EFFECTS OF E-CIGARETTE EDUCATION IN ADOLESCENTS AND YOUNG ADULTS IN PRIMARY CARE

by

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ABSTRACT

AMY E. CARRIKER. Effects of E-Cigarette Education in Adolescents and Young Adults in Primary Care. (Under the direction of DR. TONYA ANDERSON)

Approximately one in five high school student and 1 in 20 middle school students currently use e-cigarettes. The burgeoning number of e-cigarette users from 2017 to 2018, 1.5 million more, prompted the U.S. Surgeon General to declare an e-cigarette epidemic among teens. Serious health problems, such as bronchiolitis obliterans, DNA damage, increased risk for developing asthma and COPD, seizures, anoxic brain injury, elevated blood pressure, elevated heart rate, and myocardial infarction has been associated with exposure of toxic chemicals in the e-liquids that is heated to produce an aerosol and inhaled into the lungs. The long-term effects of e-cigarettes is unknown with research still in its infancy with only a little over 10 years since first introduced in the U.S. Despite a recent decline in the estimated users in 2020, adolescents and young adults continue to use e-cigarettes. The purpose of this scholarly project is to educate teens and young adults about the harmful effects of e-cigarettes in an effort to reduce e-cigarette use among current users. Objectives were to evaluate participants knowledge of perceived harms, implement e-cigarette education, and determine if the education encouraged a reduction in use or promote e-cigarette cessation. A quasi-experimental pre-posttest intervention quality improvement project was implemented at a rural family practice clinic in the southeastern region of the U. S. Participants were between the ages of 13 – 24 who vaped daily, randomized between an intervention group and control group, and administered 3 questionnaires (Initial Questionnaire, PESCDI, and E-cigarette Reasons for Use Scale). Intervention group viewed an educational video on the harms of

e-cigarettes. PESCDI was administered as a posttest 2-4 weeks following appointment in the clinic. Initial Questionnaire results revealed that 76% of participants were female and the top 2 reasons for use were curiosity/peer-pressure/friends that use and flavors/tastes good. Majority believed that e-cigarettes were equally harmful (41%) and less harmful (41%) than tobacco cigarettes. Wilcoxon signed-rank test analysis of the PSECDI did not show that the educational intervention was statistically significant, however, median scores in the intervention group decreased indicating an overall decrease in nicotine dependency. Median scores in the control group did increase on posttest denoting a higher nicotine dependence on follow-up. Fisher's exact tests compared pre and posttests according to categories, although not statistically significant, revealed that the intervention groups posttest PSECDI dependency decreased in the medium and low dependency categories and increased in the not dependent category representative of a clinically significant decline in nicotine dependency. One participant progressed from not dependent to low dependency. Limitations of the project include a small sample size due to small rural family practice and COVID-19 pandemic limiting the number of patients in the office. Future implications include replicating project at multiple sites for larger sample size to determine a statistical significance.

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LIST OF ABBREVIATIONS

CDC	Centers for Disease Control and Prevention
COPD	Chronic Obstructive Pulmonary Disease
ENDS	Electronic Nicotine Delivery Systems
EVALI	E-cigarette, or Vaping, Product Use-Associated Lung Injury
FDA	Food and Drug Administration
NYTS	National Youth Tobacco Survey
PSECDI	Penn State Electronic Nicotine Dependence Index

CHAPTER 1: INTRODUCTION

E-cigarette use among teens and young adults is occurring at an alarming rate in the United States (U.S.). The National Youth Tobacco Survey (NYTS), a cross sectional analysis of a school-based nationally representative sample in the United States in 2019, showed that 27.5% of high school students and 10.5% of middle school students reported using e-cigarettes (Cullen et al., 2019). With current users reaching an all-time high in 2019, it is remarkable that the 2020 NYTS reported a decline in use, with 19.6% of high school students and 4.7% of middle school students now reporting e-cigarette use (Centers for Disease Control and Prevention [CDC], 2020). Approximately one in five high school students and one in twenty middle school students currently use e-cigarettes (CDC, 2020). Despite the declining use in this age group, 3.6 million U.S. youth continue to use e-cigarettes (Food and Drug Administration [FDA], 2020b).

Historically, there was a decrease in e-cigarette use from 2015 to 2016 in high school students, but they gained popularity in 2017 largely in part due to appealing flavors (FDA, 2020a). There was a substantial increase of 1.5 million more youth using e-cigarettes from 2017 to 2018, prompting the U.S. Surgeon General to declare an epidemic among teens. Despite fluctuation, the potential for devastating effects with continued e-cigarette use displays a need for education to prevent youth initiation of e-cigarettes (DHHS, 2018; Gentzke et al., 2018).

According to Villanti et al., (2019) there is a higher incidence of youth versus adults starting to use tobacco products, suggesting that youth are at increased risk for tobacco use. E-cigarette use may act as a gateway to future cigarette use (Dai, 2020). It is imperative that intervention is initiated during adolescence to prevent future disease and

death (Villanti et al., 2019). The vaping industry, government agencies, parents, and lack of educational programs in schools have failed to stop the growing numbers of new e-cigarette users, thus far, proving the need for swift intervention at an early age (Miech et al., 2019).

Education provided to teens and young adults on the harms of e-cigarettes has been used in order to combat the use of e-cigarettes; however, there is a gap in evidence regarding whether the education is effective. A quality improvement project was conducted to determine if an e-cigarette education intervention in a primary care office is effective against the continued use of e-cigarettes. Primary care providers have direct contact with numerous patients and could potentially decrease the number of e-cigarette users in this age group.

Background

E-cigarettes were first introduced in 2008 and have led to an increase in morbidity and mortality in teens and young adults. The terms “e-cigs,” “e-hookahs,” “mods,” “vape pens,” “vapes,” “tank systems,” “pens,” “JUULing,” and “electronic nicotine delivery systems (ENDS)” are used interchangeably with the term e-cigarette (CDC, 2020). They come in many shapes and sizes, but most have a battery, heating element, and contain a compartment that holds liquid (CDC, 2020). The liquid, or e-liquid, that usually contains nicotine is heated to produce an aerosol and inhaled into the lungs. E-liquids contain toxic chemicals including nicotine, flavorings, heavy metals (tin, nickel, and lead), propylene glycol, glycerol, diacetyl, and formaldehyde (Hwang & O’Neil, 2020; Rohde et al., 2020). Flavored e-cigarettes are popular among youth, with more than eight out of ten using flavored e-cigarettes (FDA, 2020). Exposure to toxic chemicals in the e-liquids

has been shown to cause serious health problems, such as bronchiolitis obliterans (i.e. "popcorn lung"), DNA damage, increased risk for developing asthma and chronic obstructive pulmonary disease (COPD), seizures, anoxic brain injury, vomiting, elevated blood pressure, elevated heart rate, and myocardial infarction (Rohde et al., 2020).

Most e-cigarettes contain nicotine, which is highly addictive and is harmful to the developing adolescent brain (CDC, 2020). The brain continues to develop until approximately the age of 25, making it especially susceptible to nicotine's harmful effects on the center of the brain, which regulates attention, learning, mood, and impulse control (Hwang & O'Neil, 2020). E-cigarette use predisposes adolescents to tobacco cigarette use and other drugs in the future (Hwang & O'Neil, 2020).

E-cigarette, or vaping, product use-associated lung injury (EVALI) was initially identified in June 2019 as a result of Vitamin E acetate additive in THC-containing e-liquids. EVALI is responsible for 2,602 hospitalizations and 57 deaths; however, the exact mechanism of lung injury remains unclear and may be due to toxic chemicals (Hwang & O'Neil, 2020).

Preventing new e-cigarette users is vital to the improved health of future generations. Decreasing the number of people with chronic disease in the future will not only reduce mortality and morbidity but also improve healthcare costs related to e-cigarette use. The impact that e-cigarettes have on long-term health are yet to be seen, yet we know that users are 1.3 times more likely to develop a respiratory disease such as emphysema, chronic bronchitis, and chronic obstructive pulmonary disease (COPD) (Bhatta & Glantz, 2020).

Problem Statement

Adolescents and young adults continue to use e-cigarettes despite a recent decline in number of estimated users in the U.S. from January 16, 2020 to March 16, 2020 (CDC, 2020). The full implications of e-cigarettes are not yet known; however, nicotine is known to be highly addictive and alters adolescent brain development, affecting behaviors and increasing susceptibility to abuse of other drugs after nicotine exposure (Yuan et al., 2015). Primary care providers are in a unique position to screen and provide education to adolescents and young adults in an effort to reduce and treat e-cigarette use in this vulnerable population.

Purpose of the Project

In an effort to combat the youth e-cigarette epidemic declared by the surgeon general in 2019 (CDC, 2020), the purpose of this scholarly project is to educate teens and young adults about the harmful effects of e-cigarettes in an effort to reduce e-cigarette use among current users, and ultimately decrease the number of e-cigarette users altogether.

Significance of the Project

Recent recognition of e-cigarette harms has prompted large healthcare organizations to screen for e-cigarette use, though there is little known about the effects of education or what motivates use reduction (Rohde et al., 2020). It is known that more than half of young adults agree that nicotine is responsible for health risks and cancer (Villanti et al., 2019). Females, Blacks, Hispanics, and those without college education are more likely to report knowledge deficits to the fact that nicotine causes cancer (Villanti et al., 2019). E-cigarettes are most used by white male freshmen among middle

and high school students (Cullen et al., 2019). Young adult white males with at least some college reported the highest use of e-cigarettes in those over the age of 18 (Olfson et al., 2019). Considering culture, race, gender, and other characteristics of e-cigarette users will help to target specific populations for e-cigarette use prevention.

Clinical Question

The PICO question for this project is: "In adolescents and young adults ages 13-24, does an educational intervention about the dangers of e-cigarettes lead to reduced use and improved knowledge?"

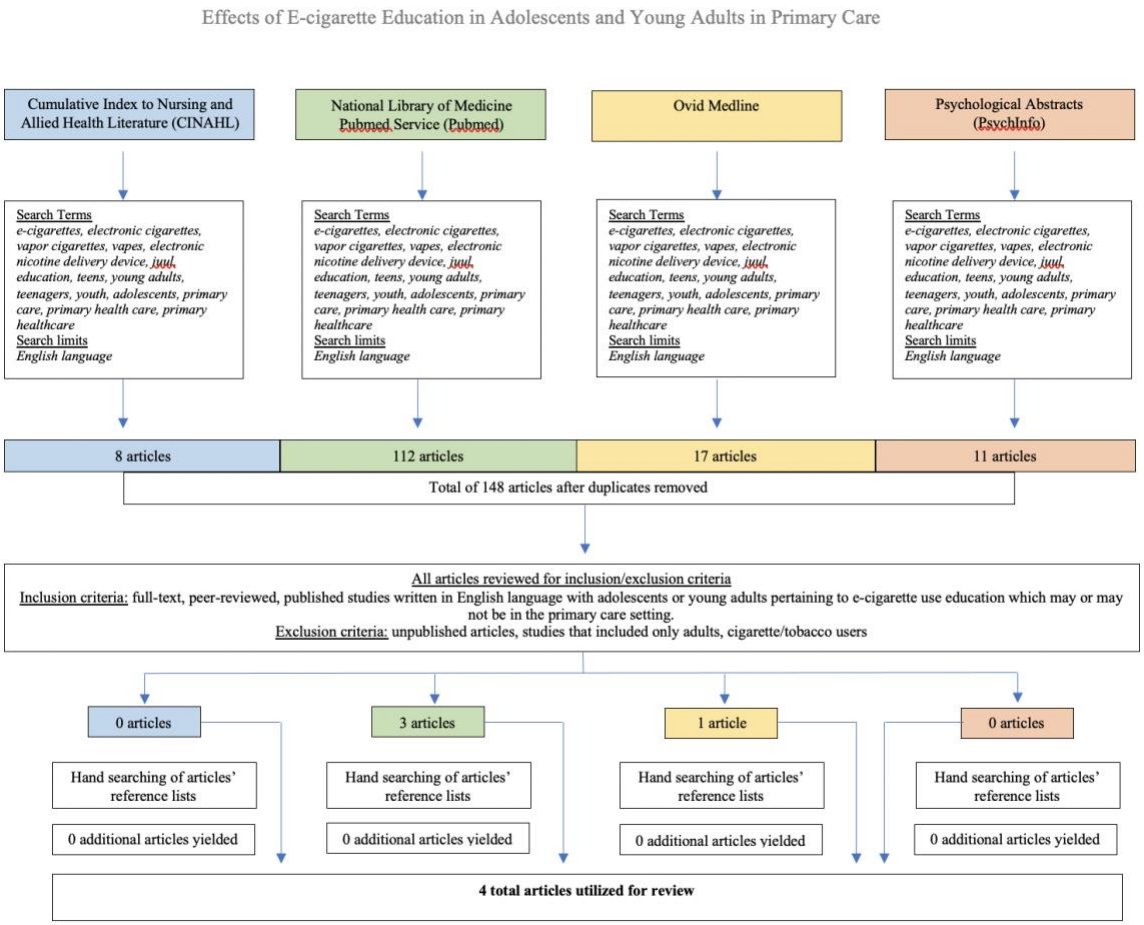
Project Objectives

The major objectives for this DNP scholarly project are to (1) evaluate adolescents and young adults' knowledge of perceived harms of e-cigarettes; (2) implement e-cigarette education in the outpatient primary care setting of patients ages 13 – 24; (3) determine if the effects of e-cigarette education will encourage adolescents and young adults to reduce use or promote e-cigarette cessation. The importance of the project is to identify patients who use e-cigarettes, provide education via video and handouts, and administer a pre and post-test to determine if the education was effective as evidenced by reduction in use or e-cigarette use cessation.

CHAPTER 2: LITERATURE REVIEW

A review of literature was conducted utilizing Cochrane, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Medline (via ProQuest) and PsychInfo. Keywords included: “e-cigarettes,” “electronic cigarettes,” “vapor cigarettes,” “vapes,” “electronic nicotine delivery device,” “Juul,” “education,” “teens,” “young adults,” “teenagers,” “adolescents,” “primary care,” “primary health care,” and “primary healthcare.” Results were filtered to include articles in English, published between 2010 – 2021, peer-reviewed, and full text publications. The search yielded 148 articles; of those, only 4 met the inclusion criteria. Articles were excluded if they were unpublished, studied only adults, and/or included cigarette/tobacco users. In addition to the computer-based literature search, a hand search of the articles’ reference lists was conducted and yielded zero results (Figure 1).

Figure 1: Literature Search



The US Preventative Services Task Force (USPSTF) and the American Academy of Pediatrics (AAP) recommend that primary care providers use brief counseling or education with adolescents for tobacco prevention (Salloum et al., 2018). A majority of patients would welcome a discussion about e-cigarettes from their primary care provider (PCP); in fact, 62% of participants in one study of e-cigarette users wanted a conversation (Doescher et al., 2017). Salloum et al. (2018) developed a tool that screens adolescents in primary care to promote improved communication between patients and provider. Accurate screening of patients who use e-cigarettes is imperative in order to

determine which patients need education. LeLaurin et al. (2019) suggested that the majority of current screening practices are inaccurately and incompletely capturing adolescents who use e-cigarettes. Their study found it is important to use specific language such as “vaping” when questioning about electronic nicotine delivery systems (ENDS). Adolescents are not equating e-cigarettes to tobacco products when screened. Also, time constraints often prohibit healthcare providers from addressing problems or concerns that are necessary but are not the top priority. Education must be effective and fit within the time constraints of the office visit (Salloum et al., 2018). Lack of clear practice guidelines is one of the reasons why PCPs fail to educate on tobacco/nicotine use in practice (Pbert et al., 2015). Pbert et al. (2015) examined primary care-based interventions to prevent tobacco use in youth, which concluded that more research is needed to develop more successful methods in youth regardless of how brief the intervention.

Additional literature was reviewed pertaining to only e-cigarettes, electronic cigarettes, vapor cigarettes, vapes, electronic nicotine delivery device, Juul, teens, young adults, teenagers, youth and adolescents. Three themes were associated with youth and young adults and the use of e-cigarettes: e-cigarette perceptions, preference of e-cigarette flavors, and marketing/advertising of e-cigarettes.

E-cigarette Perceptions

Misperceptions of potential harm in using e-cigarettes were identified in several studies. Farsalinos et al. (2015) and Villanti et al. (2019) found that there was a wide range of patient misperceptions when it came to the risk of using e-cigarettes. Studies by Farsalinos et al. (2015), Zhu et al. (2013) and Vu et al. (2019) found that participants felt

that e-cigarettes were less harmful than tobacco cigarettes. In fact, 14.1% of non-smoking vapers and 8.5% of dual users of e-cigarettes and tobacco cigarettes believed e-cigarettes to be completely harmless (Farsalinos et al., 2015). Popova et al. (2017) found that marketing has a negative impact on misperceptions. Products with the words "natural," "pure," "clean," "additive-free," or "organic" increase appeal and may cause the user to perceive that the product is not harmful (Popova et al., 2017). Two participants in a qualitative study preferred the description that used words "organically made" or "natural" because less harm was perceived (Chen et al., 2019). Adolescents and young adults' perceptions about e-cigarettes contribute to the decision of trying and continuing to use these products. There is support from the studies that education is needed to inform this age group of the hazards of e-cigarettes and participant perceptions should be considered.

Preference of E-cigarette Flavors

Flavor preference at was identified as a theme when reviewing literature about adolescents and young adults who use e-cigarettes. Appealing flavors is the leading reason for e-cigarette use among adolescent and young adults (Soneji et al., 2019). Leventhal et al., (2019) and Zare et al. (2018) found that adolescent and young adult e-cigarette users preferred sweet, fruity, and menthol flavors compared to tobacco or no flavor. They were more likely to use flavored e-cigarettes to start vaping. A study by Chen et al. (2019) found that several participants preferred flavors and enjoyed the experience, which reduced the likelihood of cessation of e-cigarette use. One study found that sweet and fruit flavors were perceived with less harm (Zare et al., 2018). Soneji et al. (2019) found that adolescents preferred fruit- and candy-flavored e-cigarettes, while older

adult users were more likely to use tobacco and menthol flavored e-cigarettes. It was concluded through analysis of several studies that restricting flavored e-cigarettes may reduce the number of adolescents and young adults using e-cigarettes. The implication of these studies is that education in this age group regarding flavor may have an impact whether youth use e-cigarettes for the first time.

Marketing and Advertising of E-cigarettes

Several of the studies determined that marketing should be taken into consideration as a factor in the increased use of e-cigarettes among young people. Padon et al. (2017) studied effects of youth appealing e-cigarette advertising and found that low youth-appealing e-cigarette ads versus high youth-appealing cigarette ads increased susceptibility to youth trying e-cigarettes because of the quality, brevity, visuals, humor, and information. Fifty-four percent were susceptible and admitted that they would likely try an e-cigarette if it were offered by a friend (Padon et al., 2017). This finding indicates that any advertising of e-cigarettes entices adolescents into using e-cigarettes. A study by Kreitzberg et al. (2019) supported e-cigarette marketing exposure is associated with increased e-cigarette use in young adults. Their results showed that after six months of exposure to e-cigarette marketing, there was a significant association predicting e-cigarette use in college students at a Texas university (Kreitzberg et al., 2019). Pokhrel et al. (2017) found similar results with their study. The study exposed young adults to e-cigarette advertisements with themes of social enhancement and harm-reduction messages. Exposure to advertisements that enhanced social life produced favorable attitudes toward young adults who do not use e-cigarettes or smoke cigarettes (Pokhrel et al., 2017).

Social media, mainly Facebook, Instagram, Snapchat, and Twitter, is a popular platform for e-cigarette advertisements and exposure for adolescents and young adults (Pokhrel et al., 2018). Exposure on social media places adolescents and young adults at greatest risk because over 90% use one or more types of social media (Pokhrel et al., 2018). It has been hypothesized that the rapid growth of e-cigarette use has been due to marketing through social media (Huang et al., 2014). Pokhrel et al. (2017) found that social media e-cigarette exposure was associated with e-cigarette use with the strongest marketed association as "fun," "cool," or "sexy." Twitter has numerous e-cigarette advertisements that promote e-cigarette use (Huang et al., 2014 & Kim et al., 2019). Celebrity endorsements for e-cigarettes create a positive effect on teens and young adults in the advertisements compared to those without celebrity endorsers (Phua et al., 2018). Phua et al. (2018) found in their study on celebrity endorsed Instagram e-cigarette advertisements significantly increased positive attitudes toward e-cigarettes and smoking intentions, and participants believed celebrities to be trustworthy. YouTube is an additional online source where e-cigarettes can be marketed. Approximately 8% of viewers on YouTube are less than 18 years old (Paek et al., 2014). Paek et al. (2014) found that the advertisements appeal to the social aspects and claim health benefits warranting regulations for on-line marketing of e-cigarettes. Overall, the research shows a correlation between advertisement and increased rates of e-cigarette use among young people, which indicates a need for education to negate the effects of the ads in the media.

Theoretical Framework

Lewin's Change Theory was utilized for the completion of this scholarly project. Lewin's theory has been met with criticism in the past due to its linear, simplistic nature

(Cummings et al., 2016). The theory identifies three stages of change: unfreezing, change, and refreezing (Sare & Ogilvie, 2010). During the first stage, there is an evaluation of the status quo to determine positive driving forces and negative restraining forces in order to achieve desired change (Sare & Ogilvie, 2010). Lewin's theory alters the current way of thinking or performing tasks and changes behavior. Within the unfreezing stage, there is a disruption in the usual way of approaching clinical thinking to change patterns.

Now that there is a disruption in usual thinking, the second stage can be implemented. Movement allows for the person that is learning the change to adapt to new practices and work through the change. Communication is imperative to ensure the change process is occurring successfully and stakeholders are empowering action. Health care workers involved in the process who support the change are promoted for their successes.

Refreezing is the third stage, and anchors changes into culture. There are developed ways to sustain change occurring during this stage. Persons responsible for imposing change should provide and support training to prevent the return of old patterns. Development of a habit is the goal of this stage (Cummings et al., 2016).

Theoretical Application

Unfreezing is the disruption in the current way of thinking. As it relates to project implementation, unfreezing includes obtaining buy-in from administration and key stakeholders. Financial resources, necessary supplies and time to develop the education were considered prior to intervention. Information sessions were held with practice employees regarding the project. Inclusion criteria and the educational intervention were

reviewed so that the process is standardized. The goal was to determine if e-cigarette education will prevent continued use of e-cigarettes. During this unfreezing stage, employees are having to change their way of thinking and implement an intervention with the designated age group of patients should they choose to participate.

In the change stage, medical office staff involved identified eligible participants and asked them to complete the initial questionnaire, Penn State Electronic Cigarette Dependence Index (PSECDI), and E-cigarette Reasons for Use Scale. The initial questionnaire was given to assess reasons for use and e-cigarette dependence prior to the educational education video on e-cigarette harms in the intervention group. Education will be followed by a post-test questionnaire in two to four weeks. The data was collected at the end of the study for evaluation and to determine education effectiveness.

Collaboration, communication, and continued perseverance to prevent reoccurrence of old patterns of practice demonstrate the goals of Lewin's refreezing stage. New cultures are nurtured to become the new norm. Prior to implementation of the project, there are factors that can promote or inhibit the success of the project and effective collaboration and communication with stakeholders promote project success. Lack of clarity may interfere with project implementation and outcomes (Moran et al., 2017). It was important to consider an assessment of the resistance to change and consider ways to overcome resistance. Practice employees were eager to participate in screening of the patients and collaboration was evident for the duration of the project.

CHAPTER 3: PROJECT DESIGN

Methodology

The design of the project is quasi-experimental pre-posttest intervention. It was implemented at a rural family practice clinic in the southeastern region of the United States. The project used selective sampling to include participants in a specific age range. Participants were invited to participate in the project when they came for a scheduled office visit if they met inclusion criteria. Inclusion criteria for the patient population required that participants be between 13 and 24 years old, English speaking, and have a present parent or legal guardian if the participant was under the age of 18. Only one parent for each adolescent aged 13 to 17 was asked to give consent. Adolescents were excluded from the project if they were minors and a legal guardian was not present to provide consent. Participants were excluded if they did not speak or write in English. Inclusion criteria for e-cigarette use required that the participant use a device on a daily basis. Demographic data collected included age and gender.

The medical team was comprised of four medical assistants, a practice manager, two front office staff, a nurse practitioner, and a physician. The staff currently employed at the practice was the team at the time of the project. Prior to implementation of the project, staff attended a short one-on-one training session directing them on inclusion criteria and their role in executing the project. The medical assistants were responsible for determining eligibility of participants and providing questionnaires to complete.

The project was implemented over a four-month time period. The patient schedule was reviewed every morning and continuously throughout the day to make sure that all eligible participants were invited to participate in the project. Patients were screened by

the medical assistant to determine if they met the inclusion criteria. Once the patient consented to participate, a consent form was obtained from one parent or legal guardian if the patient was under the age of 18. The patients were randomly selected to be in one of the two subgroups: the intervention group or the control group. The projected number of participants in the project was expected to be between 20 and 40 with similar number of participants in each group. Packets were assembled with education materials (Appendix B and C) and questionnaires (Appendix A, D, and E) and color-coded according the intervention or control group.

All participants completed the initial questionnaire (Appendix A), which gathered demographics, information about e-cigarette use, motivation to use, and questions regarding the harm of e-cigarettes. All participants were given educational handouts on the harms of e-cigarettes (Appendix B) and statistics (Appendix C). Participants in both groups completed the E-Cigarette Reasons for Use Scale and the PSECDI. In addition, the intervention group viewed a 4-minute video developed by the University of California Los Angeles School of Medicine from YouTube entitled *Electronic Cigarettes and Vaping* describing the harmful effects of e-cigarettes. Permission is not needed for the video. Two to four weeks after the educational video is viewed, all participants were asked to complete the PSECDI which served as the posttest. Participants were called by the project coordinator to administer the posttest PSECDI. A gift card was mailed to participants who completed the posttest.

Potential Risks

Potential risks for the project were the potential lack of participants who us e-cigarettes, resulting in a need to extend the length of the project. In addition, there was

concern of the posttest not being completed; therefore, gift cards were provided to participants who completed the survey. COVID was a risk due to organizational restrictions that decreased patient volumes in the office.

SWOT Analysis

A SWOT analysis was helpful in evaluating strengths, weakness, opportunities and threats in developing the project. Strengths of the project include a supportive physician, engaging leadership and positive working relationships within the office. Parents and guardians that were present during the visit were appreciative that e-cigarette use was discussed, and their teens were being educated. Often, participants would discuss numerous friends that were using e-cigarettes and how the education could be of benefit to their peers. Weaknesses include the lack of time for busy medical assistants, ensuring that all eligible participants were included, resistance to change, and change in the office with addition of new employees during the project. COVID-19 affected the number of patients coming into the office during the time the project was implemented, in part due to fear and organizational restrictions which potentially decreased the number of eligible participants. Patients fear of disclosing e-cigarette use was also a conceivable weakness. Providers had to trust that patients were honest in their responses to e-cigarette use questioning. Opportunities included reaching teens and adolescents with new e-cigarette information. Educating adolescents in the primary care office is a gateway to reaching the community through students at area middle and high schools. The threats could come with competing priorities within the organization and medical assistants not buying-in to the project because they see it as additional work.

Marketing

The marketing plan for this scholarly project considered how to garner buy-in from stakeholders. Medical assistants were the front-line staff that were responsible for determining eligibility for participation and delivering the questionnaires. One objective for the plan was to make the process as simple and streamlined as possible to cause the least interruption in the check patient in-take process. The goal was to include 100% of eligible patients. Successes were celebrated weekly throughout the implementation period to support compliance of the project. Resources for the project included printed educational handouts and questionnaires and a $5 gift card for participation. Internet resources were utilized for the intervention group to view educational video in the exam rooms.

Data Collection Plan

Participants in each group were administered two measurement tools, the E-Cigarette Reasons for Use Scale and the PSECDI questionnaire. The E-cigarette Reasons for Use Scale is a 12-item survey that utilizes a 5-point Likert response scale (Appendix D). Answers range from “strongly agree” to “strongly disagree.” Participants were asked to complete their reasons for current e-cigarette use (Saddleson et al., 2016). The questionnaire gave a better understanding of why participants use e-cigarettes to gain insight on educational opportunities in the future to prevent e-cigarette use. Permission was not needed for educational purposes.

The second questionnaire administered was the Penn State Nicotine Dependence Index for Electronic Cigarettes (Appendix E) which is a 10-question survey developed to measure nicotine dependence and was the first to measure nicotine dependence in

electronic cigarettes (Foulds et al., 2015). There are open-ended questions as well as yes/no question within the survey. The scoring of the questionnaire ranges from 0 to 13+. A score of 0-3 is not dependent, 4-8 is low dependence, 9-12 is medium dependence, and 13 and over is high dependence on nicotine in e-cigarettes. Permission to use this tool was obtained by Dr. Jonathan Foulds (Appendix F).

For the education intervention, a 4-minute video developed by the University of California Los Angeles School of Medicine from YouTube entitled *Electronic Cigarettes and Vaping* describing the harmful effects of e-cigarettes was viewed by the intervention group. Finally, educational handouts with information adapted from the FDA including statistics and the harmful effects of e cigarette education was given to all participants (Appendix B and C).

Timeline for Data Collection

After IRB approval, data was collected in a four-month time frame beginning the Fall semester of 2020. Four months' time was given in anticipation of obtaining between 20 and 40 participants in both the control group and intervention group. Two to four weeks after each participant had completed the education, all were contacted via phone or text to complete the posttest.

Data Analysis

After reviewing the data, the primary investigator coded and entered the data into a Microsoft Excel spreadsheet. The data analysis was performed with the assistance of a statistician. Descriptive statistics analyzed the demographic data and multiple-choice questions on the initial questionnaire. Wilcoxon signed-rank tests and Chi-squared Fisher's exact tests were used for the PSECDI to determine if the educational

intervention was effective in e-cigarette cessation or decreasing the use and to compare PSECDI scores. Data analysis tables were created in Stata16©.

Method to Maintain Confidentiality

Participants were assigned an identifier number to protect identity. A list of names and identifier numbers were kept by the primary investigator on an Excel spreadsheet that was password protected. Questionnaires were identified by identifier numbers until entered into Excel and were kept in a locked cabinet until data was entered in the computer. Consent was granted to mail gift cards following posttest and the verification of address. All forms were shredded to protect confidentiality.

Project Analysis

Translation of project outcomes into practice is essential for the dissemination of findings. E-cigarette education via video was well-received by participants and many verbalized learning something new from the video education. All participants received education handouts on the dangers of e-cigarettes and the most recent statistics. Ongoing education of teens and young adults who use e-cigarettes in the primary care will have an impact on their health. Results of the scholarly project helped to determine effectiveness of education.

There is limited information on the long-term effects of e-cigarettes; therefore, information on the financial impact of e-cigarettes on health has not been published. Smoking-related health care costs account for an estimated 5-14% of total health costs in the U.S. which is approximately $96 billion annually (Lichtenberg, 2017; Xu et al., 2015). An assumption may be made that e-cigarettes would have similar effect on health care costs, which would support educating patients against the use of e-cigarettes to

reduce health care cost. Additional research is needed to determine the costs of e-cigarettes on health care as well as additional long-term effects of e-cigarette use on adolescents and young adults.

CHAPTER 4: PROJECT FINDINGS

The implementation of this quality improvement project spanned five months between September 2020 and January 2021. The data was collected from patients ages 13-24 that were treated in the family practice and acknowledged to vaping on a daily basis. A total of 17 patients participated in the project and completed the questionnaires. One participant was omitted from statistical analysis on the PSECDI due to loss to follow-up for post-test questionnaire. The sample consisted primarily of females (76%), with the majority aged 16 to 18 years (41%). When asked their motivation to use e-cigarettes, three of six responses were chosen including: curiosity, peer-pressure, friends that use (45%), flavors and good taste (35%), and to quit smoking (20%). An overwhelming majority answered 'yes' (76%) when asked if they thought that e-cigarettes were addictive compared to somewhat addictive (18%) and don't know (6%). Participants were questioned regarding their thoughts about harmfulness of e-cigarettes compared to conventional cigarettes with an equal number thinking they are equally harmful (41%) and less harmful (41%). A small percentage thought that e-cigarettes were more harmful (n=2, 12%) and didn't know (n=1, 6%). A reassuring number of participants (41%) believed that e-cigarettes were associated with diseases like asthma, COPD, lung cancer, or coronary artery disease, but other responses prove that there is a need for education with the majority answering either no association (12%), somewhat associated (18%), or don't know (29%).

Table 1. Demographic and Questionnaire Information (n =17)

	n (%)
Age	
13-15 years	1 (6)
16-18 years	7 (41)
19-21 years	5 (29)
22-24 years	4 (24)
Gender	
Male	4 (24)
Female	13 (76)
What motivated you to use e-cigarettes?	
To quit smoking	4 (20)
Reducing the health hazard of cigarettes	0
Financial benefits	0
Curiosity, peer-pressure, friends that use	9 (45)
Flavors, tastes good	7 (35)
Advertisements	0
Do you think that e-cigarettes are addictive?	
Yes	13 (76)
No	0
Somewhat	3 (18)
Don't know	1 (6)
Do you think e-cigarettes are _____ harmful as compared to conventional tobacco cigarettes?	
More harmful	2 (12)
Equally harmful	7 (41)
Less harmful	7 (41)
Not at all harmful	0
Don't know	1 (6)
Do you think e-cigarettes are associated with any of the diseases like asthma, COPD, lung cancer, or coronary artery disease?	
Yes	7 (41)
No	2 (12)
Somewhat	3 (18)
Don't know	5 (29)

Statistical analyses were performed to determine if there was a statistically significant difference in median values between pre and posttest PESCDI scores in both the intervention group and the control group. Kurtosis and skewness test was completed to assess for normality. Results of the PESCDI were not normal distributed. A paired

Wilcoxon signed-rank test is performed as a test of comparison on data that is not normally distributed. This non-parametric test was chosen to compare the data due to a small number of participants. Results are considered significant when $p<0.05$. Statistics were performed using Stata16© statistical analysis software.

A Wilcoxon signed-rank test was performed comparing the medians of the PSECDI pretest of the control group and the intervention group (Table 2). The median PSECDI scores of the control group and the intervention group showed no statistically significant difference between the two groups ($p=0.2843$) prior to the educational intervention. Observational comparisons, the median score of the control group (13) was higher than the intervention group (7) indicating the control group had a higher dependence on nicotine.

Table 2
Pretest comparison of Penn State E-Cigarette Dependency Index (intervention vs. control group)

	Median Score	p-value
Control	13	0.2843
Intervention	7	

A second Wilcoxon signed-rank test was performed comparing the medians of the PSECDI posttest of the control group and the intervention group (Table 3). Test showed that the median PSECDI score of the control group and the intervention group showed no statistically significant difference between the two groups median posttest scores ($p=0.1835$) following the educational intervention.

Table 3
Posttest comparison of Penn State E-Cigarette Dependency Index (intervention vs. control group)

	Median Score	p-value
Control	14	0.1835
Intervention	6	

A third Wilcoxon signed-rank test was performed comparing the median scores of the PSECDI pre-test and posttest of the intervention group (Table 4). The median PSECDI score of the intervention groups pre-test and posttest showed no statistically significant difference between the groups after the educational intervention was administered during the office visit (p=0.3984). Despite no statistical significance, there was clinical significance when comparing the median scores between the pretest and posttest of the intervention group. Median scores decreased in the intervention group from 7 to 6 (Table 4) indicating a decrease in nicotine dependence and observational evidence that an educational may have an impact on e-cigarette use.

Table 4
Intervention Group Comparison of Penn State E-Cigarette Dependency Index Pre-test and Posttest

	Median Score	p-value
Pretest	7	0.3984
Posttest	6	

A fourth Wilcoxon signed-rank test was performed comparing the median scores of the PSECDI pre-test and posttest of the control group (Table 5). The median PSECDI scores of the control group showed no statistical difference between the groups without an educational intervention during the office visit (p=0.7005), which was expected. There was, however, an increase in the median score of the control group from 13 to 14 (Table 5) indicating increased e-cigarette nicotine dependence.

Table 5
Control Group Comparison of Penn State E-Cigarette Dependency Index Pre-test and Posttest

	Median Score	p-value
Pretest	13	0.7005
Posttest	14	

PSECDI median scores of the pretest and posttest in both the intervention and control group were essentially unchanged and showed no statistically significant association. Comparison of the median scores did, in fact, show slight clinical significance that the educational intervention was effective in lowering the median score of the intervention group. No statistical change was expected in the control group pretest and posttest given no educational intervention in Tables 2 and 3.

Fisher's exact tests of comparison were performed for categorical variables to test statistical significance in this project. The test functions in a similar manor as a Chi squared test but is used when there expected cell frequencies of less than five in small samples. A Fisher's exact test was performed comparing the pretest and posttest PESCDI scores in each nicotine dependence categories of both the control and intervention group. Fisher's exact test showed a statistically significant difference between the control and intervention groups pre-test dependency scores (p=0.010) in Table 6. The statistical difference between the two groups is the dependence on nicotine, with the largest percentage of the control group indicating high dependence on pretest (57.14%) and the intervention group scores in the low dependence category (66.67%) on pretest.

Table 6
Fisher's exact test: Pretest Comparison of Penn State E-Cigarette Dependence Index Control vs Intervention Group

PSECDI Score Categories	**Control Group** n (%)	**Intervention Group** n (%)	**Total** n (%)
High Dependency	4 (57.14%)	1 (11.11%)	5 (31.25%)
Medium Dependency	1 (14.29%)	2 (22.22%)	3 (18.75%)
Low Dependency	0 (0.00%)	6 (66.67%)	6 (37.50%)
Not Dependent	2 (28.57%)	0 (0.00%)	2 (12.50%)
Total	7 (100.00%)	9 (100.00%)	16 (100.00%)

Pearson chi2(3) = 10.0402 Pr = 0.018
Fisher's exact = 0.010

A comparison of posttest PSECDI scores in each nicotine dependency category was performed for the control versus the intervention group (Table 7). There was no statistically significant difference between the posttest score in each group ($p = 0.228$). Clinically significant observations from the data show that the control group had one participant move from not dependent on pretest to low dependency indicating an increase in dependency on nicotine. Also, there were changes in the intervention group on pretest showing reduction in dependency on posttest; a decrease in the medium dependency category from 2 participants to one, 6 participants in the low dependency category reduced to 5, and zero in the not dependent category increase to 2 participants. The reductions in dependency categories of the intervention group displayed clinical significance that an educational intervention on e-cigarette harms is potentially useful at decreasing e-cigarette use.

Table 7
Fisher's exact test: Posttest Comparison of Penn State E-Cigarette Dependence Index Control vs. Intervention Group

PSECDI Score Categories	**Control Group** n (%)	**Intervention Group** n (%)	**Total** n (%)
High Dependency	4 (57.14%)	1 (11.11%)	5 (31.25%)
Medium Dependency	1 (14.29%)	1 (11.11%)	2 (12.50%)
Low Dependency	1 (14.29%)	5 (55.56%)	6 (37.50%)
Not Dependent	1 (14.29%)	2 (22.22%)	3 (18.75%)
Total	7 (100.00%)	9 (100.00%)	16 (100.00%)

Pearson chi2(3) = 4.6222 Pr = 0.202
Fisher's exact = 0.228

Additional Fisher's exact tests were performed to determine differences in dependence categories of both intervention and control groups pretest and posttest (Tables 8 and 9). There was no statistical difference discovered between either control group ($p = 1.00$) and intervention group ($p = 0.772$) pre and posttest. Similar findings are represented in Tables 6 and 7, however, it is easier to visualize the decreases in the dependency of the intervention group (Table 8) after education intervention and the increase in dependency in the control group (Table 9).

Table 8
Fisher's exact test: Comparison of Intervention Group Pretest and Posttest

PSECDI Score Categories	**Pretest** n (%)	**Posttest** n (%)	**Total** n (%)
High Dependency	1 (11.11%)	1 (11.11%)	2 (11.11%)
Medium Dependency	2 (22.22%)	1 (11.11%)	3 (16.67%)
Low Dependency	6 (66.67%)	5 (55.56%)	11 (61.11%)
Not Dependent	0 (0.00%)	2 (22.22%)	2 (11.11%)
Total	9 (100.00%)	9 (100.00%)	18 (100.00%)

Pearson chi2(3) = 2.4242 Pr = 0.489
Fisher's exact = 0.772

Table 9
Fisher's exact test: Comparison of Control Group Pretest and Posttest

PSECDI Score Categories	**Pretest** n (%)	**Posttest** n (%)	**Total** n (%)
High Dependency	4 (57.14%)	4 (57.14%)	8 (57.14%)
Medium Dependency	1 (14.29%)	1 (14.29%)	2 (14.29%)
Low Dependency	0 (0.00%)	1 (14.29%)	1 (7.14%)
Not Dependent	2 (28.57%)	1 (14.29%)	3 (21.43%)
Total	7 (100.00%)	7 (100.00%)	14 (100.00%)

Pearson chi2(3) = 1.3333 Pr = 0.721
Fisher's exact = 1.000

A Power Analysis was performed to determine a statistically significant sample sizes at p = 0.05 and a power = 0.8 (Table 10) given the scores in the existing sample, there would have needed a total sample of 54 participants in the project to detect a statistical difference between the two mean scores (27 participants in the control group, 27 participants in the intervention group). Knowledge of a statistically significant sample

is important for potential replication of this project in the future and would impact where the project should be implemented.

Table 10. Power Analysis

Alpha	0.0500
Power	0.8000
Delta	4.6029
Mean 1	6.1111
Mean 2	10.7140
Standard deviation 1	5.5770
Standard deviation 2	6.1560

Estimated sample sizes:
n = 54
Number per group = 27

Determining the reasons for e-cigarette use is important to use cessation and it is important to assess the reasons for participants use of e-cigarettes. In Table 11, participants were asked to rank reasons for use on a 5-point Likert scale ranging from strongly disagree to strongly agree. An overwhelming response for agree and strongly agree was given for the reasons "because I enjoy it", "did not want to smell like smoke", and "I am addicted to the e-cig" representing the top three reasons on the questionnaire. Participants agreed (29.41%) and strongly agreed (35.29%) that they used because they were addicted to e-cigarettes and indicates that there is a realization that e-cigarettes are habit forming. Nicotine dependence is the reason for continued e-cigarette use and difficulty with use cessation. Enjoyment from using e-cigarettes was remarkable with majority answering agree (52.94%) and strongly agree (23.53%) and is consistent with the effects of nicotine. Nicotine affects several neurotransmitters in the brain including dopamine, norepinephrine and acetylcholine, glutamate, serotonin and endorphins which

produces relaxation, mood changes, increases memory, improves cognitive function, and reduces stress and anxiety (Prochaska & Benowitz, 2019).

Table 11. E-Cigarette Reasons for Use Scale Results

	Strongly disagree (n)	Disagree (n)	Neutral (n)	Agree (n)	Strongly Agree (n)
I use/used an e-cigarette…					
1. …because I enjoy(ed) it.	5.88% (1)	0.00% (0)	17.65% (3)	52.94% (9)	23.53% (4)
2. …to deal with my craving for tobacco.	29.41% (5)	5.88% (1)	23.53% (4)	23.53% (4)	17.65% (3)
3. …to quit smoking or avoid relapsing to smoking.	47.06% (8)	5.88% (1)	17.65% (3)	17.65% (3)	11.76% (2)
4. …to avoid bothering other people who smoke.	47.06% (8)	17.65% (3)	5.88% (1)	23.53% (4)	5.88% (1)
5. …to reduce my tobacco consumption	47.06% (8)	0.00% (0)	23.53% (4)	23.53% (4)	5.88% (1)
6. …to try something new.	23.53% (4)	17.65% (3)	23.53% (4)	35.29% (6)	0.00% (0)
7. …because it was/is less toxic than smoking tobacco.	35.29% (6)	5.88% (1)	35.29% (6)	17.65% (3)	5.88% (1)
8. …because it was/is cheaper than smoking tobacco.	41.18% (7)	17.65% (3)	17.65% (3)	5.88% (1)	17.65% (3)
9. …because I do/did not want to smell like smoke.	35.29% (6)	0.00% (0)	17.65% (3)	17.65% (3)	29.41% (5)
10. …because all other smoking cessation methods have failed.	41.18% (7)	11.76% (2)	17.65% (3)	23.53% (4)	5.88% (1)

11. …because I am/was addicted to the e-cig.	11.76% (2)	11.76% (2)	11.76% (2)	29.41% (5)	35.29% (6)
12. …to help control my appetite	41.18% (7)	17.65% (3)	17.65% (3)	23.53% (4)	0.00% (0)

An assumption can be made by the data in the chart that majority of the participants did not use tobacco cigarettes along with e-cigarettes. Questions pertaining to smoking cessation were answered in large percentages as strongly disagree. "Quit smoking or avoid relapse to smoking" (47.06%), "reduce tobacco consumption" (47.06%), "less toxic than smoking tobacco" (35.29%), "cheaper than smoking tobacco" (41.18%), and "because all other smoking cessation methods have failed" (41.18%) were answered as strongly disagree by nearly half of the participants.

Discussion of Results

The objectives for this DNP scholarly project were to evaluate adolescents and young adults' knowledge of perceived harms of e-cigarettes, implement e-cigarette education in the outpatient primary care setting of patients ages 13 – 24, and determine if the effects of e-cigarette education will encourage adolescents and young adults to reduce use or promote e-cigarette cessation. There were 16 participants recruited for this project with nine in the intervention group that received the educational intervention and seven in the control group. Evaluation of the participants knowledge and perceived harms of e-cigarettes were evaluated on the Initial Questionnaire (Appendix A) revealing that the majority of the participants in this project thought that e-cigarettes equally harmful (41%) or less harmful (41%) than conventional tobacco cigarettes and 41% thought e-cigarettes

were associated with pulmonary diseases or coronary artery disease meeting an additional objective.

While the results did not show a statistically significant difference between the control group and intervention groups on posttest following the educational intervention, there was a clinically significant difference meeting the final objective to determine effects of e-cigarette education. There was a decrease in dependency among the intervention group and an increase in dependency in the control group on posttest. The data did indicate that high dependence users were less likely to decrease e-cigarette use whereas low dependence or not dependent users were more likely to decrease use or stop using altogether (Table 6 & 7), which could account for the decreased dependency in the intervention group. There was also observational evidence on the Wilcoxon signed rank test (Table 4) showing a decrease of the median PSECDI scores following posttest in the intervention group from 7 to 6 indicating less nicotine dependency. There was an increase of the median posttest PSECDI scores in the control group from 13 to 14 representative of an increased dependency.

Identifying users and intervening with education while e-cigarette users have low PESCDI dependence scores shows an increased chance for e-cigarette use cessation. Also, identifying the leading reasons adolescents and young adults use e-cigarettes is important when educating on preventive measures in the clinical office setting. Participants in this project indicated that peer-pressure and curiosity (45%), flavors (35%), enjoy it (52.94%), and because their addicted (35.29%) were the primary reasons for e-cigarette use. This information is crucial to knowing how to address e-cigarette education in the future.

Educating adolescents and young adults prior to the initiation of using e-cigarettes is imperative to decrease use in this vulnerable population. It is necessary that education come from multiple sources including primary care providers, teachers, and parents with stronghold of nicotine addiction often limiting successful cessation.

CHAPTER 5: DISCUSSION

Practice Implications

Despite the recent decline in e-cigarette use among middle and high school students in 2020, there is still approximately one in five high school students and one in twenty middle school students who currently use e-cigarettes (CDC, 2020; FDA, 2020). Limited data exists on the education of e-cigarettes in primary care proving a gap in knowledge. The contribution of this quality improvement project supports the growing need for education on e-cigarette use and prevention measures. While there are a number of tobacco smoking cessation programs and medications, there are few programs to educate adolescents and young adults about the dangers of e-cigarettes. Implementing educational programs in primary care and pediatric primary care offices would inform a younger population in anticipation of a proactive approach to preventing use of e-cigarettes. Long-term benefits of decreasing e-cigarette users is to prevent multiple chronic respiratory diseases including emphysema, chronic bronchitis, and COPD (Bhatta & Glantz, 2020).

Attention to screening of every adolescent and young adult patient using specific terminology of "e-cigarette or vaping" should be implemented in the primary care office. Healthcare providers should be able to educate patients on the harms of e-cigarette use and if needed, educate themselves initially. An effort to address e-cigarette use should be discussed at every visit with emphasis on cessation.

Project Strengths and Limitations

Strengths. Several strengths of the project were identified. Participants were randomized to control and intervention groups that reduced the potential for bias and to

keep equal number of participants in each group. As the project coordinator, I was able to administer the questionnaires and view the educational video which afforded the availability to answer questions following the video about the effects of e-cigarette use. An additional strength of the project was administering the post-test via phone call, providing additional discussion with the participant about e-cigarette use. The phone call was another opportunity to influence cessation.

Limitations. Number of participants were limited due to the location of the project in a rural family practice with two primary care providers. A larger office with more providers or implementing the project at multiple sites would have potentially given the number of participants for results to have been statistically significant. COVID-19 pandemic was also a deterrent to the number of adolescents and young adults that were scheduling visits. Typically, during the months that the project was implemented, patients would have been scheduling yearly physicals, sports physicals and sick visits. The healthcare organization restricted physicals therefore those visits were cancelled. Patients with symptoms of COVID were seen by virtual health and were not allowed to physically come into the office for visits. Under normal circumstances, a larger number of patients would have participated in the project.

Underestimating the addictiveness of nicotine was realized during analysis of results. Determining e-cigarette cessation interventions that are effective, one must consider the mechanism and psychological process that inhibits successful smoking cessation. E-cigarettes contain nicotine which is a powerful drug that causes a surge of endorphins in the reward center of the brain causing short-term euphoria when administered. Nicotine increases dopamine in the brain which results in addiction causing

withdrawal symptoms when not smoking. Withdrawal symptoms include irritability, cravings, depression, anxiety, cognitive and attention deficits, sleep disturbances, and increased appetite within a few hours of the last use of the e-cigarette. In order to prevent withdrawal symptoms, a person will continue to use e-cigarettes which continues the vicious cycle and difficulty with e-cigarette use cessation (National Institutes of Health [NIH], 2020). Withdrawal symptoms cause a person to exhibit poor decision making, which is also known as delayed discounting. Delayed discounting is a behavioral economic principle when a person chooses a smaller, immediate reward versus a larger, delayed reward (Miglin et al., 2017). E-cigarette users must choose between vaping now to relieve withdrawal symptoms or battle temptation against the e-cigarette and choose to have reduced health problems in the future. All individuals have different delayed discounting rates when it comes to cessation. Those with higher intentions to quit have a lower delay discounting rate indicating a higher value for delayed gratification or reward. On the contrary, those with more impulsive behavior and stronger orientation toward the present have a higher discounting rate (Miglin et al., 2017). E-cigarette cessation interventions will theoretically be more difficult for someone with a high discounting rate versus a person with a lower discounting rate especially when it comes to treatment outcomes. Adolescents and young adults will have a high rate of discounting because they are typically healthy and do not foresee any imminent danger immediately with their health.

Implications for Future Research

Future projects should examine e-cigarette education on a larger scale. Replication of the project would be expanded to include multiple clinics in order to

obtain the sample size that will afford statistical significance of 27 participants in each group according to a power analysis performed (Table 9). Additional education and points of contact with participants to counsel on e-cigarette cessation would help to reinforce cessation efforts such as an e-cigarette/vaping cessation telephone counseling line. Research to determine the most effective type of e-cigarette cessation education or intervention is necessary for future efforts in combating the effects of nicotine in e-cigarettes.

Conclusion

E-cigarette use will continue to devastate the health of people and deplete healthcare resources for years to come. Healthcare providers, communities, schools, and caregivers have a responsibility to inspire change through education in adolescents and young adults. Primary care providers are fundamental in promoting practice change and initiating a sustainable education intervention to deter e-cigarette use. Implementing education to youth prior to middle school when they are exposed to e-cigarettes is a pivotal time to potentially make a change in their future health. Healthcare providers should educate themselves on e-cigarettes and be able to have a knowledgeable conversation with young patients. Viewing an educational video during the visit may decrease use in patients who have low dependence on nicotine. Further research should be conducted to determine the success of education in the cessation of e-cigarette products.

REFERENCES

Bhatta, D. N. and Glantz, S. A. (2020). Association of e-cigarette use with respiratory disease among adults: A longitudinal analysis. *American Journal of Preventative Medicine, 58*(2), 182-190. https://doi.org/10.1016/amepre.2019.07.028

Centers for Disease Control and Prevention. (2020, September 9). *Smoking & tobacco use: About electronic cigarettes.* https://www.cdc.gov/tobacco/basic_information/e-cigarettes/about-e-cigarettes.html#

Chen, J., Green, K., Fryer, C., & Borzekowski, D. (2019). Perceptions about e-cigarette flavors: a qualitative investigation of young adult cigarette smokers who use e-cigarettes. *Addiction Research & Theory, 27*(5), 420-428. doi:10.1080/16066359.2018.1540693

Cullen, K. A., Gentzke, A. S., Sawdey, M. D., Chang, J. T., Anic, G. M., Wang, T. W., Creamer, M. R., Jamal, A., Ambrose, B. K., & King, B. A. (2019). E-cigarette use among youth in the United States, 2019. *Journal of the American Medical Association, 322*(21), 2095-2103. https://doi.org/10.1001/jama.2019.18387

Cummings, S., Bridgman, T., & Brown, K. (2016). Unfreezing change as three steps: Rethinking Kurt Lewin's legacy for change management. *Human Relations, 69*(1), 33-60. https://doi:10.1177/0018726715577707

Dai, H. (2020). Exposure to secondhand aerosol from electronic cigarettes among US youth from 2015 to 2018. *Journal of American Medical Association Pediatrics, 174*(3), 298-300. https://doi.10.1001/jamapediatrics.2019.5665

Doescher, M. P., Wu, M., Rainwater, E., Khan, A. S., & Rhoades, D. A. (2018). Patient perspectives on discussions of electronic cigarettes in primary care. *Journal of the American Board of Family Medicine, 31*(1), 73-82. https://doi:10.3122/jabfm.2018.01.170206

Farsalinos, K., Romagna, G., & Voudris, V. (2015). Factors associated with dual use of tobacco and electronic cigarettes: a case control study. *International Journal of Drug Policy, 26*, 595-600. http://dx.doi.org/10.1016/j.drugpo.2015.01.006

Food and Drug Administration. (2020a, May 4). *2018 NYTS data: A startling rise in youth e-cigarette use.* https://www.fda.gov/tobacco-products/youth-and-tobacco/2018-nyts-data-startling-rise-youth-e-cigarette-use

Food and Drug Administration. (2020b, September 10). *Youth tobacco use: Results from the national youth tobacco survey.* https://www.fda.gov/tobacco-products/youth-and-tobacco/youth-tobacco-use-results-national-youth-tobacco-survey

Foulds, J., Veldheer, S., Yingst, J., Hrabovsky, S., Wilson, S., Nichols, T., & Eissenberg, T. (2015). Development of a questionnaire for assessing dependence on electronic cigarettes among large sample of ex-smoking e-cigarette users. *Nicotine & Tobacco Research, 17*(2), 186-192. https://doi.org/10.1093/ntr/ntu204

Gentzke, A., Creamer, M., Cullen, K., Ambrose, B., Willis, G., Jamal, A., & King, B. (2019). Vital Signs: Tobacco products use among middle and high school students – United States, 2011-2018. *Morbid Mortal Weekly Report, 68*(6):157-164. https://doi:10.15585/mmwr.mm6806e1

Huang, J., Kornfield, R., Szczypka, G., & Emery, S. L. (2014). A cross-sectional examination of marketing of electronic cigarettes on Twitter. *Tobacco Control, 23*(3), 26-30. https://doi.10.1136/tobaccocontrol.2014.051551

Hwang, C. & O'Neil, J. (2020). E-cigarette use among adolescents. *The Journal for Nurse Practitioners, 16*(6), 453-456. https://doi.org/10.1016/j.nurpra.2020.02.021

Kim, A. E., Chew, R., Wenger, M., Cress, M., Bukowski, T., Farrelly, M., & Hair, E. (2019). Estimated ages of JUUL Twitter followers. *Journal of American Medical Association of Pediatrics, 173*(7), 690-692. https://doi.10.1001/jamapediatrics.2019.0922

Kreitzberg, D., Pasch, K., Marti, C., Loukas, A., & Perry, C. (2019). Bidirectional associations between young adults' reported exposure to e-cigarette marketing and e-cigarette use. *Addiction, 114,* 1834-1841. doi: 10.1111/add.14710

LeLaurin, J. H., Theis, R. P., Thompson, L. A., Tan, A. S., Wolff, K. C., Harris, L., Shenkman, E. A., & Salloum, R. G. (2019). Tobacco-related counseling and documentation in adolescent primary care practice: Challenges and opportunities. *Nicotine & Tobacco Research*, 1-7. https://doi:10.2093/ntr/ntz076

Leventhal, A., Goldenson, N., Barrington-Trimia, J., Pang, R., & Kirkpatrick, M. (2019). Effects of non-tobacco flavors and nicotine on e-cigarette product appeal among young adult never, former, and current smokers. *Drug and Alcohol Dependence, 203*, 99-106. http://doi.org/10.1016/j.drugalcdep.2019.05.020

Lichtenberg, K. (1997). E-cigarettes: Current evidence and policy. *Missouri Medicine, 114*(5), 335-338.

Melnyk, B. & Fineout-Overholt, E. (2019). *Evidence Based Practice in Nursing and Healthcare: A Guide to Best Practice.* 4th ed. Philadelphia: Wolters Kluwer.

Miech, R., Johnston, L., O'Malley, P., Bachman, J., & Patrick, M. (2019). Adolescent vaping and nicotine use in 2017-2018 – U.S. National Estimates. *New England Journal of Medicine, 380,*192-193. doi:10.1056/NEJMc1910739

Miglin, R., Kable, J. W., Bowers, M. E., & Ashare, R. L. (2017). Withdrawal-related changes in delay discounting predict short-term smoking abstinence. *Nicotine & Tobacco Research, 19*(6), 694-702. https://doi:10.1093/ntr/ntw246

Moran, K., Burson, R., & Conrad, D. (2017). *The doctor of nursing practice scholarly project: A framework for success* (2nded.). Burlington, MA: Jones & Bartlett Learning.

National Institutes of Health [NIH]. (2020, January). *Tobacco, nicotine, and e-cigarettes research report: Is nicotine addictive?* https://www.drugabuse.gov/publications/research-reports/tobacco-nicotine-e-cigarettes/nicotine-addictive

Olfson, M., Wall, M. M., Liu, S., Sultan, R. S., & Blanco, C. (2019). E-cigarette use among young adults in the U.S. *American Journal of Preventative Medicine, 56*(5), 655-663. https://doi.org/10.1016/j.amepre.2018.12.004

Padon, A., Lochbeuhler, K., Maloney, E., & Cappella, J. (2017). A randomized trial of the effect of youth appealing e-cigarette advertising on susceptibility to use e-cigarettes among youth. *Nicotine & Tobacco Research, 2018,* 954-961. https://doi: 10.1093/ntr/ntx155

Paek, H., Kim, S., Hove, T., & Huh, J. Y. (2014). Reduced harm or another gateway to smoking? Source, message, and information characteristics of e-cigarette videos on YouTube. *Journal of Health Communication, 19*, 545-560. https://doi:10.1080/10810730.2013.821560

Pbert, L., Farber, H., Horn, K., Lando, H., Muramoto, M., O'Loughlin, J., Tanski, S., Wellman, R., Winickoff, J. P., & Klein, J. D. (2015). State-of-the-art office-based interventions to eliminate youth tobacco use: the past decade. *Pediatrics, 135*(4), 734-747. https://doi:10.1542/peds.2014-2037

Phua, J., Jin, S. V., & Hahm, J. M. (2018). Celebrity-endorsed e-cigarette brand Instagram advertisements: Effects on young adults' attitudes towards e-cigarettes and smoking intentions. *Journal of Health Psychology, 23*(4), 550-560. https://doi:10.1177/1359105317693912

Pokhrel, P., Fagan, P., Herzog, T. A., Laestadius, L., Buente, W., Kawamoto, C. T., Lee, H., & Unger, J. B. (2017). Social media e-cigarette exposure and e-cigarette expectancies and use among young adults. *Addictive Behaviors, 78*(2018), 51-58. http://dx.doi.org/10.1016/j.addbeh.2017.10.017

Popova, L., McDonald, E., Sidhu, S., Barry, R., Maruyama, R., Sheon, N., & Ling, P. (2017). Perceived harms and benefits of tobacco, marijuana, and electronic vaporizers among young adults in Colorado: implications for health education and research. *Addiction, 112*, 1821-1829. doi:10.1111/add.13854

Prochaska, J. J. & Benowitz, N. L. (2019). Current advances in research in treatment and recovery: Nicotine addiction. *Science Advances, 5*(10), eaay9763. http://doi:10.1126/sciadv.aay9763

Rohde, J. A., Noar, S. M., Mendel, J. R., Hall, M. G., Baig, S. A., Ribisl, K. M., & Brewer, N. T. (2020). E-cigarette health harm awareness and discouragement: Implications for health communication. *Nicotine & Tobacco Research, 22*(7), 1131-1138. https://doi:10.1093/ntr/ntz194

Saddleson, M. L., Kozlowski, L. T., Giovino, G. A., Goniewicz, M. L., Mahoney, M. C., Homish, G. G., & Arora, A. (2016). Enjoyment and other reasons for electronic cigarette use: Results from college students in New York. *Addictive Behaviors, 54*, 33-39. http://dx.doi.org/10.1016/j.addbeh.2015.11.012

Salloum, R. G., Theis, R. P., Pbert, L., Gurka, M. J., Porter, M., Lee, D., Shenkman, E. A., & Thompson, L. A. (2018). Stakeholder engagement in developing an electronic clinical support tool for tobacco prevention in adolescent primary care. *Children, 5*(12). https://doi:10.3390/children5120170

Sare, M.V., & Ogilvie, L. (2010). *Strategic planning for nurses: Change management in health care.* Jones and Bartlett Publishers.

Soneji, S. S., Knutzen, K., & Villanti, A. C. (2019). Use of flavored e-cigarettes among adolescents, young adults, and older adults: Findings from the population assessment for tobacco and health study. *Public Health Reports, 134*(3), 282-292. https://doi:10.1177/0033354919830967

University of California at Los Angeles. (2017, August 23). Electronic Cigarettes and Vaping [Video]. YouTube. https://www.youtube.com/watch?v=9dZS_Rniak0

U.S. Department of Health and Human Services (2018). *Surgeon General releases advisory on e-cigarette epidemic among youth.* Retrieved from

https://www.hhs.gov/about/news/2018/12/18/surgeon-general-releases-advisory-e-cigarette-epidemic-among-youth.html

Villanti, A., Naud, S., West, J., Pearson, J., Wachowski, O., Niaura, R., Hair, E., & Rath, J. (2019). Prevalence and correlates of nicotine and nicotine product perceptions in U.S. young adults, 2016. *Addictive Behaviors, 98*. doi.org/10.1016/j.addbeh.2019.06.009

Vu, T. T., Hart, J. L., Groom, A., Landry, R. L., Walker, K. L., Giachello, A. L., Tompkins, L., Ma, J. Z., Kesh, A., Robertson, R. M., & Payne, T. J. (2019). Age differences in electronic nicotine delivery systems (ENDS) usage motivations and behaviors, perceived health benefit, and intention to quit. *Addictive Behaviors, 98*. https://doi.org/10.1016/j.addbeh.2019.106054

Xu, X., Bishop, E. E., Kennedy, S. M., Simpson, S. A., & Pechacek, T. F. (2015). Annual healthcare spending attributable to cigarette smoking: An update. *American Journal of Preventative Medicine, 48*(3), 326-333. https://doi:10.1016/j.amepre.2014.10.012

Yuan, M., Cross, S. J., Loughlin, S. E., & Leslie, F. M. (2015). Nicotine and the adolescent brain. *The Journal of Physiology, 593(*16), 3397-3412. https://doi.org/10.1113/JP270492

Zare, S., Nameti, M., & Zheng, Y. (2018). A systematic review of consumer preference for e-cigarette attributes: flavor, nicotine strength, and type. *PLOS One, 13*(3). https://doi.org/10.1371/journal.pone.0194145s

Zhu, S., Gamst, A., Lee, M., Cummins, S., Yin, L., & Zoref, L. (2013). The use and perception of electronic cigarettes and snus among the U.S. population. *PLOS One, 8*(10). https://doi:10.1371/journal.pone.0079332

APPENDIX A: INITIAL QUESTIONNAIRE

Initial Questionnaire

Participant # _____

1. Are you:
   a. Female
   b. Male

2. How old are you?
   a. 13
   b. 14
   c. 15
   d. 16
   e. 17
   f. 18
   g. 19
   h. 20
   i. 21
   j. 22
   k. 23
   l. 24

3. Have you ever heard of electronic cigarettes or e-cigarettes? These are electronic devices that contain nicotine in a vapor and are designed to look like cigarettes but contain no tobacco.
   a. Yes
   b. No
   c. Don't know

4. Have you ever vaped or used an e-cigarette?
   a. Yes
   b. No

5. Do you currently use an e-cigarette at least once a week?
   a. Yes
   b. No

6. What motivated you to use e-cigarettes?
   a. Desire to quit smoking cigarettes
   b. Reducing the health hazard of cigarettes
   c. Financial benefits
   d. Curiosity, peer-pressure, friends use
   e. Flavors, tastes good
   f. Advertisements

7. Do you think e-cigarettes are addictive?
   a. Yes
   b. No
   c. Somewhat
   d. Don't know

8. Do you think e-cigarettes are _____ harmful as compared to conventional tobacco cigarettes?
   a. More harmful
   b. Equally harmful
   c. Less harmful
   d. Not at all harmful
   e. Don't know

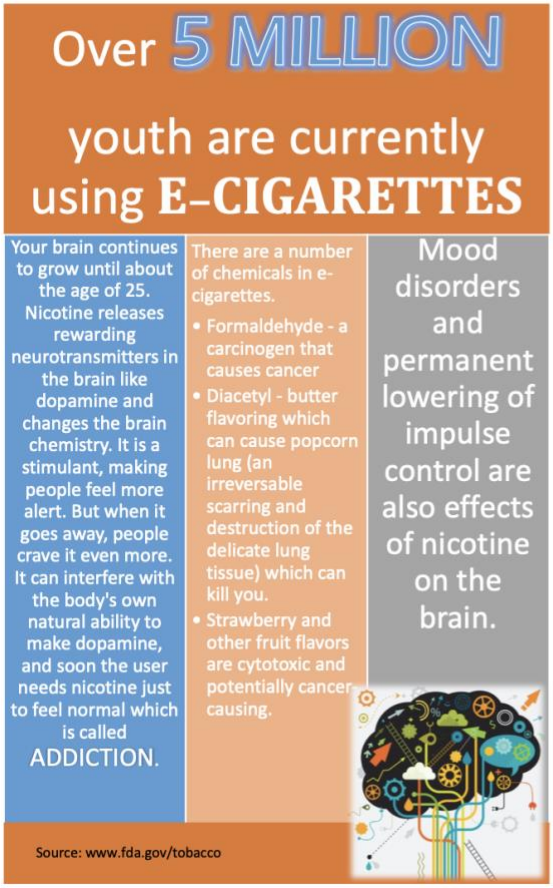
9. Do you think e-cigarettes are associated with any of the diseases like asthma, COPD, lung cancer, or coronary artery disease?
   a. Yes
   b. No
   c. Somewhat
   d. Don't know

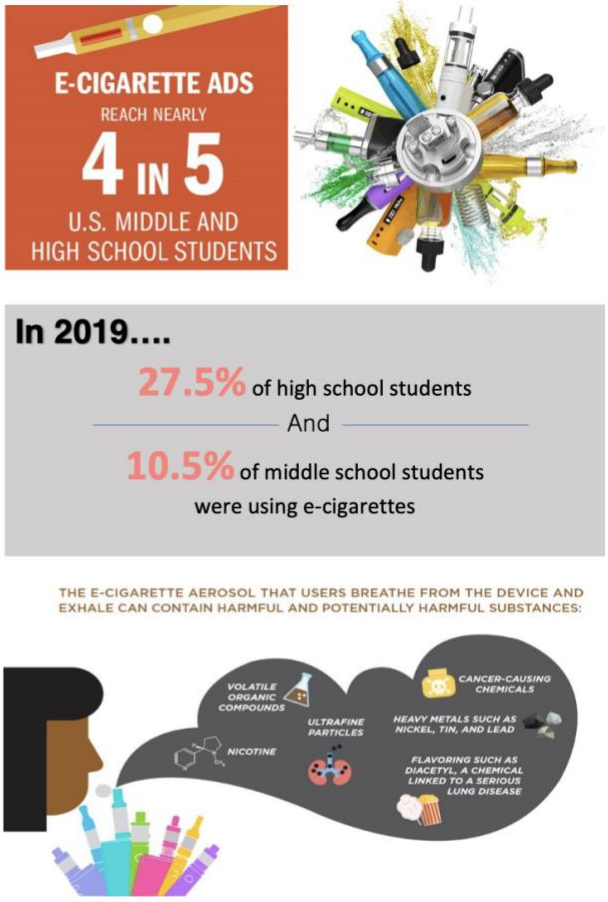
Please list a phone number or email address that we may use to text/email with the follow-up questionnaire in 2 weeks.

Phone_____

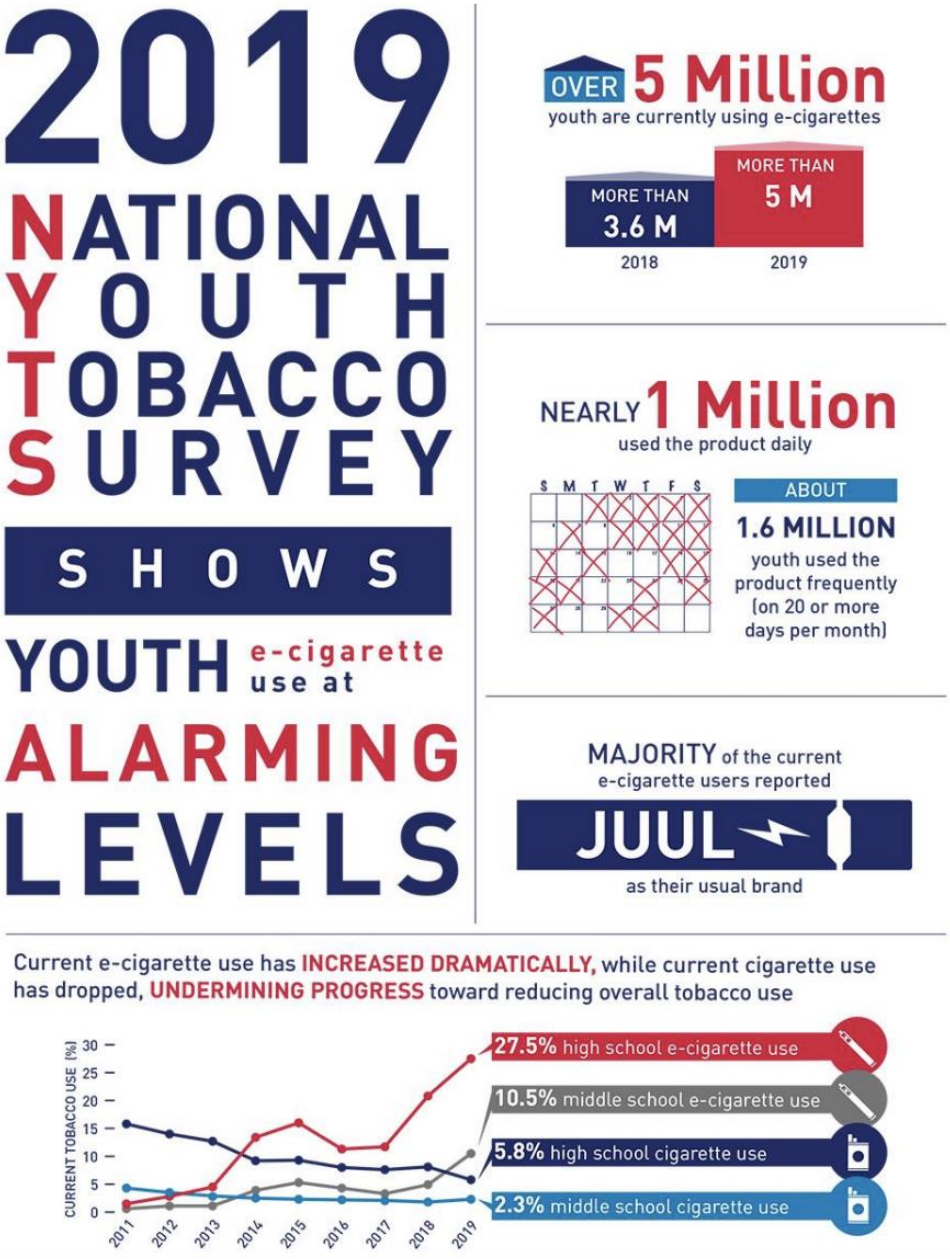
Email _____

APPENDIX B: EDUCATIONAL HANDOUT





APPENDIX C: EDUCATIONAL HANDOUT



https://www.fda.gov/media/132299/download

APPENDIX D: E-CIGARETTE REASONS FOR USE SCALE

Please complete the following questionnaire regarding e-cigarette use.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I use/used an e-cigarette…					
1. …because I enjoy(ed) it.					
2. …to deal with my craving for tobacco.					
3. …to quit smoking or avoid relapsing to smoking.					
4. …to avoid bothering other people who smoke.					
5. …to reduce my tobacco consumption					
6. …to try something new.					
7. …because it was/is less toxic than smoking tobacco.					
8. …because it was/is cheaper than smoking tobacco.					
9. …because I do/did not want to smell like smoke.					
10. …because all other smoking cessation methods have failed.					
11. …because I am/was addicted to the c-cig.					
12. …to help control my appetite					

APPENDIX E: PENN STATE ELECTRONIC CIGARETTE DEPENDENCE INDEX

Penn State Electronic Cigarette Dependence Index

1. How many times per day do you usually use your electronic cigarette? (assume one "time" consists of around 15 puffs, or lasts around 10 minutes)
_____ times per day

2. On days that you can use your electronic cigarette freely, how soon after you wake up do you first use your electronic cigarette? _____ minutes

3. Do you sometimes awaken at night to use your electronic cigarette? ☐ Yes ☐ No

4. If yes, how many nights per week do you typically awaken to use your electronic cigarette?
_____ nights

5. Do you use an electronic cigarette now because it is really hard to quit? ☐ **Yes** ☐ **No**

6. Do you ever have strong cravings to use an electronic cigarette? ☐ **Yes** ☐ **No**

7. Over the past week, how strong have the urges to use an electronic cigarette been? (check one)

- ☐ **No urges**
- ☐ **Slight**
- ☐ **Moderate**
- ☐ **Strong**
- ☐ **Very strong**
- ☐ **Extremely strong**

8. Is it hard to keep from using an electronic cigarette in places where you are not supposed to?
☐ **Yes** ☐ **No**

When you haven't used an electronic cigarette for a while… OR when you tried to stop using…

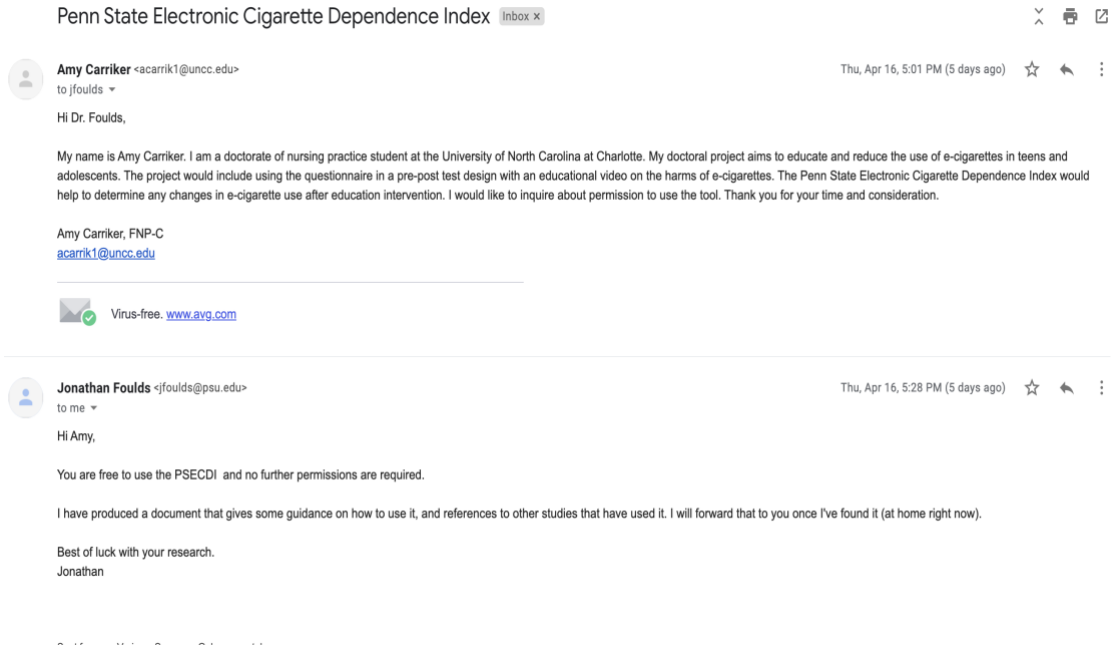
9. Did you feel more irritable because you couldn't use an electronic cigarette? ☐ **Yes** ☐ **No**

10. Did you feel nervous, restless or anxious because you couldn't use an electronic cigarette?
☐ **Yes** ☐ **No**

11. What concentration of nicotine is in the liquid you typically use with your e-cig? _____ mg/ml.

Used with permission from Jonathan Foulds, PhD, Penn State College of Medicine.

APPENDIX F: CONSENT TO USE PSECDI



Penn State Electronic Cigarette Dependence Index Inbox ×

Amy Carriker <acarrik1@uncc.edu> Thu, Apr 16, 5:01 PM (5 days ago)
to jfoulds

Hi Dr. Foulds,

My name is Amy Carriker. I am a doctorate of nursing practice student at the University of North Carolina at Charlotte. My doctoral project aims to educate and reduce the use of e-cigarettes in teens and adolescents. The project would include using the questionnaire in a pre-post test design with an educational video on the harms of e-cigarettes. The Penn State Electronic Cigarette Dependence Index would help to determine any changes in e-cigarette use after education intervention. I would like to inquire about permission to use the tool. Thank you for your time and consideration.

Amy Carriker, FNP-C
acarrik1@uncc.edu

Virus-free. www.avg.com

Jonathan Foulds <jfoulds@psu.edu> Thu, Apr 16, 5:28 PM (5 days ago)
to me

Hi Amy,

You are free to use the PSECDI and no further permissions are required.

I have produced a document that gives some guidance on how to use it, and references to other studies that have used it. I will forward that to you once I've found it (at home right now).

Best of luck with your research.
Jonathan