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# Predicting Outcomes of American Youths' Shift Toward E-cigarette Use

D.J. Resendez  
*Walden University*

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# Walden University

College of Social and Behavioral Sciences

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D J Resendez

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## Review Committee

Dr. Brandy Benson, Committee Chairperson, Psychology Faculty

Dr. Scott Gfeller, Committee Member, Psychology Faculty

Dr. Michael Plasay, University Reviewer, Psychology Faculty

Chief Academic Officer  
Eric Riedel, Ph.D.

Walden University  
2019

Abstract

Predicting Outcomes of American Youths' Shift Toward E-cigarette Use

by

D J Resendez

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Clinical Psychology

Walden University

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## Abstract

There has been a shift toward e-cigarette use and away from tobacco smoking among American youth. Despite effects of ongoing public health campaigns that bring attention to the harmful effects of tobacco and nicotine use generally, youths might not perceive e-cigarette use to be unhealthful in terms of psychological functioning. This study was an investigation of the impact of the method of tobacco use (cigarette or e-cigarette), past cessation attempts, cravings or needs to use tobacco, and serious cognitive difficulties, upon youths' intentions concerning future tobacco usage. The conceptual framework was based upon the self-medication hypothesis, biopsychosocial model, and social cognitive theory. The research questions focused on whether factors surrounding youth tobacco use would significantly predict the youths' intent. Data were drawn from 2015, 2016, and 2017 National Youth Tobacco Survey (NYTS) responses. Cross-sectional data from 56,258 cases allowed for a total of 387 cases to be identified for inclusion in the analysis, based upon completeness of the data and inclusion criterion of a singular form of recent and regular tobacco use. Data were analyzed by using a chi-square test of independence and multinomial logistic regression. The research findings suggest that past cessation attempts and methods of tobacco use are variables that could significantly predict intent concerning future tobacco use; however, the findings did not suggest that craving or need for tobacco or serious cognitive difficulties significantly predicted these intentions. The study is replicable and amendable for purposes of more specific analyses. This research also contributes to the understanding of the e-cigarette epidemic, and the findings of the study can ultimately benefit young e-cigarette users who receive psychological treatment.

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## Dedication

My dissertation is dedicated to young Americans who are faced with the choice of never trying nicotine or experimenting with the stuff. You are the future of the nation. Choose wisely.

## Acknowledgments

I sincerely thank the entire faculty for furthering my academic endeavors. This dissertation would not be possible without them.

I extend a special thank you to Dr. Brandy Benson, who served as my dissertation committee chair, and Dr. Scott Gfeller, who served as a member of the committee. You have both provided the very much needed support and recommendations that have made it possible for the research cycle to go much more smoothly and timely than I expected.

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## Chapter 1: Introduction to the Study

### **Introduction**

The purpose of this study was to compare predicted future nicotine use among youths using e-cigarettes as well as youths smoking combustible tobacco cigarettes. This study was an attempt to identify whether there were similar reports of addiction symptoms by youths using e-cigarettes and those using combustible tobacco cigarettes. The study was also an attempt to identify whether serious cognitive difficulties, cravings, needs or urges to use tobacco, methods of tobacco use, or unsuccessful cessation attempts predict intent to quit nicotine. This study examined whether youths who have taken up e-cigarette use and those smoking combustible tobacco cigarettes became similarly dependent upon the nicotine use, and if so, what potential reasons contributed to these occurrences. This study brings attention to the addictive nature of nicotine usage in general, in spite of the shift toward e-cigarettes stemming from perceived safety of the technology. Public health campaigns are in place to counter e-cigarette marketing efforts, but there is an ongoing epidemic due to selective attention toward only some of nicotine's harmful effects. Clinical psychologists with clients who are young e-cigarette users must play a vital role in identifying the harm and educating such clients about the implications.

The social change implications of this study are broad, as it is intended to give the public an increased awareness of the harmful implications of the shift toward e-cigarette use. Additional potential positive social change will be made through advising general health practitioners, integration of the research findings into nicotine cessation and therapy, education of the public via school curricula and visits to doctors' offices, as well

as overall reduction of youth nicotine use.

Greater detail about the background of this study can be found in Chapter 2 in terms of historical basis, gaps in literature, and implications for research and practice. This chapter includes a statement of the research problem and questions, the hypotheses, theoretical framework, definitions, assumptions, scope, limitations, and the significance of the current study. The nature of the study is also summarized at the end of the chapter.

### **Problem Statement**

Use of e-cigarettes (particularly, electronic nicotine delivery systems) has grown substantially among young Americans since the advent of the technology. The extent of usage has reached a point that youths might now be using e-cigarette technology more than traditional methods of smoking tobacco (Harrell, Naqvi, Plunk, Ji, & Martins, 2016). England, Bunnell, Pechacek, Tong, and McAfee (2015) expressed enthusiasm about the shift away from traditional cigarettes among the youth, but also expressed caution about potential effects of e-cigarette use on human brain development during adolescent years. England et al. (2015) noted smoking tobacco during adolescence can be associated with lasting cognitive and behavioral impairment, including issues such as reduced prefrontal cortex activation as well as deficits in working memory and attention. In addition to the impaired functioning, Lydon, Wilson, Child, and Geier (2014) noted that cognitive deficits might also change incentive and decision-making processes. Up to now, most literature related to cognitive deficits has only concerned smoking, despite the shift.

Kong and Krishnan-Sarin (2017) argued that adolescents might be particularly drawn to e-cigarette technology for reasons such as aggressive marketing, ease of access,

and adolescents' perceptions of lesser harm of e-cigarettes compared to the harms of smoking. Ambrose et al. (2014) said that the recent National Youth Tobacco Survey data (NYTS; CDC, 2013) showed that 64% of the youth sampled believed the amount of harm potentiated by e-cigarette use is less than that of smoking cigarettes. Moreover, Ambrose et al (2014) said that young people also believe that the extent of harm depends upon the dose amounts or amount of exposure. Many young Americans in grade levels 6 through 12 have completed the NYTS over the past 10 years. Three of the most recent NYTS datasets included self-reported variables both for frequency of e-cigarette use and cigarette smoking during the prior month, as well as serious difficulties in concentrating, remembering, or decision-making (CDC, 2018). The existing research on adolescent cigarette smoking and adolescent e-cigarette use does not compare cognitive implications of smoking and e-cigarette use. This research offers a comparison between nicotine use via e-cigarette technology and combustible tobacco, for a conceptualization of predicted future use.

### **Purpose of the Study**

The purpose of this study was to address gaps in research related to the enduring use of e-cigarette technology among the youth. The study was quantitative, in that the relevant NYTS data were previously measured and numerically coded by CDC researchers before this independent inquiry. England et al. (2015) said that the e-cigarette debate often neglects how the effects of nicotine can differ as a result of e-cigarette use in comparison with other methods of use. Additionally, while existing literature has addressed the general cognitive factors related to youth nicotine usage (e.g.,



Treur et al, 2015), existing literature has not explained whether the consumption of nicotine via e-cigarette technology is related to the same cognitive factors. NYTS data allowed for direct comparison, as specific survey items within the NYTS address both forms of use. There is great need for an updated inquiry about the consequences of this trending form of use, in the same way that there has been continual need for inquiries regarding the consequences of youth cigarette smoking. The ultimate purpose of this research was to conduct meaningful comparisons of some factors that relate to the continued usage of e-cigarettes and cigarette smoking among the youth.

### **Research Questions and Hypotheses**

*RQ1:* Do youths who smoke cigarettes daily and those using e-cigarettes daily equally report having had strong cravings or real needs to use tobacco products during the prior 30 days?

*H<sub>01</sub>:* Youths smoking cigarettes daily and those using e-cigarettes daily are equally likely to report cravings or real needs to use tobacco products during the prior 30 days.

*H<sub>a1</sub>:* There is a difference between the likelihood of youths smoking cigarettes daily and youths using e-cigarettes daily reporting having strong cravings or real needs to use the tobacco products during the prior 30 days.

*RQ2:* Do unsuccessful cessation attempts, serious cognitive difficulties, cravings or needs to use tobacco, or methods of tobacco use predict reported intent to quit nicotine use?

*H<sub>02</sub>:* There is no significant prediction of reported intention to quit nicotine use in

terms of unsuccessful cessation attempts, serious cognitive difficulties, craving, needs, or urges to use tobacco, or method of nicotine use.

*H<sub>a2</sub>*: There is significant prediction of reported intent to quit nicotine use in terms of unsuccessful cessation attempt, serious cognitive difficulties, craving, needs, or urge to use tobacco, or method of nicotine use.

### **Theoretical Framework**

Three theories served as the foundation for this research: the self-medication hypothesis, the biopsychosocial model, and social cognitive theory. Khantzian's (1985) version of the self-medication hypothesis stemmed from his earlier work on mental health concerns and unpleasant affect. Originally posited to describe self-medication in cases of mental conditions and unpleasant affect leading to use of illicit substances, the hypothesis has also been applied in cases involving alcohol and nicotine use (e.g., Hall et al., 2015).

Regarding application of the biopsychosocial model to the study, it is useful to point out that the societal shift toward e-cigarette technology might lead to differences in society members' psychological and biological development during early phases of life. A benefit of Engel's (1977) biopsychosocial theory is that health-related factors (in this research, cognitive ones) are conceptualized more broadly than in simple cause and effect relationships. Rather, there is an incorporation of relevant social factors (e.g., marketing toward youth) as well as psychological factors (e.g., coping) coinciding in a phenomenon.

In the context of e-cigarettes' rising popularity among the youth, social cognitive theory (Bandura, 2005) explains self-management processes that occur during the use of e-cigarettes by those youths concerned about the health effects of smoking tobacco. The

processes can include self-efficacy and self-regulative and evaluative processes (Bandura, 2005). In essence, youths are weighing costs and benefits of this health-related behavior, alongside cognitions related to caution against nicotine use within the social environment.

### **Nature of the Study**

Data used in this study were quantitative data resulting from the annual NYTS. In this quantitative study, I performed a secondary analysis of the data and addressed the problem statement's call for a predictive analysis of intent to quit tobacco use. Extant research using NYTS data, mostly including cigarette-smoking research, made the quantitative approach most appropriate for this type of analysis. Data to be used in this study are also publicly available, owned, and maintained by the CDC, and are routinely used by researchers working in psychology, psychiatry, public health, and related fields. Greater detail about the nature of the study can be found in Chapter 3.

### **Definitions of Key Terms**

*Cessation Attempt*: Ceasing use of all tobacco products for one day or longer while attempting to quit all tobacco (CDC, 2018).

*E-cigarette Use*: Inhalation or vaping of a mixture containing nicotine through an e-cigarette device or other electronic nicotine delivery system (Glasser et al., 2017).

*Recent Regular Use*: Daily use during the prior 30 days (CDC, 2018).

*Serious Cognitive Difficulty*: Serious difficulty concentrating, remembering, or making decisions because of a physical, mental, or emotional condition (CDC, 2018).

*Tobacco Use*: Tobacco product use, such as cigarettes, cigars, smokeless tobacco, electronic cigarettes, hookahs, pipes, snus, dissolvable tobacco, or bidis (CDC, 2018).

### **Assumptions**

NYTS participation is voluntary and fundamentally assures confidentiality. It is also assumed that survey participants respond honestly. Additionally, it is assumed that factors used in this study to predict continued tobacco use have potential for prediction of continued use through the reports regarding participants' intent to quit all tobacco use.

### **Scope and Delimitations**

The scope of this study was limited to recent and regular cigarette smoking or e-cigarette usage, using NYTS participants' reports of tobacco-related factors and intent to quit tobacco use. Potential NYTS participants were sampled and randomly selected in American middle schools and high schools, according to the CDC's rigorous standards for survey administration. Additionally, the dataset was scanned for relevant cases of tobacco use for this study. Findings of this research might not be generalizable to other populations or during a later point in time. This study is intended to be a timely inquiry.

### **Limitations**

The limitations of this research mainly result from the nature and methodology of secondary data analysis. Nonprobability sampling methods pose limitations to findings' generalizability. Additionally, data collection relied on self-reports, which might create a threat to reliability. It is possible for participants to have misunderstood survey items, which would also create a threat to reliability. The survey data cannot provide causal or temporal explanations regarding the variables of interest. While some nicotine concepts are universal, the sample characteristics might not generalize abroad. However, findings of this study will be useful in American clinical psychological practice and related fields.

### **Significance of the Study**

This research is a meaningful contribution to the e-cigarette debate and will highlight cognitive concepts related to youth nicotine use. Results of this study can provide clinical psychology practitioners with an updated analysis of the recent evidence regarding the impacts of the shift in preference toward e-cigarette technology on youths' cognitive functioning and tobacco use-related decision-making. This timely large-scale analysis is needed for providing insight and directions for countering aspects of nicotine addiction among the youth (Wills & Soneji, 2018). The implications of this study can be useful for practitioners implementing therapeutic interventions within a clinical setting.

The emphasis upon clinical implications of the research findings has the potential to greatly improve the lives of current e-cigarette users. Additionally, a timely report will allow for educating the practitioners, which serves as a method for educating youths undergoing treatment, and the knowledge attained will remain useful whenever a related harmful trend occurs within the youth population. The intent of this study is to improve human biological, psychological, and social conditions of current e-cigarette users.

### **Summary**

This study was aimed to compare predicted future nicotine use among youths using e-cigarettes and those smoking combustible tobacco cigarettes, based upon NYTS data collected during 2015, 2016, and 2017. The predictor variables for this research are unsuccessful cessation attempts, serious cognitive difficulties, cravings, needs or urges to use tobacco, and method of nicotine use (all variables were present in the NYTS data). The outcome variable, intent to quit use of all tobacco, was based on the urgency of

youths' plan to quit, and no reported intent indicated indefinite continued use.

If educated about dangers of nicotine (dependence, withdrawal, cognitive effects, potential biological changes), the public might address the shift toward e-cigarette usage more urgently and with more caution. Youths who are identified as e-cigarette users in a clinical case conceptualization can benefit from a targeted focus on this aspect of mental health. Timely targeted focus can potentially prevent effects of long-term e-cigarette use.

Chapter 2 will provide a review of literature that is relevant to this research. The literature includes a solid theoretical foundation for the inquiry to be understood in terms of clinical psychological practice. Following my explanation of many gaps in the current literature that my study addressed, research methods are included in Chapter 3.

## Chapter 2: Literature Review

### **Introduction**

Nicotine researchers have identified several major factors associated with tobacco addiction, withdrawal, and enduring use. However, the implications of the factors within the context of youths' shift toward e-cigarette use are not adequately addressed in the current literature. In this study, I examined associations that some of the key factors have with intent to quit tobacco use. Scholars have identified cravings to be a manifestation of nicotine withdrawal that can contribute toward continued use (Dawkins, Turner, Hasna, & Soar, 2012; Eissenberg, 2010; Etter & Eissenberg, 2015; Perkins, Karelitz, & Michael, 2017). Studies have also focused on attempts to quit (e.g., Hammett et al., 2017; Foulds, Veldheer, & Berg, 2011). However, the literature typically considers e-cigarette use for smoking cessation and does not consider e-cigarette use in attempt to quit all tobacco use.

Cognitive implications of nicotine usage, particularly regarding adolescent brain development, are also considered within existing literature (e.g., London, 2015, Watson, DeMarree, & Cohen, 2018). Interaction of nicotine with ongoing brain development has been demonstrated to facilitate greater likelihood of continued usage. I have focused this literature review on several cognitive implications of youth nicotine use, as well as theoretical and clinical implications of recurring use. Discussions within this literature review include identification and descriptions of the self-medication hypothesis, the biopsychosocial model, and social cognitive theory. In various subsections of my review, I present, analyze, and synthesize literature on youth e-cigarette usage, adolescent brain development, addiction, withdrawal, and intent to quit tobacco as related to this study.

### **Literature Search Strategy**

The literature search performed for this study primarily covered the past seven years, using the following databases: EBSCOHost - PsycINFO, PsycARTICLES, Science Direct, Pro Quest Central Science Direct, Academic Search Premier/Complete, Medline, and Google Scholar. Keywords used in the literature search were: *E-cigarette\**, *e-cig\**, *youth*, *perc\**, *risk*, *cognit\**, *ADHD*, *depress\**, *anxi\**, *mental*, *physical*, *emotion\**, *memory*, *concentrat\**, *decision\**, *brain*, *develop\**, *crav\**, *need\**, *urge\**, *quit*, and *medic\**. I also scanned reference lists of significant articles for additional sources and books, such as, the DSM-5 and publications by the Centers on Addiction. I also reviewed potential secondary data sources concerning e-cigarette use, cessation, and cognitive implications.

### **Theoretical Foundation**

This section contains an overview of the self-medication hypothesis (Khantzian, 1985), the biopsychosocial model (Engel, 1977), and social cognitive theory (Bandura, 2005), and a review of the current literature as the theories apply to this study. While the self-medication hypothesis has been selected for use as the primary theory in this study, literature regarding the biopsychosocial model is reviewed in the following sections of this chapter in order to illustrate relationships among relevant biological, psychological, and social processes. Additionally, social cognitive theory is reviewed in the following sections of this chapter in terms of how the theory relates to youth nicotine use behavior.

### **Self-Medication Hypothesis**

The earliest investigations of youth nicotine use focused upon factors such as peer pressure, self-destruction, or pleasure-seeking as a basis for the initiation of use and



subsequent addiction. However, psychotherapists have more recently begun to consider the potential associations between substance use and mental health concerns (Khantzian, 1985). Khantzian's (1985) self-medication hypothesis is a widely accepted psychological theory of addiction with over 40 years of empirical support. Studies that have used the self-medication hypothesis have also routinely focused upon use of illegal or non-illegal substances (such as alcohol or tobacco) for potentially desired pseudo-medicating effects.

Khantzian's research in 1977 involving heroin and cocaine addiction served as the basis for one of the first self-medication hypotheses (Khantzian, 1985). In that study, Khantzian (1985) focused on psychotropic effects of heroin and cocaine, and how drugs and effects might interact with mental health conditions and associated unpleasant mental states. In terms of the main finding, Khantzian (1985) said that drugs might relieve an unpleasant affective state and that the relief could lead to the drugs becoming irresistible.

Negative reinforcement is an important phenomenon to address when examining the impacts of carrying out certain behaviors to relieve a negative mental state. Watson et al. (2018) used negative reinforcement theory to explain nicotine use in times of social stress and as a method to cope with social anxiety. The theory suggests that nicotine use is a method of coping with unpleasant cognitive states involving social stress, and, that a great deal of relief can be achieved by using nicotine. The concept of self-medication is unquestionably associated with negative reinforcement in this context (Hall et al., 2015).

Hall et al. (2015) authored a review of the literature on the negative reinforcement factors motivating the continued use of nicotine. This is a different angle to focus on the phenomenon, considering most research on nicotine dependence focuses on the positive

reinforcing effects of nicotine. Hall et al. (2015) argued that vast individual differences of those who are addicted to nicotine reflect the differing motivational forces driving the use (e.g., affective function, cognitive function, or nicotine withdrawal symptoms). Hall et al. (2015) suggested that the negative reinforcement paradigm is important throughout all phases of nicotine addiction, as relief might be taken from the early points of smoking initiation, any time during progression to dependence, or in relapses during quit attempts.

Dierker (2015) conducted a study that showed depression was a consistent risk factor for nicotine dependence. Dierker (2015) found that risk is present from the earliest nicotine experiences in adolescence through establishment of regular smoking patterns and into young adulthood. Dierker (2015) went a step further from the early studies that hypothesized the need to medicate negative affective experiences common to depressive disorders, and directly linked depression symptoms to symptoms of nicotine dependence. It might be further explained that depression symptoms can become signals for nicotine dependence, and the signals or associations become stronger with cumulative exposure.

ADHD is also shown to be a consistent risk factor for nicotine dependence, and the self-medication hypothesis is often used to explain associations between ADHD and nicotine use (e.g., Symmes et al., 2015). In Symmes et al.'s (2015) research, the authors set out to examine the extent of enduring nicotine use as youths with ADHD mature into adulthood. Symmes et al.'s (2015) study revealed that participants in groups representing either ADHD-only or ADHD comorbid with an externalizing disorder demonstrated a greater prevalence of nicotine usage at ages 18, 20, and 22, than those participants who were in the control group. Symmes et al. (2015) noted that a large extent of the young

adult aged participants with ADHD had started using nicotine regularly before age 18. Symmes et al.'s (2015) findings also showed that participants in the ADHD groups who had reported a history of childhood inattentiveness were more likely to report regular use. Symmes et al.'s (2015) explanation for the elevated use considers that youths who have ADHD may turn to nicotine for its known attention enhancing pharmacologic properties.

### **Biopsychosocial Model**

Engel (1977), a cardiologist, borrowed support for the biopsychosocial model from behavioral psychology and Greek philosophy (Borrell-Carrio, Suchman, & Epstein, 2004). The model is a humanistic and holistic approach to understanding illnesses at the individual level and accounting for all the factors that might influence illnesses, such as: physical addiction (a biological factor), coping (a psychological factor), or cultural norms (a social factor), in the case of youths' enduring use of e-cigarettes. In essence, the biopsychosocial model is a person-centered framework (Borrell-Carrio et al., 2004).

In conceptualizing the biological reasons for youth nicotine use, it is important to identify whether the nicotine use is at the point of initiation, if the use occurs regularly, or if perhaps the usage has been discontinued. This is because initiation, for example, might not bring about the same biological response to the stimulus as biological processes that might occur during addiction to nicotine (De Biasi & Dani, 2011). The biological reward that a person receives when first successfully engaging in the nicotine use behavior, at the point of initiation, involves dopamine processing in a biological system that is otherwise naïve to the dopaminergic responses to a nicotine stimulus (De Biasi & Dani, 2011). The processes occurring during nicotine use initiation must be contrasted with the biological

adaptations occurring with continued usage and dependence, and further contrasted with the withdrawal syndrome that can occur if nicotine is removed (De Biasi & Dani, 2011).

The myriad psychological reasons for nicotine use must therefore be considered alongside biological and social reasons in the biopsychosocial model conceptualization. For example, with habitual nicotine use, altered cortisol reactivity to stress is one possible adaptation in the biological system (Richards et al., 2011), which may make nicotine use more likely to occur as an adjunct method of coping with stressors (i.e., self-medication). Such coping may constitute overreliance upon nicotine use to counter stress (Richards et al., 2011), which would continuously affect biological cortisol reactivity and present the potential for many social consequences regarding the illegality of youth nicotine use.

As with the biological and psychological reasons for nicotine use, social reasons do not occur alone in the biopsychosocial model. Due to the complexity of all potential factors, it is impossible to identify precise directional or causal links. The use of nicotine for coping, as an example, may occur when a person has not developed coping strategies to buffer against stressors, like communication or reaching out to social support (Lechner, Janssen, Kahler, Audrain-McGovern, & Leventhal, 2017). In such cases, using nicotine may become a primary source of recreation, and the young users may be more vulnerable to biological dysfunction or psychological symptoms that might or might not have been present or identified at the initiation of nicotine use to begin with (Lechner et al., 2017).

### **Social Cognitive Theory**

Bandura's (2005) social cognitive theory (SCT) is as relevant to this multifaceted theoretical foundation as the self-medication hypothesis and the biopsychosocial model,

because of SCT's focus on self-regulation and the self-evaluative process concerning the costs and benefits of certain health habits. The most important elements of SCT are: self-regulation, self-management, and self-efficacy (Bandura, 2005). The model of self-regulation concerns the theory that cognitive factors are significant contributors to health behaviors. Cognitions are relevant within many of the social processes within the context of youth nicotine use, such as: thoughts about public information on risks and benefits of nicotine use, or perceived socio-structural facilitators and impediments (Bandura, 2005), such as: ease of procuring nicotine (facilitator) or laws restricting nicotine (impediment).

The concept of self-management comes into play when youths use nicotine in an attempt to manage stress, for example, because the mental health management behavior involves preference for one's own cognitions in spite of social conditions or advice that discourage the behavior. A user's personal cognitions are competing with such thoughts and warnings and circumvent effective healthful self-management (Bandura, 2005). Self-regulatory self-efficacy is also important to consider when conceptualizing youth nicotine use in terms of SCT. In cases of nicotine use as coping behavior, it is possible for social-cognitive processes resulting in thoughts of low self-efficacy to precede the behavior, and that users deem nicotine to be the least restrictive means of achieving a desired outcome.

### **American Youths' Shift Toward E-cigarette Use**

This section contains six subsections reviewing literature on: (a) e-cigarettes, (b) youth e-cigarette use initiation, (c) adolescent brain development (d) the National Youth Tobacco Survey (NYTS), (e) nicotine use related cravings or needs, and (f) intent to quit using nicotine. Because of the limited amount of available research with focus upon the

youth population's nicotine-related cravings, needs, and intention to quit use of nicotine, studies that investigated these concepts among other populations were included as a part of this literature review. Also, studies investigating nicotine use methods other than the use of e-cigarettes were included in order to describe general nicotine-related concepts.

### **E-cigarettes**

The majority of the world's e-cigarettes are made in China (Wang, Zhang, Gu, & Gao, 2018). In America, where e-cigarette usage has become increasingly popular, users "vape" or inhale aerosol mixture from replaceable cartridges contained within e-cigarette devices, and users can easily purchase e-cigarettes or replacement cartridges from a store or on the Internet (Glasser et al., 2017; Trtchounian & Talbot, 2011). There are growing varieties of e-cigarettes, comprising many brands, device types, and user profiles (Glasser et al., 2017). The research focusing upon health effects of vaping has so far indicated no impacts or only a small impact to physiological biomarkers, and has indicated potential acute positive effect upon cognition and mood regulation (Glasser et al., 2017). Some of the reported reasons for e-cigarette use relates to smoking cessation, evasion of a smoke free policy, or because e-cigarettes are perceived to be less harmful (Glasser et al., 2017).

A possibility exists that e-cigarette users can use e-cigarette cartridges that do not contain nicotine (e.g., cartridges with no drug ingredients, or even cartridges that contain substances derived from the cannabis plant-or any other drugs besides nicotine). A recent study found that a significant proportion of adolescent users use e-cigarette cartridges that have no nicotine content (Miech, Patrick, O'Malley, & Johnston, 2016). For the purposes of this study, however, the only relevant e-cigarette usage included vaping using nicotine.

### **Youth E-cigarette Use Initiation**

This section contains a review of literature regarding the American youth's shift toward e-cigarette use. All electronic nicotine delivery systems or similar vaping devices were identified as e-cigarettes. Marketing was identified as a major factor influencing the shift in preference. Perception about e-cigarettes' lesser potential harm was identified as an important contributing factor for the shift away from the typical combustible tobacco.

### **Shifting Preference**

E-cigarettes have risen in popularity since their introduction in the United States just over a decade ago (Hammett, Veldheer, Yingst, Hrabovsky, & Foulds, 2017). The e-cigarette technology was initially introduced in the United States as a new cessation tool (Bell & Keane, 2012), and was hailed for the potential harm reduction. However, a concern currently exists that e-cigarettes appeal to those who have never smoked tobacco, which might cause those individuals to become nicotine dependent (Cobb, Hendricks, & Eissenberg, 2015). Many other existing nicotine use methods might have led to addiction however, as a sizable portion of current e-cigarette users might have used another form of tobacco prior to initiating e-cigarette use and never having smoked tobacco (Berg, 2016). It is unfeasible to base inquiry upon only a singular cause of nicotine addiction, since the multitude of potential factors within the biopsychosocial model does not even limit the possibility of addiction to cases of personal use. However, it is possible to filter the data to cover recent and regular use of substances, and focus inquiry upon particular use. For this study's purpose, the data was filtered to identify cases of daily e-cigarette use as the sole method of nicotine usage during the prior 30 days (i.e., the e-cigarette condition).

Important distinctions can be seen in literature indicating a drop from 16% to 9% of high school students who smoke tobacco, with a remaining 20% of overall tobacco use among high school students (Arrazola, Singh, & Corey, 2015). Poly-tobacco use, or use of two or more tobacco products, is also common in research on tobacco use (England et al., 2015), which shows 24.4% of adult tobacco users are poly-users. The extant research on e-cigarette preference by the target population (American youth) has not been limited to analyze the shift in preference from singular use of combustible tobacco to singular use of e-cigarettes. In this study, reports of daily use over the prior 30 days were defined as recent regular use, and the data were filtered to focus only upon recent regular singular use of combustible tobacco (cigarettes) or recent and regular singular use of e-cigarettes.

### **Marketing**

The youth consumer behavior supplanting prior demand for combustible tobacco smoking products, with new demand for e-cigarettes, would not occur without marketing. The appeal for e-cigarette devices can be directly likened to the appeal for cigarettes, as the new technology makes vaping similar amounts of nicotine possible, with apparatuses that are similar in size to cigarettes, with a similar social symbolism, and through similar marketing communications (Krugman, 2016). In the same way that the cigarette industry employed strategies to reach adolescents, the current widespread e-cigarette marketing is found in the media and other places that are likely to reach the youth (Krugman, 2016).

The communications are arguably better facilitated during the current Internet-use era than during the rise of tobacco smoking popularity, however, due to the instantaneous connectivity and ability to circumvent laws and regulations (Bunnell et al., 2014). Even



without considering Internet capabilities, annual expenditures for e-cigarette advertising in traditional forms of print, radio, and television media increased from 2 million dollars in 2011 to >14 million dollars in 2012 (Duke et al., 2014). Such advertising also includes claims that e-cigarettes are more healthful than cigarettes (Buu, Hu, Piper, & Lin, 2018).

### **Perceptions**

Some of the effects of the abundant marketing and advertisement might be in the form of perceived less harms and less addictive potential of e-cigarettes, and decreasing attractiveness of combustible tobacco (Richardson, Pearson, Xiao, Stalgaitis, & Vallone, 2014; Choi & Forster, 2013). Research by Amrock, Zakhar, Zhou, & Weitzman (2014) led to a finding that 34.2% of the surveyed adolescents perceived e-cigarettes to be less harmful in comparison with tobacco cigarettes, and 71.8% of the surveyed adolescent e-cigarette users were more likely to perceive e-cigarettes to be less harmful than smoking.

Applied to youths' shifting preference for e-cigarettes, SCT would assume health claims implied by manufacturers, and even the judgments of medical organizations, about the relative safety of e-cigarettes (Grana & Ling, 2014; Cervellati et al., 2014; Goel et al., 2015) are part of the thought process preceding youths' initiation of e-cigarette usage. If such perceptions are formed, and social pressure is part of the impetus for nicotine usage, SCT would further explain how the cognitions lead the youths to use e-cigarettes to fit in with smokers in social groups while abating the temptation to smoke tobacco (Hammett et al., 2017). Ambrose et al. (2014) noted that youths might perceive e-cigarette use to be a reduced risk alternative due to the marketing messages tailored for the youth, and that the degree of risk would vary depending upon frequency and intensity of use. There is a

real danger in forming perceptions based upon claims of sources that are not supported by the science on nicotine addiction. In this research, the data were used to directly compare cigarettes and e-cigarettes in terms of addictive potential, as the cognitions reported about intent to quit among youth who have experienced addiction were considered in the study.

### **Adolescent Brain Development**

As the brain development ensuing in adolescence can be affected by nicotine use (e.g., Yuan, Cross, Loughlin, & Leslie, 2015; Treur et al., 2015; London, 2015; Lydon et al., 2014; England et al., 2015), this important biological factor is worthy of focus. Yuan et al.'s (2015) review highlighted data that explain adolescent brain neurobiology and its unique sensitivity to nicotine. According to Yuan et al. (2015), the adolescent brain will undergo processes toward both structural maturation (reorganization of grey matter) and maturation of neurochemical systems. Yuan et al. (2015) noted that preclinical research tended to use chronic, high-dose protocols for nicotine exposure that do not model early nicotine use behavior, but more recent studies indicate that even brief exposure to a low dose of nicotine can lead to lasting changes in the adolescent brain. In terms of changes nicotine might lead to, if introduced during adolescent brain maturation (whether through cigarette smoking or e-cigarette use), the redirected neuronal signaling might pose severe risks factors related to addiction, cognition, and emotional regulation (Yuan et al., 2015).

Treur et al. (2015) analyzed longitudinal data from Netherlands' Twin Register, focusing upon smoking and attention problems. Participants within Treur et al.'s (2015) twin sample with smoking history demonstrated significantly more attention problems than the non-smoking co-twins. It is important to note that the analyses showed that the

larger increases in attention issues occurred from adolescence to adulthood, while the attention scores were similar in the time prior to initiation of smoking or in cases that both twins began smoking (Treur et al., 2015). The findings in Treur et al.'s (2015) study imply that attention problems that occur during the time of adolescent brain development can be exacerbated by nicotine use. Related to concepts in the current research, Treur et al.'s (2015) findings support the notion of biologically detrimental factors within the biopsychosocial model explanation for the self-medication hypothesis and nicotine usage. The detrimental effects of nicotine use that cause attention issues might make continued nicotine use likely, due to positive cognitive effects that users seek (Glasser et al., 2017).

London (2015) also explored the potential effects of adolescent smoking on brain function. London (2015) considered an increased susceptibility of adolescents diagnosed with ADHD to initiate nicotine use for self-medication. London (2015) also argued that the direction of causality might be reversible, such that nicotine is the cause of the issue, in some cases of attention deficits. In terms of developmental reasons that might support London (2015)'s reasoning for reversal, it is important to consider the altered functional response within the prefrontal cortex (a brain area responsible for a variety of executive functions), which may lead to issues with cognition and behavior that can extend beyond problems with attention. London's (2015) commentary and the results from Treur et al.'s (2015) twin study have each referred to some of the important biological implications of altered brain development due to nicotine use, that are possible to occur in the prefrontal cortical region. These implications support the aim of the current study to provide youths with education that might serve to prevent potentially negative life-altering nicotine use.

In Lydon et al.'s (2014) review of the literature on adolescent brain development and nicotine dependence, the authors constructed a model of the psychosocial factors that co-occur alongside adolescent brain development and serve to make the adolescents more vulnerable to initiation of nicotine use than adults. Lydon et al. (2014) describe that risk-taking and high impulsivity occurring during adolescence, together with positive nicotine use norms in the community and positive expectancies about the effects of using nicotine, may lead to especially strong incentive motivation because of normative adolescent brain development (brain structure and function). Lydon et al.'s (2014) model further reasons that inhibiting the impulse to use nicotine is especially unlikely in adolescence because of strong incentive motivation and lack of fully developed cognitive control in adolescence, and that the motivation is more likely to lead to an impulse toward nicotine use initiation during brain development. At that point, Lydon et al (2014) reasoned, adolescents attain more pleasure from first nicotine use than adults, leading to persistent usage and effects.

In a related review, Counotte, Smit, Pattij, and Spijker (2011) noted that smoking in adolescents between the age of 12 and 15 years might be precipitated by the influence of peer pressure or higher degrees of impulsivity and risk-taking (e.g., among those with ADHD). According to Counotte et al.'s (2011) review of the differences in responses to smoking cues among adolescents and adults, the adolescents' underdeveloped prefrontal cortex region makes for a more heightened reactivity that could have a great impact upon smoking initiation or maintenance, compared to the more developed adult brain structure. This notion of heightened reactivity is consistent with Rubinstein et al.'s (2010) findings that even adolescents who are light smokers (1-5 cigarettes per day) exhibited a level of

reactivity similar to adult heavy smokers when brain activity was observed under fMRI.

While nicotine-use explored in most of the foregoing literature primarily focuses upon adolescent cigarette smoking, the purpose of this study was to compare effects of cigarette smoking and e-cigarette use. Because the literature base regarding adolescent e-cigarette use related developmental considerations is in its infancy, it might be useful to draw a parallel between the potential effects of inhaled nicotine and some general public health findings associated with environmental toxicants. For example, organophosphate, mercury, or lead exposure during critical brain developmental periods can lead to serious long-term consequences, such as: behavioral problems, decreased academic achievement, and lower IQ (England et al., 2015). In a review of literature on secondhand smoke and cognitive outcomes in children and adolescents, Chen, Clifford, Lang, and Anstey (2013) noted that 12 out of 15 studies evidenced significant inverse associations of outcomes, to include: poor academic achievement and neurocognitive performance, as well as signs of neurodevelopmental delay. Campbell-Heider and Snow's (2016) review of research in the context of addictions nursing makes an obvious point that e-cigarettes' elimination of the tars of combustible tobacco smoke cannot make vaping nicotine harmless, as it is well known that there are direct effects of nicotine upon the still-developing adolescent brain.

## **NYTS**

Since 1999, the National Youth Tobacco Survey (NYTS) has been conducted 13 times (annually since 2011). The broad goals of the survey, according to the Centers for Disease Control & Prevention's (CDC) Internet landing page for the survey data, are both to "provide national data on long-term, intermediate, and short-term indicators key to the

design, implementation, and evaluation of comprehensive tobacco prevention and control programs” and to “(serve as a) baseline for comparing progress toward meeting selected Healthy People 2020 goals for reducing tobacco use among youth” (CDC, 2018). NYTS items are used to gain an understanding of emerging correlates of tobacco usage, such as: demographic factors, youth access to nicotine, or youths’ vicarious exposure to nicotine use (CDC, 2018). While past NYTS datasets are available for public use, it is important to approach the data as cross-sectional data that cannot be used for determining causal or temporal direction of association among survey items. NYTS datasets to be used for the purpose of this research were derived from stratified cluster sampling, with the primary sampling units being counties or similar entities. Schools within the primary sampling units were randomly selected, and students at selected schools were randomly selected.

Youth tobacco use is a well-researched area, and the NYTS data has enabled the continual growth of the literature base on the subject. Many studies have utilized NYTS data to understand concepts concerning youth access to nicotine or e-cigarettes as well as the demographic factors that relate to youth nicotine use. As the various researchers have indicated, youth access to nicotine in general, and the e-cigarette technology in particular, naturally follows the marketing efforts of companies standing to profit from sales of the products (Buu et al., 2018; Krugman, 2016; Duke et al., 2014; Bunnell et al., 2014). This response of the youth to marketing may be best conceptualized through a social cognitive theoretical lens because of the cognitions that are formed with exposure to the marketing.

Existing research utilizing NYTS data is not only focused upon youths’ reactions to the marketing, but is also focused upon youths’ reactions to broad-level interventions.

For example, researchers have been able to pair independent studies simultaneously with the annual NYTS for research leading to inferences about the social desirability of youths who report nicotine use in the survey (e.g., Messeri et al., 2007). Messeri et al.'s (2007) study focused on 2002 NYTS data concerning exposure to the truth® counter-marketing campaign, as well as comparing the reported tobacco use behavior during the prior three days (and measurements of saliva to determine biochemical indicators of smoking). The findings in Messeri et al.'s (2007) study did not suggest that the youths' level of truth® exposure was related to under-reporting. While Messeri et al. (2007) found that under-reported smoking was not a major source of error in the NYTS, the authors did note that African Americans and youths in lower grades were more likely to under-report smoking.

Demographic items (e.g., age, race, and ethnicity) have been useful to researchers as well. For example, Choi, Yu, and Sacco (2018) utilized 2014 NYTS data to reach the conclusion that there were distinct classes of youth tobacco use by race or ethnicity. Choi et al. (2018) suggested that more ethnically and racially focused prevention strategies are needed. The suggestion Choi et al. (2018) made, regarding this necessity for the distinct types of interventions, might be disagreeable to some practitioners during the current era of nicotine use with e-cigarettes and poly-tobacco use, as other researchers believe that it is important to address the risk for the singular forms of nicotine usage (e.g., e-cigarettes) to become gateways to other forms of nicotine use (Lanza, Russell, & Braymiller, 2016; Cardenas et al., 2016). Cardenas et al.'s (2016) study used the (2011-2013) NYTS data to reach the conclusion that adolescent use of e-cigarette technology was associated with initiation of cigarette smoking (particularly for the younger adolescents). Lanza et al.'s

(2016) study utilized the 2014 NYTS data to reach a finding that the rate of poly-tobacco use was reported differently both in terms of age groupings, as well as the varying racial and ethnic backgrounds. Due to wide-ranging variances in frequency and poly-tobacco usage, Lanza et al. (2016) advised that adaptive strategies are better suited to answer the needs of particular ethnic and racial groups' shifting substance usage (when considering Hispanic youth, the authors suggested that interventions should focus upon both cigarette smoking and e-cigarette use). In other words, racial or ethnic backgrounds of the nicotine users must not operate to limit the forms of interventions available. Rather, demographic data is only one factor in the overall case conceptualizations for individual nicotine users.

Tworek et al. (2014) were also able to utilize 2012 NYTS data to analyze ethnic and racial correlates among young tobacco users, finding that the youths were more likely to initiate attempts to quit all forms of nicotine use when parental advice against nicotine use was reported, and the finding was not dependent upon racial or ethnic backgrounds of the youths. In Tworek et al.'s (2014) study, the main goal was to describe the prevalence of quitting behaviors (i.e., intention to quit, and any past year attempts to quit). However, because in 2012 the new e-cigarette technology had only recently become available to the American youth, findings in Tworek et al.'s (2014) study were only reflective of 2.8% of high school students reporting e-cigarette usage. Although the early timing of Tworek et al.'s (2014) inquiry into the prominence of young e-cigarette users in 2012 NYTS data is not reflective of the shift toward e-cigarettes indicated in current data (to be focused on in the current study), the overall finding of the research offers an important implication for practitioners concerned with youth nicotine cessation. The implication of the finding is



that social characteristics surrounding youth nicotine usage are far more dynamic than racially or ethnically based interventions can be used to confront. At the same time, the practitioners working with the biopsychosocial model in mind can use such factors or trends to benefit clients with better understanding of individual differences in each case.

The conclusions of research focusing on racial or ethnic background can possibly offer practitioners suggestions, including nicotine use warning signs, biological or social underpinnings of particular types of nicotine usage, and even ways to tailor interventions, but the research is lacking in that there is no focus upon the psychological factors that can maintain nicotine use, universally, during the period of youth. Many social or biological explanations should remain useful parts of individual case conceptualizations, but there is also a need to analyze and compare mechanisms of addiction within the environment of e-cigarette usage, both at the individual and the ecological levels (Wills & Soneji, 2018).

For example, the three most recent NYTS datasets (2015, 2016, and 2017) were the first to include an item asking for a “yes” or “no” response to the following question: “Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions?” At the time of this literature review, none of the published work that has been located has utilized this important variable. The variable is useful for the purpose of the current study both in terms of the self-medication hypothesis as well as the biopsychosocial model, for a better understanding of reports of youths using e-cigarettes or smoking traditional cigarettes. Also, while researchers have looked at reports of nicotine dependence within the NYTS data (e.g., Harrell et al., 2016), the variables chosen for use in such research might be too restrictive for the current study.

In Harrell et al.'s, (2016) study, the researchers compared reports of cravings for nicotine products within the first five minutes of waking up and found that the e-cigarette users were less likely than the cigarette smokers to report cravings soon after waking up. Another current NYTS item asks for a “yes” or “no” response to the following question: “During the past 30 days, have you had a strong craving or felt like you really needed to use a tobacco product of any kind?” This current NYTS item allows for a greater overall measure of reported cravings, which implicates a broader sense of addiction to nicotine, than the more restrictive variable Harrell et al. (2016) used. Additionally, use of recent (2017) NYTS data allowed for this study to focus on the up-to-date reports of cravings.

### **Cravings and Needs**

Craving for a drug can be defined in numerous different ways, but craving has generally been regarded as the desire to use a drug (Sayette et al., 2000). In cases of e-cigarette use or cigarette smoking, cravings for nicotine use can be one of the prominent psychological manifestations of addiction, dependence, or onset of withdrawal (Jorenby, Smith, Fiore, & Baker, 2017; Perkins et al., 2017; Eissenberg, 2010; Etter & Eissenberg, 2015; Dawkins et al., 2012). In terms of the biopsychosocial model, such cravings and perceived needs to use nicotine are part of the psychological responses to nicotine stimuli that interventions should target, in addition to nicotine users' expectations about nicotine use operating to satiate the cravings (Etter & Eissenberg, 2015; Eissenberg, 2010; Copp, Collins, Dar, & Barrett, 2015). In a study by Shmulewitz et al. (2011), researchers went so far to suggest that a craving criterion should be added to the Diagnostic and Statistical Manual of Mental Disorders' (American Psychiatric Association, 2013) diagnostic label

for nicotine use disorder (NUD). In other words, Shmulewitz et al.'s (2011) concept of the psychometric criteria for nicotine abuse criteria is similar to other abused substances.

In research by Copp et al. (2015), the researchers manipulated information about the nicotine content of the e-cigarettes used in the study by telling participants the stimuli contained nicotine in one of the study's trials, and telling the participants the e-cigarette stimuli contained no nicotine in the study's other trial, although all stimuli contained no nicotine. Copp et al. (2015) found the participants, who were e-cigarette naïve, reported decreased intentions to smoke and decreased withdrawal-related cravings when told the e-cigarettes contained nicotine. Findings in Copp et al.'s (2015) research might suggest a-priori beliefs about effects of e-cigarette nicotine intake can be powerful, especially to naïve users, and also implicate important aspects about youth e-cigarette use initiation.

A more recent study by Palmer and Brandon (2018) also showed that expectancy might contribute to the effects of e-cigarettes upon craving. In Palmer and Brandon's (2018) study, the researchers varied nicotine instruction sets such that e-cigarette stimuli that did contain nicotine were either given to participants with an instruction stating that the e-cigarette contained nicotine or given with an instruction stating that the e-cigarette stimuli did not contain nicotine. The participants in Palmer and Brandon's (2018) study reported greater reduction of craving when using nicotine e-cigarettes and told to expect the nicotine than when using nicotine e-cigarettes and told to not to expect the nicotine.

Considering those experienced with e-cigarette use and expecting nicotine to be present in the e-cigarettes being vaped, however, the acute effects are likely to rely upon nicotine content in the e-cigarettes (Perkins et al., 2017). Perkins et al.'s (2017) research

utilized e-cigarettes that contained nicotine in one condition, and placebo e-cigarettes for the other experimental condition. Perkins et al.'s (2017) findings demonstrated that both cravings and withdrawal symptoms were abated when the e-cigarettes contained nicotine. In fact, because the participants in Perkins et al.'s (2017) study were in contemplation of reducing smoking or intending to quit smoking combustible tobacco with the aid of the e-cigarette use advertised in that study, the study's findings may also implicate support for the self-medication hypothesis and achieving negative reinforcement with e-cigarette use.

The findings in Dawkins et al.'s research (2012) also supported self-medication hypothesis, in terms of cognitive performance boost. Dawkins et al. (2012) compared the efficacy of tobacco cigarettes with the efficacy of e-cigarettes upon reduction of cravings, desire to smoke, and nicotine withdrawal symptoms, 20 minutes after use. Dawkins et al. (2012) looked at the participants' results on a memory task and letter cancellation task in addition to reports on a mood and physical symptoms scale. The findings in Dawkins et al.'s (2012) study showed that e-cigarettes were not only effective for reducing the desire to smoke and withdrawal craving signals, but the technology was also able to improve the participants' working memory performance. An additional finding among participants in Dawkins et al.'s (2012) study implicated higher importance of nicotine content for males.

Jorenby et al.'s (2017) research, contrastingly, presented the study participants a choice of reporting dual use (i.e., e-cigarettes to substitute for smoking), single use (only smoking cigarettes), or abstinence, in the real world conditions of maintaining reduction of smoking. Jorenby et al. (2017) also looked at participants' urinary nicotine level and the participants' reports of cravings and negative affect. Jorenby et al. (2017) found that

the female participants were able to effectively utilize the e-cigarettes as a substitute for smoking, and the finding was indicated by the higher nicotine level found in the female sample as well as that samples' lower reported cravings and negative effect conditioned upon the substitution. The findings of Jorenby et al.'s (2017) research indicate that, at least for the female participants of the study, e-cigarettes are a viable answer to cravings and negative affect items such as anxiety, irritability, or feelings of sadness or depression.

Prior research (e.g., Eissenberg, 2010) has not always shown reliable increases to biological markers of nicotine delivery (e.g., nicotine levels in blood) corresponding with e-cigarettes used in a manner similar to smoking cigarettes. Eissenberg (2010) sought to determine whether e-cigarette usage could effectively suppress nicotine cravings, and the findings of that early inquiry suggested e-cigarettes did not deliver nicotine as effectively as regulated nicotine products (e.g., gum or patches). Also, in a more recent study, Etter & Eissenberg (2015) found that e-cigarettes were less addictive to the study's participants than tobacco cigarettes and were also less addictive than nicotine gum. In such studies by Etter & Eissenberg (2015) and Eissenberg (2010) or similar existing literature, however, the participants are not among the targeted population (i.e., youth users) and results of the research cannot be accurately extrapolated to reflect the modern e-cigarette technology or effects of e-cigarette technology upon those within the current generation of youth users.

The current, internationally available, e-cigarette technology offers variable levels of nicotine administration (e.g., R  ther et al., 2018) that completely erase doubt about the feasibility of e-cigarette or vaping devices effectively delivering nicotine to users. R  ther et al. (2018) found that the current second-generation "tank model" of e-cigarette devices

might deliver less nicotine content to users, with fewer side effects than tobacco smoking, but the technology can still decrease craving and withdrawal in the acute phase of usage. The modernization of e-cigarette technology and its improving ability to have substantial roles in addressing nicotine cravings, needs, and other signals of addiction or withdrawal are important parts of the shift toward use of e-cigarettes were focused upon in this study.

It is, of course, also important for practitioners to consider the other psychological triggers for e-cigarette use that can serve to increase dependence symptoms and cravings (e.g., social anxiety or stress). For example, Watson et al.'s (2012) research showed that more severe symptoms of social anxiety were associated with smoking to cope and other coping behaviors (e.g., avoiding situations where smoking is prohibited), which might be reflected similarly in e-cigarette users' behavior. In a related study, Watson et al. (2018) built upon research connecting social anxiety and smoking to cope, in a task that induced a state of social anxiety in participants both before and after a 24-hour period of smoking cessation. Watson et al.'s (2018) findings demonstrated that the smokers who were rated high in both social anxiety (state, and trait) and smoking to cope symptoms might be at a risk for similar coping behaviors due to intense craving in stressful social environments.

Research by Kimbrel, Morissette, Gulliver, Langdon, and Zvolensky (2014) also investigated the connection between social anxiety and use of nicotine to reduce cravings. Kimbrel et al.'s (2014) study generalized the feasibility of coping through use of nicotine in a nicotine patch and placebo patch experimental design, finding that participants with social anxiety disorder reported higher levels of craving and urge to smoke in the placebo condition than the other participants reported. Findings in Kimbrel et al.'s inquiry might

further implicate the self-medication hypothesis in youth use of e-cigarettes for coping.

General stress is another example of the possible psychological triggers that can be manifested in the craving episodes. Kleinjan, Visser, and Engels (2012) conducted a study exploring Dutch adolescents' coping strategies for dealing with the temptations (cravings) to smoke during a 24-hour period of abstinence. Kleinjan et al. (2012) found that a combination of a high perceived level of stress and a low engagement in behavioral and cognitive temptation coping strategies led to more severe craving during abstinence compared to the combination of a high perceived level of stress and a high engagement in behavioral and cognitive temptation coping strategies. The implications of the findings in Kleinjan et al.'s (2012) research, if considered in the context of nicotine dependence in general, can be useful to those practitioners who are crafting interventions for youths who intend to quit nicotine use, with an emphasis upon effective strategies to cope with stress.

### **Intent to Quit**

Literature tracking use of e-cigarettes by those youth who intend to quit smoking is limited in itself, and the literature base regarding youth intent to quit e-cigarette use is wholly lacking (Kong & Krishnan-Smith, 2017). At this time, it is possible that critical components of the lacking impetus for ending the youth e-cigarette epidemic are being obfuscated by the youths' perceptions of the relative safety of the technology (Ambrose et al., 2014) or the undetermined health effects of the devices (Kong & Krishnan-Smith, 2017), and will be better addressed in future public health initiatives and policies. There is, however, some literature concerning adults intending to quit smoking with the aid of the e-cigarette technology (Pepper, Ribisl, Emery & Brewer, 2014; Foulds et al., 2011).

In Pepper et al.'s (2014) study, the researchers sought to explain the reasons for starting and stopping e-cigarette use, and found that 30% of users started using the devices in an effort to quit or reduce smoking. In Foulds et al.'s (2011) research, one of the goals was to identify patterns of e-cigarette use, and the authors found that out of 3037 ever users of e-cigarettes, 77% were using the technology to quit smoking or to avoid relapse, and 20% were using e-cigarettes to reduce tobacco consumption but not intending to quit smoking.

Pepper et al.'s (2014) research also directly examined reasons for discontinuing e-cigarette usage. In analyzing the data from a national survey sample of 3878 adults who reported ever using e-cigarettes, one of Pepper et al.'s (2014) findings was that a choice to stop using e-cigarettes was associated with education, smoking status, and income. In terms of the common reasons Pepper et al.'s (2014) results listed for stopping e-cigarette use: 49% of the cessation was due to users only experimenting with the devices, 15% of users reported that the devices did not feel like smoking cigarettes, 14% did not like the way e-cigarettes tasted, 13% reported e-cigarettes are too expensive, and 11% of the ever users reported stopping using e-cigarettes because the devices did not help with cravings. Only 3% of the e-cigarette quitters reported total nicotine cessation (Pepper et al., 2014).

While Pepper et al.'s (2014) research findings are telling about quitting intentions of adult e-cigarette users, it is impossible to tease information about nicotine dependence out of that study's results. In research by Liu, Wasserman, Kong, and Foulds (2017), the Population Assessment of Tobacco and Health (PATH) study data were used in order to assess relative dependence among the adult, exclusive everyday users of e-cigarettes and cigarettes. Liu et al. (2017) operationalized five variables of dependence: (1) self reports



of participants considering themselves addicted to e-cigarettes or cigarettes, (2) reports of ever having strong craving to use e-cigarettes or smoke cigarettes, (3) having experienced difficulty in the past 12 months to refrain from using e-cigarettes or smoking cigarettes in place where prohibited, (4) ever feeling real needs to use e-cigarettes or smoke cigarettes, and (5) reported time to first use upon waking. Within the reported data, Liu et al. (2017) found that the established and exclusive everyday e-cigarette users showed lower nicotine dependence than established, everyday exclusive cigarette smokers. Notwithstanding this finding of lower dependence, however, over three-quarters of the e-cigarette users in Liu et al.'s (2017) sample considered themselves to be addicted to the e-cigarettes. It is also notable that 92.9% of the daily e-cigarette users were former smokers (Liu et al., 2017).

It is highly plausible that much of the e-cigarette use among adults in Liu et al.'s (2017) study evidenced e-cigarette use as a method of coping with withdrawal symptoms of cigarette cessation. The shift toward the e-cigarette technology in the adult established cigarette smoking population might be analyzed in terms of the transfer to an alternate source of substance to fuel the addiction, but such information gives no attention to total cessation of e-cigarette use. As it is important to focus upon the intention to quit the e-cigarettes among young established daily users, one of the variables in the current study considered self-reports of youths concerning intent to quit using all tobacco products.

While it would also be beneficial to explore data concerning e-cigarette users who were never cigarette smokers, it is not necessarily feasible to do so. It is possible for the youths' nicotine use to be initiated via e-cigarette use, but rates of youth e-cigarette usage remain highest among adolescent smokers (Hammett et al., 2017). Hammett et al. (2017)

considered the characteristics of adult e-cigarette users who were never cigarette smokers and found that 63% of such users had tried other forms of tobacco prior to initiation of e-cigarette use, such as cigars, hookah, pipes, or chewing tobacco. Hammett et al.'s (2017) results indicated less than one percent of e-cigarette users had never used any other kind of tobacco products. Considering recent regular use during the prior 30 days of a singular tobacco product (e-cigarettes or cigarettes) offered the best potential for prediction of continued use for the current study. The focus of this study was upon a total cessation rather than considering unknown methods that might be utilized for future nicotine use.

### **Summary**

Together, self-medication hypothesis, biopsychosocial model, and the social cognitive theory provide an excellent foundation for exploring the many factors related to enduring youth nicotine use. Several gaps exist in current literature regarding e-cigarette use in general, youth e-cigarette use, youth nicotine use, and attempts to quit. This study serves to bridge those gaps through a specific focus on youths' reports of e-cigarette use. Additionally, this research was the first attempt to connect the NYTS item concerning serious cognitive difficulties to the youths' intent to quit or to continue to use tobacco.

Chapter 3 involves the research methods that will be employed in this study. The research design and its rationale, target population, sampling process, data collection, and instrumentation are also discussed in Chapter 3. There are discussions about operational variables used in the NYTS and how the variables were operationalized for this study. The threats to validity and ethical concerns will also be included in the larger discussion.

## Chapter 3: Research Method

### **Introduction**

The primary purpose of this study was to compare predicted future nicotine usage among youths using e-cigarettes and those smoking combustible tobacco cigarettes. In this study, I have examined predictability of intent to quit nicotine use as related to strong cravings or needs to use nicotine, serious cognitive difficulties, methods of nicotine use, and past unsuccessful cessation attempts. The following sections cover methodological aspects of the study involving the research design and rationale, target population and sampling procedures, data collection methods, and instruments used. The operational definitions of the predictor and outcome variables support the rationale for the research methodology and type of data analysis to be used. A discussion of the threats to internal and external validity is included following aspects of research design and methodology. Ethical concerns and procedures detailed in this chapter provide assurance of paperwork that reflects ethical practices during the study as well as proper institutional review.

### **Research Design and Rationale**

In this study, I examined youth nicotine use related variables as the variables relate to intent to quit using nicotine or the lack thereof. Nicotine use-related variables were independent predictor variables, with intent to quit nicotine use as the dependent outcome variable. Nicotine use-related variables included nicotine use methods, serious cognitive difficulties, past unsuccessful cessation attempts, and strong cravings or needs to use nicotine, as reported on the 2015, 2016, and 2017 NYTS. Unlike previous studies using NYTS data, the current study utilized the serious cognitive difficulty item, as well

as multiple years of datasets from the NYTS. In examining feasibility of obtaining variables to be used in this study, the NYTS format offered an efficient means of access to the quantitative data. The chosen design was not time-consuming or costly, as all the existing data are cross-sectional and publicly and freely available for retrieval from CDC.

## **Methodology**

### **Population**

The study population included males and females from public and private schools, with an emphasis upon middle and high school grades 6 to 12 in the United States (CDC, 2016, 2017, 2018). Surveyed schools also included alternative schools, special education schools, and Department of Defense schools (CDC, 2016, 2017, 2018). All participation was voluntary, and participants were randomly selected for inclusion (CDC, 2016, 2017, 2018). The population consisted of participants of different socioeconomic backgrounds, races, and ethnicities (CDC, 2016, 2017, 2018). As NYTS age-related survey entry is not limited in terms of age with possible values from “9 years old” to “18 years old,” but also includes a “19 years or older” value (CDC, 2016, 2017, 2018), it is not possible to know the exact ages of all participants. However, for purpose for this research, I excluded data outside of the “9 years old” to “18 years old” range to eliminate ambiguity regarding age.

The NYTS has a track record of adequate response in the realm of youth tobacco surveys. In 2017, there was a 76.8% participation rate among the 241 schools considered eligible for the NYTS (CDC, 2018), 81.5% of 248 schools in 2016 (CDC, 2017), and for 2015, 72.6% of 255 schools (CDC, 2016). Among the 2015-2017 NYTS data, there was an average of 88% of overall student participation within the participating schools (CDC,

2016, 2017, 2018). I have used the same data for my study population, and these data are also available from the CDC at: [https://www.cdc.gov/tobacco/data\\_statistics/surveys/nyts](https://www.cdc.gov/tobacco/data_statistics/surveys/nyts)

### **Sampling and Sampling Procedures**

Random sampling was used for the original secondary data. All participants were randomly selected, and both active and passive parental consent forms were sent by mail to participating schools. Students in schools requiring active consent were required to return consent forms to be allowed to participate, while students in schools allowing passive consent forms only needed to return forms if a parent did not want a child to participate. No completed NYTS was accepted without indication of parental consent.

The sampling process was based upon two main components: (1) school selection, and (2) student selection. The school selection was broken down as follows: for the 2015 NYTS, a total of 255 schools (140 middle schools, 115 high schools), for 2016, at total of 220 schools (110 middle schools, 110 high schools), and for 2017, a total of 220 schools (110 middle schools, 110 high schools) were selected. The student selection consisted of only currently enrolled students (verified by course schedule) within participating schools who agreed to participate, with the course schedules of relevant classes serving to protect against duplication or multiple sampling (CDC, 2016, 2017, 2018). The NYTS sampling strategy aimed to support a national estimate of tobacco use and exposure to pro-tobacco and anti-tobacco influences among youths enrolled in grades 6 to 12 (CDC, 2016, 2017, 2018). The framework of general sampling procedures also supported the estimation of tobacco related knowledge, attitudes, and behaviors, in a national population of the public and private school students (CDC, 2016, 2017, 2018). More specifically, the sampling

design allowed for a national estimate at 95% level of confidence and 5% error margin by school level (middle school or high school), grade level (6-12), sex (male, female), and race/ethnicity (Hispanic, non-Hispanic black, non-Hispanic white) variables (CDC, 2016, 2017, 2018). The design allowed for different subgroups, emphasizing grade, sex, and race/ethnicity within the school level domains as well (CDC, 2016, 2017, 2018).

I have used the convenience sampling strategy to obtain a sample for the study. A convenience or availability sampling is a non-probability method that depends upon prior collected data without additional requirements (Dudovskiy, 2018). There are important reasons why researchers use the strategy, including simplicity for gathering participants' data, efficiency in time and implementation, and cost benefits (Dudovskiy, 2018).

The frequency of NYTS data collection has been on an annual basis from 1999 through 2017. I have taken my sample from 2015, 2016, and 2017 NYTS datasets due to the current nature of the data and the inclusion of the variable concerning any serious cognitive difficulty. The  $n$  (sample size) of the entire 2015 dataset is 255 schools, out of which 185 participated (CDC, 2016), while the sample size for the entire 2016 dataset is 248 schools, out of which 202 schools participated (CDC, 2017), and the sample size for the entire 2017 dataset is 241 out of which 185 participated (CDC, 2018). The sampling design of the NYTS and allocation of strata are proportional, serving to prevent the need for oversampling (CDC, 2016, 2017, 2018). The NYTS sampling methods also provide sufficient information for an analysis of short, intermediate, and long-term indicators key to designing, implementing, and evaluating the Tobacco Prevention and Control Program regarding middle and high school students' tobacco-related beliefs, attitudes, behaviors,

and exposure to pro and anti-tobacco influences, which allows for states to compare local estimates with national data (CDC, 2016, 2017, 2018). Moreover, all datasets obtained in conducting this study were public documents that are readily accessible to researchers.

### **Procedures for Recruitment, Participation, and Data Collection**

NYTS participants were selected from the various schools in the United States. In May 2014, May 2015, and June 2016, recruitment for subsequent years' NYTS began with calls to State Departments of Education and Health (CDC, 2016, 2017, 2018). Support letters were also sought from various states' agencies and participating school districts (CDC, 2016, 2017, 2018). The participants agreed upon unanimous dates and timeframes that were convenient for all participating schools for efficient implementation of the surveys, as well as accommodation of school schedules (CDC, 2016, 2017, 2018). The convenience noted in school calendars was considered when selecting dates (CDC, 2016, 2017, 2018). For schools co-located within geographical regions, the surveys were scheduled together so as to facilitate efficiency in travel time and survey administration (CDC, 2016, 2017, 2018). Secure electronic calendaring facilitated communication and protected against scheduling conflict, lost time, or resampling (CDC, 2016, 2017, 2018).

### **Instrumentation and Operationalization of Constructs**

Several instruments were used in the NYTS to cover short, intermediate, and long-term tobacco prevention and control indicators. For an example, the 2017 survey instruments utilized a total of 88 items, with the first five items consisting of students' demographic information, and the remaining items focusing upon gathering information related to the comprehensive tobacco-related topics (CDC, 2018). Some of the topics

included: cessation attempts, access to nicotine, and nicotine dependence (CDC, 2018).

NYTS topics also co-facilitate and supplement items from other surveys, such as: the State Youth Tobacco Survey (YTS), or the Youth Risk Behavior Surveillance System (YRBSS). The topics also enable comprehensive data collection concerning the tobacco-related indicators in both middle school (6-8) and high school (9-12) grade levels (CDC, 2018). Combined, the instruments have been successfully used within the NYTS to gain more specific information related to e-cigarettes, cigarettes, hookah, bidis, kreteks, snus, smokeless tobacco products, dissolvable tobacco products, cigars, and tobacco pipes, to include exposure to second-hand smoke, smoking cessation, school curricula, minors' ability to obtain or purchase tobacco products, knowledge and attitudes about tobacco, and familiarity with various pro and anti-tobacco messages (CDC, 2016, 2017, 2018).

### **Operationalization**

For the original survey, the variables were operationalized to ensure measurability and quantification of the data. Questionnaire form of measurement was utilized in order to operationalize the variables in the original survey. The NYTS variables included age, race/ethnicity, gender, grade (level of education), and items according to the key short, intermediate, and long-term tobacco prevention and control outcome indicators, with an emphasis on demographic information and comprehensive tobacco topics (CDC, 2018).

Unsuccessful cessation attempt, serious cognitive difficulty, craving or need to use tobacco, method of tobacco use and intent to quit nicotine usage were the research variables extracted from the NYTS (CDC, 2016, 2017, 2018) for use in this research.

The variables were used to infer aspects of tobacco use and tobacco cessation among the



youth. The following definitions outline the variables examined in the current study:

*Craving or Need to Use Tobacco:* “Yes” or “No” reported for the following NYTS item: “During the past 30 days, have you had a strong craving or felt like you really needed to use a tobacco product of any kind?”

*Intent to Quit Nicotine Usage:* This variable refers to the seriousness of intent to quit all tobacco use, reported in terms of a length of time, such as: (Yes,) (a) “during the next 30 days” (b) “during the next 6 months” (c) “during the next 12 months” or (d) “but not during the next 12 months” –OR– the lack of intent to quit all tobacco use, reported as” “No, I am not thinking about quitting the use of all tobacco products” for the following NYTS item: “Are you seriously thinking about quitting the use of all tobacco products? (Please choose the first answer that fits)”

*Method of Tobacco Use:* “All 30 days” reported for only one of the following NYTS items: (a) “During the past 30 days, on how many days did you smoke cigarettes?” –or– (b) “During the past 30 days, on how many days did you use e-cigarettes?”

*Serious Cognitive Difficulty:* “Yes” or “No” reported for the following NYTS item: “Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions?”

*Unsuccessful Cessation Attempt:* “1 time” (or more) reported for the following NYTS item: “During the past 12 months, how many times have you stopped using all tobacco products for one day or longer because you were trying to quit all tobacco?” The NYTS questionnaire sections regarding all tobacco begin with the following preface: “The next six sections of questions ask about your use of particular kinds of tobacco

products, such as cigarettes, cigars, smokeless tobacco, electronic cigarettes, hookahs, pipes, snus, dissolvable tobacco, and bidis.” (CDC, 2016, 2017, 2018).

### **Data Analysis**

SPSS version 25 was utilized for data analysis. Multinomial logistic regression was performed for the statistical analysis, as is prudent in research involving prediction of a nominal dependent outcome variable having more than two categories, based upon a set of independent predictor variables with inherent nonlinear relationships (Pampel, 2000). The dependent or outcome variable was intent to quit nicotine use, which is a categorical variable with five possible categories including: (a) during the next 30 days (b) during the next 6 months (c) during the next 12 months (d) not during the next 12 months, and (e) I am not thinking about quitting. The independent predictor variables were all dichotomous. Predictor variables included reports of past unsuccessful cessation attempt, reports of serious cognitive difficulty, reports of craving/need to use tobacco, and reports of e-cigarette use or cigarette smoking. The research questions and hypotheses were:

*RQ1:* Do youths who smoke cigarettes daily and those using e-cigarettes daily equally report having had strong cravings or real needs to use tobacco products during the prior 30 days?

*H<sub>01</sub>:* Youths smoking cigarettes daily and those using e-cigarettes daily are equally likely to report cravings or real needs to use tobacco products during the prior 30 days.

*H<sub>a1</sub>:* There is a difference between the likelihood of youths smoking cigarettes daily and youths using e-cigarettes daily reporting having strong cravings or real needs to

use the tobacco products during the prior 30 days.

*RQ2:* Do unsuccessful cessation attempts, serious cognitive difficulties, cravings or needs to use tobacco, or methods of tobacco use predict reported intent to quit nicotine use?

*H<sub>02</sub>:* There is no significant prediction of reported intention to quit nicotine use in terms of unsuccessful cessation attempts, serious cognitive difficulties, craving, needs, or urges to use tobacco, or method of nicotine use.

*H<sub>a2</sub>:* There is significant prediction of reported intent to quit nicotine use in terms of unsuccessful cessation attempt, serious cognitive difficulties, craving, needs, or urge to use tobacco, or method of nicotine use.

### **Data Coding**

Within SPSS, responses to NYTS items were dummy-coded into newly labeled variables, using 0 and 1 for the predictor variables and 1, 2, 3, 4, and 5 for the outcome variable covering intent to quit all use of tobacco. The independent predictor variables were all dichotomous variables that were labeled and coded as follows: METHOD for method of nicotine use (0 for e-cigarette, 1 for cigarette), CRAVENEED for craving, need or urge to use tobacco (0 for no, 1 for yes), PASTQ\_RECODE for unsuccessful cessation attempt (0 for no, 1 for yes), and SERCOGDIF for serious cognitive difficulty (0 for no, 1 for yes). The outcome variable was labeled INTENT5 and coded 1 for "during the next 30 days," 2 for "during the next 6 months," 3 for "during the next 12 months," 4 for "not during the next 12 months" and 5 for "not thinking about quitting the use of all tobacco products."

## **Threats to Validity**

### **Threats to External Validity**

I am confident in the external validity of this research. The survey data covered a very expansive population of the American youth, who were randomly selected, differing in race/ethnicity, socioeconomic background, age, and gender, which are factors lending toward generalizability of the conclusions of this study. For example, for the most recent NYTS administration, 241 schools were sampled and 185 schools participated, making a 76.8% participation rate for the return of 17,872 of 20,144 questionnaires (CDC, 2018). Thus, the external validity is in line with the various American middle and high schools.

### **Threats to Internal Validity**

I am also confident in the internal validity of this research. I exclusively sampled from the ongoing NYTS, which is carefully controlled by the CDC in terms of scientific research protocol. There is considerable literature utilizing the NYTS data, offering great testimony to the authenticity of the data. Additionally, the NYTS relies upon many of the same techniques in supplementing other widely accepted surveys, such as the YRBSS.

## **Ethical Procedures**

Data that I used in conducting the study were entirely de-identified, preventing researchers from possessing personal information about participants. I reported results in the aggregate form, and did not report individual data. I applied to Walden University's Institutional Review Board (IRB) for permission to analyze the data, and conducted the study only after receiving written permission from the IRB to do so. Upon review of my

proposal and application to conduct the study, the IRB granted me permission to analyze the data. My IRB approval number was 12-12-18-0645521

### **Summary**

The shift toward e-cigarette use among American youth is among the issues that clinical psychologists are tapped to confront. Importantly, the effects of nicotine upon the developing brain are not eliminated by the shift. E-cigarette devices may be attractive to young people for many reasons, such as: the concealable nature of the devices, lack of some of the byproducts of combustible tobacco smoke, or the perceived positive effects of nicotine use. The NYTS aggregates annual comprehensive data concerning e-cigarette device related topics among a national sample of middle and high school level students.

The data analysis plan for this research included both descriptive and inferential reasoning. Power analysis and the necessary post-hoc analyses were completed. The data utilized in this inquiry have been drawn from the most current NYTS surveys, years 2015, 2016, and 2017. The publicly available data are owned and maintained by CDC.

In this study, I have answered the research questions I identified to be of interest to clinical psychologists. In approaching the research questions, I relied upon literature concerning research design, methodology, and statistical analysis. Some of the most fundamental concerns guiding my inquiry included the variables of interest, choice of design, population selection, sampling process, size of sample, instrumentation, data analysis plan, construct operationalization, and how all the components can lead to the results of a study that will be a meaningful contribution toward positive social change.

## Chapter 4: Results

### **Introduction**

In this study, I compared predicted future nicotine usage between youths using e-cigarettes and those smoking combustible tobacco cigarettes. The research questions were focused upon determining whether the differences involved in the two nicotine use technologies can predict future nicotine usage. All data used in this study originated from the 2015, 2016, and 2017 NYTS administrations. In this chapter, I present information about preliminary analyses and screening, descriptive analyses, and findings of analyses for each of the research questions. Finally, I include a summary of the primary findings of the study before transitioning into the interpretation of findings in the final chapter.

### **Data Analyses**

After obtaining Walden's IRB's approval (12-12-18-0645521), I began the initial analyses using raw data from years 2015, 2016, and 2017 of the NYTS. As the NYTS contains items irrelevant to this study or not used in this study, I consolidated only the data necessary for this study through appropriately labeled SPSS variables. The data files produced by the CDC were downloadable over the Internet in SAS format, and there was not any conversion necessary in order to use SPSS software to analyze the SAS files.

### **Preliminary-Analyses and Data Screening**

The student questionnaires included in the 2015, 2016, and 2017 NYTS datasets consisted of 56,258 total cases (17,711 in 2015, 20,675 in 2016, and 17,872 in 2017). As data needed for this study included only cases indicative of two forms of nicotine use (e-cigarette or cigarette), only 444 cases (155 cases from 2015, 169 cases from 2016, and

120 cases from 2017) indicating these forms of singular nicotine use were consolidated into the SPSS variables labeled for further analyses. In addition to variables pertaining to the research questions, the demographic variables of age and sex reported among the 444 selected cases were also labeled for the descriptive analyses. An additional element of data screening consisted of deleting 57 cases missing needed data.

### **Descriptive Analyses**

Among the 387 cases retained for analysis in this study, 385 of the cases included responses for age, and 382 of the cases included responses for sex. As for age, the percentage of the NYTS respondent cases indicating 9 years is 2.6%, 0.8% for 10 years, 1.0% for 11 years, 2.1% for 12 years, 4.7% for 13 years, 5.2% for 14 years, 11.4% for 15 years, 19.5% for 16 years, 24.7% for 17 years, 22.6% for 18 years, and 5.5% for 19 years or older. For sex, the percentage of the NYTS respondent cases indicating male sex was 68.1% and the percentage of the NYTS respondent cases indicating female sex was 31.9%. A summary of the selected sample's reported demographics is shown in Table 1, with the cumulative percentages of reported age listed in Table 2 and the values for sex listed in Table 3. Figures 1 and 2 show the distribution of age and sex for the participants who responded.

Table 1

*Reported Values for the Demographic Characteristics of the Selected Sample Cases*

Characteristic	<i>Reported Values</i>	<i>Missing Values</i>
Age	385	2
Sex	382	5

Table 2

*Cumulative Percentages of Reported Age*

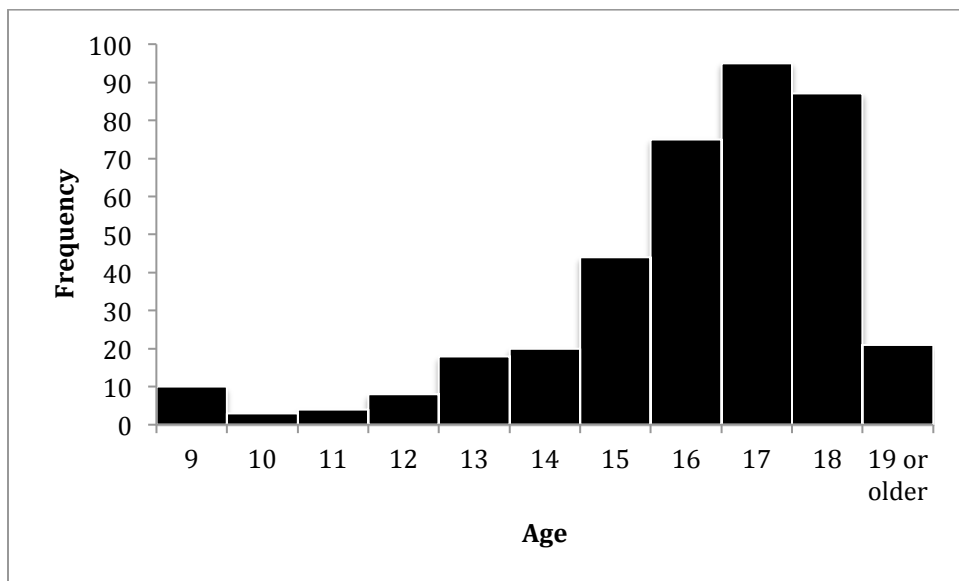
<i>Age</i>	<i>Frequency</i>	<i>Valid Percent</i>	<i>Cumulative Percent</i>
9 years old	10	2.6	2.6
10 years old	3	0.8	3.4
11 years old	4	1.0	4.4
12 years old	8	2.1	6.5
13 years old	18	4.7	11.2
14 years old	20	5.2	16.4
15 years old	44	11.5	27.8
16 years old	75	19.5	47.3
17 years old	95	24.7	71.9
18 years old	87	22.6	94.5
19 years old or older	21	5.5	100

Table 3

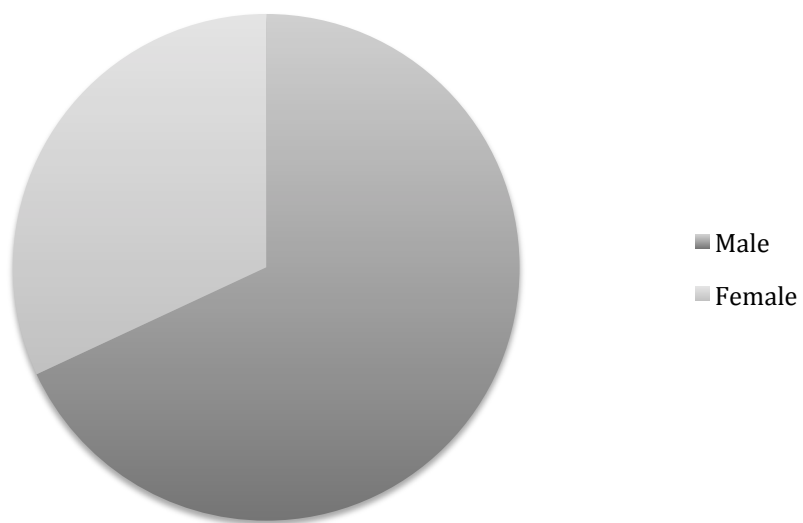
*Cumulative Percentages of Reported Sex*

<i>Sex</i>	<i>Frequency</i>	<i>Valid Percent</i>	<i>Cumulative Percent</i>
Male	260	68.1	68.1
Female	122	31.9	100





*Figure 1.* Histogram for the ages of the participants.



*Figure 2.* Pie chart for the sex of the participants.

All 387 selected cases included responses to NYTS items covering unsuccessful cessation attempt, serious cognitive difficulty, craving, need or urge to use tobacco,

method of use, and intent to quit all use of tobacco. These were the predictor variables.

The frequency distributions for these four predictor variables are shown in Table 4.

Table 4

*Frequencies for Predictor Variables*

Variable	<i>Value = 0</i>	<i>Value = 1</i>
METHOD	192	195
CRAVENEED	193	194
PASTQ_RECODE	243	144
SERCOGDIF	273	114

### **Assumption Testing**

Six assumptions must be met to ensure multinomial logistic regression is suitable for the analysis (Field, 2013). The assumptions are: the outcome variable is measured at the nominal level, there are one or more predictor variables (continuous, ordinal or nominal), there is an independence of observations (with the outcome variable having mutually exclusive categories), the data does not show multicollinearity, there is a linear relationship between continuous independent variables and the logit transformation of the dependent variable, and there are no significant outliers, high leverage points, or highly influential points (Field, 2013). Prior to data screening, cleaning, and preliminary analyses, I determined that the first three assumptions were met based upon the structure of the items selected for variables. I verified all other assumptions were met using SPSS.

### **Statistical Analysis**

The following sections cover all the analyses. Analyses included a chi-square and

multinomial logistic regression. Results are shown for hypotheses and research questions.

### **RQ1 and H<sub>0</sub>1.**

RQ1 is Do youths who smoke cigarettes daily and youths using e-cigarettes daily equally report having had strong cravings or real needs to use tobacco products during the prior 30 days? H<sub>0</sub>1 assumes no statistically significant difference between the cravings or needs to use tobacco products during the prior 30 days by youths smoking cigarettes daily and reports of those using e-cigarettes daily. H<sub>0</sub>1 hypothesis was tested.

A Chi-square test of independence was performed to examine the relationship between tobacco use methods and reports of cravings or needs. A significant relationship was shown,  $\chi^2(1) = 73.799, p < .001$ . This value is highly significant and shows there is a statistically significant relationship between method of tobacco use and reported cravings or real needs to use tobacco products during the prior 30 days. The first null hypothesis, H<sub>0</sub>1, is rejected, and alternative hypothesis, H<sub>1</sub>1, is accepted. Multinomial regression was used to further explore craving or real needs as a covariate with method of tobacco use.

### **RQ2 and H<sub>0</sub>2.**

RQ2 is Do unsuccessful cessation attempts, serious cognitive difficulties, cravings or needs to use tobacco, or methods of tobacco use predict the reported intent to quit nicotine use? H<sub>0</sub>2 assumes none of the listed predictor variables predict membership in groups of intention to quit tobacco use. H<sub>0</sub>2 was tested.

Multinomial logistic regression was performed to model the relationship between the predictors and membership in the groups of intention to quit all tobacco usage (those intending to quit using during the next 30 days, those intending to quit during the next 6

months, those intending to quit during the next 12 months, those intending to quit but not during the next 12 months, and those with no intention to quit all tobacco). The standard .05 criterion of statistical significance was used for all tests, and the tests were conducted twice in order to cross check the inverse values of the logit transformations.

Addition of the predictors to a model containing only the intercept significantly improved the fit between model and data,  $\chi^2(16, N = 387) = 91.479$ , Nagelkerke  $R^2 = .23$ ,  $p < .001$ . Significant unique contributions were made by two predictors, METHOD and PASTQUIT\_RECODE, but not by CRAVENEED or SERCOGDIF. Goodness of fit was explored by conducting Hosmer-Lemeshow tests for each pair of groups. In no case was the test significant. Unique contributions of the predictors are shown in Table 5.

Table 5

*Unique Contributions of the Predictors*

Predictor	$\chi^2$	<i>df</i>	<i>p</i>
METHOD	19.72	4	.001
CRAVENEED	2.78	4	.595
PASTQ_RECODE	0.63	4	< .001
SERCOGDIF	53.88	4	.960

The reference category represented no intent to quit the use of tobacco products. Accordingly, each predictor lists four parameters: 1) during the next 30 days, 2) during the next 6 months, 3) during the next 12 months, and 4) yes, but not during the next 12 months. The parameter estimates contrasting the intent groups are shown in Table 6 and Table 7.

Table 6

Parameter Estimates Contrasting the Groups of Intent ( $N = 387$ )

Predictor	No intent vs.	<i>B</i>	<i>OR</i>	<i>p</i>
METHOD	next 30 days	-.936	.392	.020
(E-cigarettes)	next 6 months	-1.533	.216	.004
	next 12 months	-.843	.430	.041
	not next 12 mos.	-1.126	.324	.001
CRAVENEED	next 30 days	-.382	1.465	.343
(NO)	next 6 months	-.237	.789	.634
	next 12 months	.353	1.424	.396
	not next 12 mos.	-.207	.324	.546
PASTQ_RECODE	next 30 days	-1.527	.217	.000
(NO)	next 6 months	-2.287	.102	.000
	next 12 months	-1.776	.169	.000
	not next 12 mos.	-1.344	.261	.000
SERCOGDIF	next 30 days	-1.527	.849	.675
(NO)	next 6 months	.045	1.046	.923
	next 12 months	.138	1.148	.742
	not next 12 mos.	.158	1.171	.638

Table 7

Inverse Parameter Estimates Contrasting the Groups of Intent ( $N = 387$ )*(table continues)*

Predictor	No intent vs.	<i>B</i>	<i>OR</i>	<i>p</i>
METHOD (Cigarettes)	next 30 days	.936	2.551	.020
	next 6 months	1.533	4.634	.004
	next 12 months	.843	2.323	.041
	not next 12 mos.	1.126	3.084	.001
CRAVENEED (YES)	next 30 days	-.382	.682	.343
	next 6 months	.237	1.268	.634
	next 12 months	-.353	.702	.396
	not next 12 mos.	.207	1.230	.546
PASTQ_RECODE (1 or more)	next 30 days	1.527	4.602	.000
	next 6 months	2.287	9.848	.000
	next 12 months	1.776	5.905	.000
	not next 12 mos.	1.344	3.835	.000
SERCOGDIF (YES)	next 30 days	1.527	1.178	.675
	next 6 months	-.045	.956	.923
	next 12 months	-.138	.871	.742
	not next 12 mos.	-.158	.854	.638

The results of the multinomial logistic regression analysis suggest METHOD and PASTQ\_RECODE both predicted membership across the four groups having intention to quit all tobacco use compared to no intention to quit. When conceptualizing the odds predicted in the findings for any outcome of individual predictors, it is necessary to also

conceptualize other predictors as being held constant. The next two sections cover the odds of membership in intent to quit groups for METHOD and PASTQ\_RECODE levels.

#### **METHOD Odds of INTENT5 Group Membership for PASTQ\_RECODE**

In terms of the likelihood of an e-cigarette user intending to quit all tobacco usage in the next 30 days, the findings suggest the odds are .608 less than having no intention to quit. In terms of the likelihood of an e-cigarette user intending to quit all tobacco usage in the next 6 months, the findings suggest the odds are .784 less than having no intention to quit. In terms of the likelihood of an e-cigarette user intending to quit all tobacco usage in the next 12 months, the findings suggest the odds are .570 less than having no intention to quit. In terms of the likelihood of an e-cigarette user intending to quit all tobacco use, but not in the next 12 months, findings suggest the odds are .676 less than having no intent.

In terms of the likelihood of a cigarette smoker intending to quit all tobacco usage in the next 30 days, the findings suggest the odds are 2.551 greater than having no intent to quit. In terms of the likelihood of a cigarette smoker intending to quit all tobacco usage in the next 6 months, the findings suggest the odds are 4.634 greater than having no intent to quit. In terms of the likelihood of a cigarette smoker intending to quit all tobacco use in the next 12 months, findings suggest the odds are 2.323 greater than having no intent to quit. In terms of the likelihood of a cigarette smoker intending to quit tobacco use, but not in the next 12 months, findings suggest the odds are 3.084 greater than having no intent.

#### **PASTQ\_RECODE Level Odds of INTENT5 Group Membership**

In terms of the likelihood of an e-cigarette user who did not attempt to quit tobacco use in the past 12 months intending to quit all tobacco usage in the next 30 days, findings

suggest the odds are .783 less than having no intention to quit. In terms of likelihood of an e-cigarette user who did not attempt to quit tobacco use in the past 12 months intending to quit all tobacco usage in the next 6 months, the findings suggest the odds are .898 less than having no intention to quit. In terms of the likelihood of an e-cigarette user who did not attempt to quit tobacco use in the past 12 months intending to quit all tobacco usage in the next 12 months, the findings suggest the odds are .831 less than having no intention to quit. In terms of likelihood of an e-cigarette user who did not attempt to quit all tobacco use in the past 12 months intending to quit all tobacco use, but not in the next 12 months, the findings suggest that the odds are .739 less than having no intent to quit tobacco use.

In terms of likelihood of a cigarette smoker who attempted to quit tobacco use in the past 12 months intending to quit all tobacco usage in the next 30 days, the findings suggest the odds are 4.602 greater than having no intention to quit. In terms of likelihood of a cigarette smoker who attempted to quit tobacco use in the past 12 months intending to quit all tobacco usage in the next 6 months, findings suggest the odds are 9.848 greater than having no intent to quit. In terms of likelihood of a cigarette smoker who attempted to quit tobacco use in the past 12 months intending to quit all tobacco usage in the next 12 months, the findings suggest the odds are 5.905 greater than having no intent to quit. In terms of likelihood of a cigarette smoker who attempted to quit tobacco use in the past 12 months intending to quit all tobacco usage, but not in the next 12 months, the findings suggest that the odds are 3.835 greater than having no intention to quit all tobacco usage.

Given that there were two statistically significant predictors of intention to quit all tobacco usage (or the lack thereof),  $H_02$ , is rejected, and  $H_12$  is accepted. However, two



predictors (CRAVENEED, SERCOGDIF) were not found to be statistically significant in the prediction of intention to quit all tobacco usage. In general, the results suggest that it is more likely for e-cigarette users to intend to continue using tobacco than the cigarette smokers. The results also generally suggest that it is more likely for cigarette smokers who attempted to quit tobacco use in the past 12 months to intend to quit all tobacco use than it is for those cigarette smokers who had not attempted to quit in the past 12 months. However, the findings suggest it is less likely for e-cigarette users, regardless of whether having attempted to quit all tobacco usage in the past 12 months, to have intent to quit.

### **Summary**

The purpose of this study was to conduct a meaningful comparison of factors that are related to the continued usage of e-cigarettes and cigarette smoking among the youth. NYTS items, consisting of questions relating to tobacco usage method, cravings or needs, past quit attempts, serious cognitive difficulty, and intention to quit all tobacco use, were used to compare the predicted outcome. A total of 56,258 NYTS cases were considered for inclusion in the analysis, of which 387 cases with complete responses and a singular forms of tobacco use were included in the data analysis. There were only a few items of missing demographic data. Upon completion of analyses, it was found that two predictor variables led to statistically significant odds of the intent to quit outcome. While it was found that method of tobacco use and existence of a past quit attempt could enhance or diminish odds of intent to quit in the future, the analysis did not provide evidence of cravings or needs or serious cognitive difficulties statistically influencing predictions.

These findings provide limited support for two of the predictors of intended future nicotine use. The study results create an opportunity to discuss the overall effect of failed cessation attempts, as well as the difference that e-cigarette usage can make in predicting continued nicotine use. The results will be further discussed and interpreted in Chapter 5. Chapter 5 also explains limitations, implications, and recommendations for further study.

## Chapter 5: Discussion, Conclusions, and Recommendations

This study focused on some factors that predict future nicotine usage, including method of nicotine use, past cessation attempts, cravings or real needs, and any serious cognitive difficulties. The main purpose of this study was to answer two questions:

*RQ1:* Do youths who smoke cigarettes daily and youths using e-cigarettes daily equally report having had strong cravings or real needs to use tobacco products during the prior 30 days?

*RQ2:* Do prior cessation attempts, serious cognitive difficulties, cravings or needs to use tobacco, or methods of tobacco use predict reported intent to quit nicotine use?

The hypotheses tested in this study were:

*H<sub>0</sub>1:* youths smoking cigarettes daily and youths using e-cigarettes daily are equally likely to report cravings or real needs to use tobacco products during the prior 30 days.

*H<sub>a</sub>1:* there is a difference between the likelihood of youths smoking cigarettes daily and youths using e-cigarettes daily reporting having strong cravings or real needs to use the tobacco products during the prior 30 days.

*H<sub>0</sub>2:* there is no significant prediction of reported intention to quit nicotine use by unsuccessful cessation attempt, serious cognitive difficulty, craving, need or urge to use tobacco, or method of nicotine use.

*H<sub>a</sub>2:* there is significant prediction of reported intent to quit nicotine use by unsuccessful cessation attempt, serious cognitive difficulty, craving, need or urge to use tobacco, or method of nicotine use.

The study relied upon cross-sectional analysis, with four independent predictor variables (CRAVENEED, METHOD, PASTQ\_RECODE, and SERCOGDIF) and one dependent outcome variable (INTENT5). The data analysis of 387 cases revealed that a significant relationship exists between METHOD and CRAVENEED ( $p < .001$ ). Data analyses also revealed METHOD and PASTQ\_RECODE to be significant predictors of INTENT5 ( $p < .05$ ). However, the analyses did not suggest the other predictor variables (CRAVENEED, SERCOGDIF) significantly predicted the INTENT5 outcome variable.

### **Interpretation of the Findings**

Prior nicotine research has identified issues related to e-cigarette use in terms of nicotine cessation, craving or perceived real needs to use nicotine, and serious cognitive difficulty (e.g., Harrell et al., 2016; Etter & Eissenberg, 2015; Campbell-Heider & Snow, 2016; Tworek et al., 2014). As presented in Tables 5, 6, and 7 in Chapter 4, this research has demonstrated that both the nicotine usage method (cigarettes versus e-cigarettes) and history of cessation attempt in the past year might offer some support for predicted future nicotine usage intent in the youth-aged sample. The overall support offered by these two variables may be an alarming reflection of the youths' shift toward e-cigarettes since the advent of the technology, as well as an illustration of the youths' perception of the safety of e-cigarettes in contrast to traditional cigarettes. Research has also shown that male sex and older age are among the most common characteristics of youth e-cigarette use and youth nicotine use in general (e.g., Perikleous, Steiropoulos, Paraskakis, Constantinidis, & Nena, 2018). This study showed that over 68% of the included cases indicated male sex, and more than 72% of included cases indicated the youths' ages as over 16 years old.

These figures characterize the included cases among the sample for this study (for those students who answered all NYTS items, and who used either the singular e-cigarette or cigarette method of nicotine intake for all of the prior 30 days), but the figures will not necessarily represent the entire American youth population. However, the figures might be helpful to create a better idea about the demographic patterns of youth nicotine usage. It is possible that more males have reported daily use than females due to an extraneous variable not measured in this research. In terms of age, it is possible older youths have a greater level of exposure to nicotine-related stimuli generally, which can enable daily use.

Prior studies have considered e-cigarette use to be a method of tobacco cessation rather than the trending form of nicotine usage among the youth. While prior research is indicative of success in curbing cigarette smoking by substituting combustible cigarettes with e-cigarettes, this study did not consider the possibility that some of the youth daily e-cigarette users could have substituted using e-cigarettes in such manner. Instead, this study considered the prior 30 days to be consistent and daily, with the sole method of use being the most preferred method of use. As presented in Chapter 4, the statistically significant prediction of intent to quit all tobacco use for those youth who smoked cigarettes daily, compared with those who used e-cigarettes daily means that there is a somewhat evident urgency surrounding the desire to cease one form of substance use, but not the other. This could also mean that younger e-cigarette users are content with daily use of a perceived safer form of nicotine. Given that the variables for cravings or needs and serious cognitive difficulties are not shown to be significant predictors, the results of this study cannot confirm whether one method is more effective for self-medication.

When it comes to past cessation attempts, many prior studies have focused upon the repeated unsuccessful cessation of cigarette smoking, but fewer studies focus on e-cigarette cessation. This study explored the potential that past unsuccessful attempts to quit might help predict future intent to quit. As the finding demonstrated that the daily e-cigarette users who had not attempted to quit have much less odds of intending to quit in the future than those who have reported prior unsuccessful cessation attempts, there is support for a possibly powerful within-group effect of the prior quitting behavior.

One potential reason for this possible effect is past quitters' awareness of strong forces of addiction and withdrawal responses in the absence of nicotine, and in the case of those who have made no prior cessation attempts, the lack of such awareness. Based upon the findings of this study, the factor that matters most is the existence of the failed cessation attempt, as that is the factor that might predict the potential greater likelihood for a subsequent quit attempt within the next year. However, the findings do not suggest that either the method of usage or the existence of the past cessation attempts combine as a better predictor of a particular state of urgency for a subsequent quit attempt (i.e., more precisely than within the next twelve months). Overall, these findings showed significant predictions regarding those with past cessation attempts intending to make a subsequent quit attempt across all of the four levels of the INTENT5 outcome variable ( $p < .001$ ), while the findings demonstrated that the METHOD variable led to the most significant prediction ( $p = .001$ ) at the lowest level of the INTENT5 variable (i.e., reported intent to quit, but not within the next 12 months).

This study was based upon the self-medication hypothesis by Khantzian (1985),

concerning use of nicotine to alleviate aversive symptoms related to mental conditions, Engel's (1977) biopsychosocial model, concerning the biological, psychological, and social factors behind the nicotine use behavior, and also the social cognitive theory (SCT) developed by Bandura (2005), involving the self-management processes that might occur during the use of e-cigarettes by youths concerned with health effects of smoking. While characteristics of the sample data utilized for this study do not exhibit CRAVENEED or SERCOGDIF acting as predictors of future nicotine use behavior, the findings also do not disconfirm the self-medication hypothesis as applied to this youth nicotine use behavior. In that the PASTQUIT\_RECODE and METHOD did serve as significant predictors for the future nicotine use behavior, explanations rooted in both the biopsychosocial model and the social cognitive theory are offered as support through the results of this research.

### **Limitations of the Study**

The limitations discussed in this section include construct validity and control. A form of internal validity limitation exists due to the cross-sectional design of the survey data not including a time component (Frankfort-Nachmias & Nachmias, 2008). In this research, it was impossible to determine whether serious cognitive difficulties led to any particular nicotine use behavior or vice versa without such a time component. The data simply indicated the presence or absence of serious cognitive difficulties, and the lack of the time component means that there would have been no way for the results to present the inference of causality between the variables in this study. However, as the serious cognitive difficulties variable did not significantly predict intent, this limitation will not hinder the predictive power of the significant findings that were evident in the analysis.

There were also no control techniques or manipulation used in carrying out this research. None of the variables were controlled. The participants could have used other forms of nicotine or other drugs that were not included as a part of this research. In fact, the types or techniques of nicotine usage reported in the data might have differed from some of the youths' actual usage due to misunderstandings about the NYTS questions.

External validity is related to the generalizability of the results, and the level of representativeness that is achieved with sample data (Frankfort-Nachmias & Nachmias, 2008). As explained in Chapter 4, a total of 56,258 cases from three years of the NYTS survey data were screened for an inclusion of 387 cases of sample data in this research. The sampling methods utilized by the CDC for collecting the NYTS data collection are robust and are inclusive of the intended population (the American youth). The sample's representativeness has been achieved throughout the initial data collection and remained unaffected during the subsequent screening and data analyses conducted in this research.

Although construct validity for the NYTS questionnaire in itself is not a concern, there was potential for the items used in this research to have different validity due to the nature of data coding and the research methodology. For example, in coding a variable into dichotomous form, there is a potential for change to construct validity. In terms of variables used for this research, there was balance achieved through the strong construct validity of NYTS items and practicality of the coding used in order to analyze the data.

### **Recommendations**

This research can be conducted using more precise wording for the variables of interest. Targeting the requisite sample during the data collection phase of a future study



could reduce the possibility of noise from extraneous variables and could also allow for an analysis of a greater number of cases. It would also be beneficial to introduce the time component discussed in the limitations of this research, as the findings of a future study could explain the temporal direction of causality. Another recommendation would be for the items concerning cravings and real needs and serious cognitive difficulties to have an interval classification, so the restrictions of utilizing binary responses may be eliminated. Such items could both increase the accuracy of the responses and also include more input data (for each of the predictor variables) for better interpretation of the outcome variable.

### **Implications**

The proposition behind this study was to find whether some factors surrounding youth nicotine use predict future nicotine use behavior. The goal was to provide a timely comparison of the implications of e-cigarette use versus cigarette smoking. Practitioners educated in such differences can be better facilitative of young clients' issues concerning nicotine use. Better understanding of the differences between these two forms of nicotine use can help throughout many different public health venues and can operate to improve health outcomes within communities. The findings from this study showed that there is a significant difference in the odds of intending to continue using nicotine between the two methods, which can also mean that young e-cigarette users who find themselves in public health settings or psychological therapy are less likely to think e-cigarettes are dangerous to them. The shift toward the e-cigarettes and attitudes demonstrated in the results of this study highlight the important function for practitioners to expend a great deal of effort to address the youths' misconceptions about the relative safety of using e-cigarette devices.

Additionally, the results demonstrate that the past nicotine cessation attempt is a significant predictor of intention for future nicotine cessation. Considering those who are experienced with the cessation process are more likely to try to quit again than those who have not tried to quit in the past year, this means that the experienced ones are very aware of the very real nature of addiction and the ramifications of cessation. It is therefore very important for clinical psychologists to be supportive and understanding of the reasons for continued use that seems dissonant in terms of the intention to quit nicotine within a year.

This study is among the first that have focused upon the intended future nicotine use behavior when comparing e-cigarettes with traditional cigarettes. In that regard, this research has contributed to the body of knowledge on this concept and filled in some of the gap of the explanation of some of the factors that might predict future nicotine usage. This study is replicable (and modifiable with recommended changes) by researchers who aim to supply practitioners with further information to be used within clinical settings or other areas related to combatting the e-cigarette use epidemic. The fact that differences in the predicted future nicotine use behavior is evident between the two methods that this study compared provides practitioners and the public evidence of the dangerous effect of the shift toward e-cigarettes. As the abundance of evidence about the epidemic continues to grow, the most appropriate intervention is bound to follow.

### **Conclusion**

This study contributed to the limited body of literature regarding youth e-cigarette use cessation-related intention. The self-medication hypothesis led to an assumption that those youths who are daily e-cigarette users or daily cigarette smokers, and report serious

cognitive difficulties, are also likely to experience cravings or real needs to use nicotine. In addition to the method of nicotine use and serious cognitive difficulties being possible variables that predicted future youth nicotine use intentions, past cessation attempts were also assumed to predict the nicotine use related intentions. All variables were measured through analysis of NYTS response data. The results showed that those who made prior attempts to quit had extremely a higher likelihood of undertaking a subsequent cessation attempt within the next year than those who reported having made no attempt to quit in the prior year. The results also showed that cigarette smokers had an extremely higher likelihood of undertaking a cessation attempt within the next year than e-cigarette users. It is important to note that the data used in this study did not offer evidence to support the self-medication hypothesis, as neither serious cognitive difficulties nor cravings or real needs predicted any particular cessation-related intention, but the data also did not at all disprove the self-medication hypothesis. Despite the limitations of this research, it was valuable in that the differences in reports of the cessation-related intentions of e-cigarette users and smokers are identified to the public. This knowledge can serve as an element of caution for those concerned with alleviating the negative effects of the ever-evolving maladaptive nicotine use behavior.

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## Appendix A: Selected NYTS Questions (2017 Administration)

1. How old are you?

- A. 9 years old
- B. 10 years old
- C. 11 years old
- D. 12 years old
- E. 13 years old
- F. 14 years old
- G. 15 years old
- H. 16 years old
- I. 17 years old
- J. 18 years old
- K. 19 years old or older

2. What is your sex?

- A. Male
- B. Female

11. During the **past 30 days**, on how many days did you smoke cigarettes?

- A. 0 days
- B. 1 or 2 days
- C. 3 to 5 days
- D. 6 to 9 days
- E. 10 to 19 days



- F. 20 to 29 days
  - G. All 30 days
- 31. During the past 30 days, on how many days did you use e-cigarettes?**
- A. 0 days
  - B. 1 or 2 days
  - C. 3 to 5 days
  - D. 6 to 9 days
  - E. 10 to 19 days
  - F. 20 to 29 days
  - G. All 30 days
51. During the past 30 days, have you had a strong craving or felt like you really needed to use a tobacco product of any kind?
- A. Yes
  - B. No
53. Are you seriously thinking about quitting the use of **all tobacco products**? (**Please choose the first answer that fits**)
- A. I do not use tobacco products
  - B. Yes, during the next 30 days
  - C. Yes, during the next 6 months
  - D. Yes, during the next 12 months
  - E. Yes, but not during the next 12 months
  - F. No, I am not thinking about quitting the use of all tobacco products

54. During the **past 12 months**, how many times have you stopped using **all tobacco products for one day or longer** because you were trying to quit all tobacco **products for good?**

- A. I did not use tobacco products during the past 12 months
- B. I did not try to quit all tobacco products during the past 12 months
- C. 1 time
- D. 2 times
- E. 3 to 5 times
- F. 6 to 9 times
- G. 10 or more times

88. Because of a physical, mental, or emotional condition, do you have serious difficulty concentrating, remembering, or making decisions?

- A. Yes
- B. No