that vaping could be as dangerous as smoking



- But e-cigarettes are designed to be safer, they produce vapor which cuts out exposure to the dangerous toxins found in cigarette smoke
- Indeed, millions of US adults have already used e-cigarettes without reporting any serious negative effects



15

- In addition, there is little reason to suspect harmful effects from the major ingredients of e-juice: Nicotine, propylene glycol and vegetable glycerin



16

- Besides being addictive, nicotine is relatively harmless, it's the other ingredients in cigarettes that cause serious illnesses
- As for propylene glycol and vegetable glycerin, both are officially "Generally Recognized As Safe" (GRAS) by the FDA



17

- How does that compare to smoking?
- Cigarettes contain over 5,000 different ingredients, including more than 60 cancer-causing chemicals like formaldehyde, arsenic, benzene and lead



18

Replacement Slides 19-24

In summary, all the evidence suggests e-cigarettes are much safer than regular cigarettes



19

• Indeed, an international group of researchers examined the research on e-cigarettes and concluded that:

"The available evidence indicates that e-cigarettes do not raise serious health concerns and can be considered a much safer alternative to conventional smoking"

-Harm Reduction Journal, 2013

20

- Despite these findings, critics maintain that e-cigarettes are dangerous and not helpful for quitting
- They believe vaping makes it harder to quit cigarettes in the long-run and state that smokers should use nicotine patches or gum instead

21

- But according to many surveys, thousands of ex-smokers have already quit smoking by using e-cigarettes



- Smokers also report preferring e-cigarettes over nicotine patches or gum

22

Conclusions

The evidence clearly shows e-cigarettes are a far safer alternative to smoking that can help save millions of lives



23

Conclusions


Smokers should switch to e-cigarettes to avoid the risk of cancer and improve their overall health



24

Replacement Slide 25

Thank you for watching
We hope this presentation has been
informative and helpful to you



25

Caution Slides 1-6

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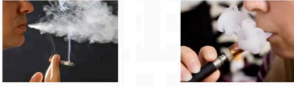
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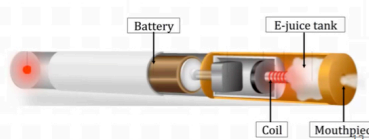
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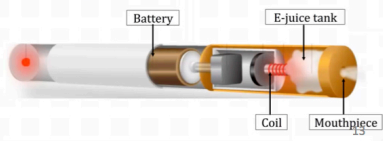
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Caution Slides 13-18

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Supporters of e-cigarettes believe these products are safe and claim e-cigarettes are the answer for the world's smoking problem



- But e-cigarettes are new products that have not been researched for long enough
- It is currently impossible to say they are in fact safe



- Cancer and other serious illnesses can take years to develop
- If e-cigarettes do cause serious illnesses, we will only find out after it is too late for the millions of individuals already using these products



- There are also strong reasons to suspect e-cigarettes are not safe
- Propylene glycol and vegetable glycerin have never been tested for regular inhalation
- The long-term effects of these chemicals are unknown and could be disastrous



- Indeed, many health professionals are concerned about these chemicals
- Dr. Richard Hurt, director of the Mayo Clinic's Nicotine Dependence Center:

"propylene glycol is a cousin of antifreeze and why anybody would want to puff on something and put that in their mouth is amazing."

Caution Slides 19-24

- In addition, many e-cigarette brands have been shown to contain dangerous unreported chemicals like formaldehyde and diethylene glycol
- These are the same cancer causing chemicals found in cigarettes



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Taken together, these facts show that e-cigarettes are not safe and could prove to be as harmful as regular cigarettes



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- Despite the evidence, supporters of e-cigarettes argue the products are safe and encourage using them to quit cigarettes
- But it's not even clear that e-cigarettes are good for quitting

21

- Using e-cigarettes is so similar to smoking that many experts fear vaping will keep people addicted to smoking
- In fact, numerous surveys show that most e-cigarette users do not successfully quit smoking



22

- Due to these concerns, the FDA has not approved e-cigarettes as "cessation products" to help quit smoking
- In fact, the FDA is currently in the process of regulating e-cigarettes like regular tobacco products



23

Conclusions

Despite the claims of some, e-cigarettes are not safe or good for quitting. They might even be as dangerous as smoking.




24

Caution Slides 25-27

Conclusions


Both smokers and non-smokers should avoid e-cigarettes to save themselves from serious risks.



25

Conclusions


Smokers who need help quitting should use safe and FDA-approved products like nicotine patches or gum instead.



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Thank you for watching

We hope this presentation has been informative and helpful to you



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Appendix O: Presentation length and slide number

	Length	Number of slides
Caution	5:36	27
Replacement	5:19	25
Control	5:21	22

Appendix P: IRB approval letter



RESEARCH INTEGRITY AND COMPLIANCE
Institutional Review Boards, FWA No. 00001669
12901 Bruce B. Downs Blvd., MDC035 • Tampa, FL 33612-4799
(813) 974-5638 • FAX(813)974-7091

November 19, 2014

Idan Ariel, M.A.
Psychology
4202 East Fowler Ave.
Tampa, FL 33620

RE: **Expedited Approval for Initial Review**
IRB#: Pro00019284
Title: Effect of Electronic Cigarette Messages on Young-Adult Behavioral Dispositions
Towards Use

Study Approval Period: 11/19/2014 to 11/19/2015

Dear Mr. Ariel:

On 11/19/2014, the Institutional Review Board (IRB) reviewed and **APPROVED** the above application and all documents outlined below.

Approved Item(s):

Protocol Document(s):

[Main study protocol](#)

The study involves the use of deception. It does not appear that the study could be executed without the use of deception. The study is minimal risk and the use of deception does not appear to have impact on the risk/benefit to participants. The deception debriefing meets all USF IRB requirements. The application and Reviewer Notes have been reviewed in detail. The study presentations appear to be under development and have not been included with the application. The study is approved, but cannot proceed until the PI has submitted the study presentations for review in an amendment

Consent/Assent Document(s)*:

[Informed Consent.pdf](#)

*Please use only the official IRB stamped informed consent/assent document(s) found under the

"Attachments" tab. Please note, these consent/assent document(s) are only valid during the approval period indicated at the top of the form(s).

It was the determination of the IRB that your study qualified for expedited review which includes activities that (1) present no more than minimal risk to human subjects, and (2) involve only procedures listed in one or more of the categories outlined below. The IRB may review research through the expedited review procedure authorized by 45CFR46.110 and 21 CFR 56.110. The research proposed in this study is categorized under the following expedited review category:

(3) Prospective collection of biological specimens for research purposes by noninvasive means.

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval by an amendment.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,



John Schinka, Ph.D., Chairperson
USF Institutional Review Board