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Electronic Cigarettes and Young Adults: Use of Screening Tools and Provider Knowledge

Kayla Erin Chelf
University of Kentucky, kaylamullins213@hotmail.com

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Electronic Cigarettes and Young Adults: Use of Screening Tools and Provider Knowledge

Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Nursing
Practice at the University of Kentucky

Kayla E. Chelf BSN, RN

Crestwood, KY

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Abstract

Background: Electronic Cigarette (e-cigarette) use is now more common than traditional cigarette use in adolescents and young adults (Dinardo & Rome, 2019). There is concern that the lack of screening for use and knowledge about the health consequences of e-cigarette use is driving this growth.

Objective: The purposes of this project were to (1) assess baseline e-cigarette knowledge and screening practices from healthcare professionals, and (2) evaluate changes in knowledge after delivery of an educational intervention about e-cigarettes.

Methods: In this quasi-experimental study a seven-question survey on screening practice and knowledge concerning e-cigarettes in young adults was posted on the discussion board of a national professional healthcare site for college healthcare professionals. Participants were then presented with a ten-minute educational video followed by a seven-question post survey. A paired t-test was used to analyze data.

Results: Forty professionals from 14 different health professions completed the pre-test and 23 completed the post-test. Statistical significance was observed between the pre-educational and post-educational survey for the following questions. 1) Electronic Cigarettes are safer than traditional cigarettes for young adults ($p = .038$) and 2) Electronic Cigarettes are an effective quit tool to quit using traditional cigarettes in young adults ($p = .013$).

Conclusion: The educational tool was effective in changing attitudes toward electronic cigarette safety in young adults. Although the sample was small, it is clear providers need accurate information about e-cigarettes to adequately assess use and education their young adult patients.

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To Austin, your support and sacrifice have made this dream possible for me. We spent three years working toward our doctorates together and I could not have done this without you by my side. Thank you.

Dedication

I would like to dedicate this project to my husband Austin, and my daughter Palmer. This project is a culmination of many years of hard work, and I would not have made it this far without them. Austin has been a constant support and encouragement, even when I have felt like I couldn't do anything more. Palmer, you have been the push of encouragement to finish this journey on a high note. PJ, I hope one day when I tell you about DNP school it serves as inspiration to you that you can do anything you put your mind to. I hope I can continue to make you both proud.

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Background and Significance

Introduction

E-cigarette use is now more common than traditional cigarette use in adolescents and young adults (Dinardo & Rome, 2019). There is concern that the lack of knowledge about the health consequences of e-cigarette use is driving this growth. Data has shown that users of e-cigarettes are three times more likely to begin using traditional cigarettes (Dinardo & Rome, 2019). In 2019 there were 2,051 cases of vaping-associated lung injury in the United States with 39 confirmed deaths (Dinardo & Rome, 2019).

Background

In Kentucky, 13.1% percent of young adults (age 18-24) report using e-cigarettes daily or most days, an increase from 10.9% in 2016 (CDC, 2017). Nearly half of Kentucky high schoolers (44.5%) report having ever tried an e-cigarette (CDC, 2017). Nationwide, young adults are more likely to report e-cigarette use than any other age group (Copeland et. al, 2017). E-cigarettes are the most used form of tobacco among United States youth (Lichtenberg, 2017). A study of young adults who had ever used e-cigarettes found that these individuals endorse e-cigarette use as safer than traditional cigarettes (Choi & Forester, 2014). The same study also found that these young adults felt that there was a high acceptance for public use of e-cigarettes and that they were helpful in aiding traditional cigarette cessation (Choi & Forester, 2014). Lastly, young adults thought that e-cigarettes were less harmful and addictive than traditional cigarettes (Choi & Forester, 2014). The favorable opinion of e-cigarettes makes individuals more likely to use e-cigarettes in the future.

Electronic cigarettes were first patented in 1965 in China, entered the market there in 2003, and were patented internationally in 2007 (Bhatnagar et. al, 2014). The sale of e-cigarettes is prohibited in Australia, Brazil, Canada, Mexico, Panama, Singapore, and Switzerland (Bhatnagar et. al, 2017). Electronic cigarettes may also be called “e-cigs”, “vapes”, “e-hookahs”, “vape pens”, and electronic nicotine delivery systems.” (CDC, 2022). They may look like regular cigarettes or cigars, but some look like USB flash drives or pens. Most of these devices have a battery, a heating element, and a place to hold liquid. They work by heating a liquid that contains nicotine and flavoring into an aerosol that can be inhaled. Electronic cigarettes can also be used with marijuana or other drugs (CDC, 2022). Electronic cigarettes can be highly addictive due to the nicotine they contain. They can be even more harmful to young adults whose brains are still developing. There is also the risk for lung injury due to the cancer-causing chemicals often found in “vape liquid”. There have also been cases of defective electronic cigarette batteries causing fires and explosions which have also resulted in injuries (CDC, 2022). Electronic cigarettes are relatively new, and research is still being conducted on the long-term health effects caused by the devices.

There is a lack of studies that document potential harms of e-cigarettes which has led to the perceived safety of these devices. Advertising campaigns have also promoted e-cigarettes as safer than traditional tobacco products. Analysis of the vapor exhaled by users has contained: formaldehyde, acetaldehyde, isoprene, acetone, propylene glycol, and nicotine (Lichtenberg, 2017). It is unknown at this time if their substances can have the same effect on indoor air quality or as tobacco secondhand smoke. There is very little information on long term effects and the safety of use of e-cigarettes long term due to their relative newness to the market. There is

also no evidence that demonstrates that e-cigarettes are safer or more effective than any FDA-approved smoking cessation treatment (Lichtenberg, 2017).

Additionally, there is concern from public health experts about the exposure of non-e-cigarette using individuals to the liquid nicotine cartridges used for e-cigarettes. From January to October 2016 there were 1,292 exposures to liquid nicotine across all age groups (Lichtenberg, 2017). Half of these exposures occurred in children under the age of six. In 2014, a one-year-old child died after ingesting liquid nicotine. There is also concern about the inhalation of nickel, lead, and cadmium which can be found in e-cigarette vapor (Lichtenberg, 2017). Lead exposure is known to cause neurologic damage and hematologic dysfunction.

Despite young adults being the largest users of e-cigarettes there is a large gap in the research for this population. There is ample evidence regarding adolescents and e-cigarettes but not much information in the young adult population. It is not well known what young adults know or perceive about electronic cigarettes. This presents an opportunity for the education of healthcare providers who care for the young adult population.

Purpose and Objectives

The specific aims of this project were 1. To assess electronic cigarette knowledge and screening rates from college healthcare professionals. 2. Evaluate changes in knowledge after delivery of an educational intervention about e-cigarettes..

Theoretical Framework

To meet the specific aims of this project the Health Belief Model was utilized. The Health Belief Model was developed in the 1950's by the U.S. Public Health Service in response to the failure of individuals to adopt disease prevention or screening tests (BUSPH, 2019). The Health Belief Model was based on Lewin's Field Theory which suggested that behavior is a result of not only the individual but the environment they are surrounded by (Lewin, 1951).

Perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cue to action, and self-efficacy are the six components that make up the Health Belief Model (BUSPH, 2019). Perceived susceptibility is the subjective assessment of risk for developing a health issue. In theory, if an individual feels they are at a high risk of developing a specific issue, they will alter their behavior to reduce the risk (BUSPH, 2019). Perceived severity pertains to the individual's opinion regarding the severity of a health issue, and the complications or consequences that may occur as a result of it. If a health problem is perceived as more severe then behavioral changes may occur to prevent the specific health issue (BUSPH, 2019).

Perceived benefits are a subjective assessment of the efficacy of performing health related behaviors to prevent health problems. If an individual believes that a certain health behavior will provide a large health benefit, they are more likely to perform that behavior (BUSPH, 2019). Perceived barriers are a subjective assessment of obstacles to health behavior change. Perceived barriers and benefits are intertwined. If is the individual's opinion that the benefit outweighs the barrier, then a positive behavioral change will occur. If the benefit does not outweigh the barrier, it is more likely that the barrier will remain, and no change will occur.

Cue to action is a trigger for change (BUSPH, 2019). This can be internal or external depending on the situation and individual. One common cue to action is an illness in a close

family member or friend. Self-efficacy is an individual's belief or perception that they can perform a behavior. An individual's confidence in their ability to change can be the highest predictor of future health behavior change (BUSPH, 2019).

In the context of e-cigarette screening several of these components come into play. It is important to educate young adults about e-cigarette use and its potential health implications. This education may influence their perceived susceptibility, benefits, and severity. It is also important to screen this population for use of e-cigarettes so that education can be provided to increase their self-efficacy for cessation. The Health Belief Model provides guidance to healthcare professionals on which factors to consider when exploring health behaviors. Utilizing the Health Belief Model to select screening and educational tools acknowledges how social behavior can influence many of our health beliefs and practices.

Review of Literature

PICOT Question and Search Methods

E-cigarette use is growing rapidly in the young adult population but there are many misconceptions about the safety of these products. With increased knowledge, healthcare professionals may screen for use more appropriately and better educate their patients on the risks of e-cigarette use.

To determine the evidence supporting the use of the e-cigarette screening tools and assessing individuals' knowledge and screening for e-cigarette use, a review of the literature was conducted. Specifically, using the PICO format, the question guiding the review was: Among health care professionals, how is screening for e-cigarette use performed and what are the perceived dangers and benefits of e-cigarette use in young adults?

The literature review was conducted using PUBMED and CINAHL. The literature search covered studies published between 2010 and the present. Inclusion criteria for the search included studies conducted in western countries such as Canada, the US, the UK, and Australia, international studies including those conducted in developing countries, studies published in English, peer-reviewed studies, quantitative studies, and qualitative studies. Exclusion criteria included studies published in a language other than English and studies published before 2010. A review of PubMed and CINAHL database was performed using the following combination of search terms: electronic cigarettes, young adult, screening, knowledge, e-cigs, vape, provider knowledge, college student. The literature search produced a wide range of study types such as randomized control trials, qualitative studies, clinical trials, systematic reviews, and meta-analysis.

Synthesis of Evidence

This literature review produced eight studies that were relevant to the PICO question. The review revealed that in studies based in outpatient clinics in the United States, the standard tobacco screening use question was not sensitive to e-cigarette use. The typical question is most often asked as “do you smoke” or “do you use tobacco products” (Liu et al., 2021). Liu et al. (2021) analyzed the use of this question and found that it was not sensitive to e-cigarette use in the adolescent population. Hein et al., (2020), Mathues et al. (2021), and Cano Rodriguez et al., (2020) all echoed this finding but went a step further to apply this information in the context of an electronic health record (EHR). These studies found that providers should utilize a designated e-cigarette screening tab in the EHR to screen for e-cigarette use more specifically. These studies were quasi experimental as they all lacked a random assignment of subjects.

Screening options used in the reviewed studies varied. First, the Risk and Benefit of E-Cigarette Use or RABE tool is a 30-item screening tool with a Cronbach alpha score of assessing risk at a $\alpha = 0.92$ and assessing benefit at $\alpha = 0.89$ (Copeland et al., 2017, Appendix B). Next, the Penn State Electronic Cigarette Dependence Index which is a ten-item tool with a Cronbach alpha score of $\alpha = 0.8472$ (Pienkowski et al., 2022, Appendix C). Lastly, the Electronic Cigarette Dependence Scale which has a four, eight, and twenty-two item version with a Cronbach alpha score of 4- item $\alpha = 0.86$, 8-item $\alpha = 0.93$, and 22-item $\alpha = 0.98$ (Morean et al., 2019, Appendix D).

In 2016 it was estimated that 80% of middle and high school students were exposed to e-cigarette advertisements (Marynak et al., 2018). Millions of dollars are being poured into marketing campaigns to target adolescents and young adults to purchase and use e-cigarettes. Yet, there is little research to understand the effects of these devices on the young adult population. Clinician lack of knowledge and the lack of screening for electronic cigarettes in healthcare settings leaves many young adults at risk for health consequences, such as addiction and lung injury, from e-cigarettes.

While some studies address the accuracy of screening for e-cigarette use (Liu et al., 2021) or quantifying dependence on electronic cigarettes (Copeland et al., 2017, Morean et al., 2019, & Pienkowski et al., 2022), there is a lack of research on assessing patient knowledge regarding e-cigarettes. Information on patient knowledge was much more difficult to find in the literature review. The Risk and Benefits of E-cigarette (RABE) tool does assess e-cigarette knowledge. Copeland et al., (2017) found the RABE tool to be a “reliable instrument to measure college students perceived risk and benefits of e-cigarettes”. In the 2017 study this tool was administered

to 734 college students via email and was validated as a tool to assess use of and knowledge regarding e-cigarette use.

The literature demonstrates the need for a specific e-cigarette screening tool as it was reported that just screening for tobacco use does not accurately identify e-cigarette users. The studies all recommended incorporating the screening tool in the EHR and they suggest having a separate area where this occurs. This can be a separate tab, specific question prompt with each patient, or a tool located in the screening area. The studies were limited in that they all had relatively small sample sizes as they were limited to single outpatient offices, and they were not randomized trials. Despite this, the studies had similar outcomes that were statistically significant.

Copeland et al. (2017) takes a different approach to screening. In this study the RABE tool was completed online by 734 college students. This study had a larger sample size and like the above studies the results were found to be statistically significant. The online format of the study would most likely be more accessible for individuals. Overall, the studies discussed in this literature review were level III or above on the evidence hierarchy and provided information about screening options and how they should be implemented.

Identification of Gap

Currently, young adults are not being accurately assessed for e-cigarette use nor are they being educated on the risks of using these substances. The goal of this project is to accurately assess healthcare professionals screening practices and their knowledge and opinions of the risks and benefits of e-cigarettes. While there is ample research surrounding e-cigarette use in adolescents the research in the young adult population is very limited. In the clinical setting young adults are not accurately screened or educated about e-cigarettes (Hein et al., 2020). The

data shows that many young adults are not aware of the dangers that e-cigarettes pose (Choi & Forester, 2014, & Copeland et al., 2014).

Proposed Strategy to Address the Gap

To address this gap in the research and in practice this project assessed e-cigarette screening in healthcare professionals who specifically care for young adults and to educate the healthcare professionals about e-cigarettes and their use in young adults. The project included an educational intervention about available screening tools for e-cigarette use developed for healthcare professionals who care for young adults. Overall, the goal was to provide evidence-based information to these healthcare professionals as accurate knowledge is essential to make meaningful change in their practice and patients' lives.

Methods

Design

The design of the study is a quasi-experimental study. This study used a one-group pretest-posttest design to examine the effect of the electronic cigarette educational intervention for members of the American College Health Association on knowledge about electronic cigarettes. This project intended to add to the knowledge base of e-cigarette screening in the young adult population and provide a baseline of healthcare providers' knowledge about e-cigarette use. This information is foundational in assessing the need for a practice change.

Setting

The setting of this project was the American College Health Association (ACHA). ACHA was founded in 1920 and serves as an organization for health care professionals who

work with college students. The mission of ACHA is “to serve as the principal leadership organization for advancing the health of college students and campus communities through advocacy, education, and research.” The vision of ACHA is “to be the recognized voice of expertise in college health.” To support this goal and mission, the current project assessed healthcare professional views and practices regarding electronic cigarette use and provide education for them to implement in their practice. This organization was chosen for this project because it is comprised of individuals who work with young adults who are in college. In a clinical rotation in the college health setting, healthcare providers discussed e-cigarette use and cessation in the young adult population and the prevalence of use was concerning. Yet, the literature was lacking on information about screening tools and practices as well as provider knowledge regarding e-cigarettes.

Stakeholders

College healthcare professionals are the stakeholders of this project as they are receiving the education from this project and implementing this into their practice where they care for young adults. College students and young adults are also stakeholders as they benefit from the education their healthcare professionals are receiving.

There are several factors that will help facilitate completing the project with the ACHA. Specifically, the discussion board used to send out the survey has several thousand members, the ease of access to this discussion board by members, and the availability of healthcare professionals to complete the survey. The author is a member of this organization and as such, has access to the discussion board. The main barriers to implementing the project include member buy in and participation. Other barriers may include survey fatigue, busy schedules that cause individuals to bypass the invitation to the study, and the time of year of the study. This was

conducted in December 2022 to January 2023 and individuals may have been out of the office or not checking their emails and organization discussion board as much during this time of year. To overcome these barriers, a short description of the project was presented with the survey link to inform members of its purpose in hopes to encourage participation. The education was kept as short as possible to decrease the time burden. Lastly, the survey link was posted three times to increase the number of individuals who saw the link.

Sample

A convenience sample of 1000 healthcare professionals from a national healthcare organization were targeted for this study. Inclusion criteria for this study were: 1) Healthcare Professionals (MD, DO, Nurse Practitioner, PA, RN, Mental Health Professional, Health Educator, Dietician/Nutritionist, Pharmacist, PT, OT) who subscribed to the ACHA discussion board during the study period, 2) Healthcare Professional who treats patients aged 18-24 in their practice. Exclusion Criteria were: 1) Non-healthcare Professional, 2) Healthcare Professional who do not treat patients aged 18-24 in their practice, 3) inability to read and understand English.

Procedure

This project has three components including: 1) Seven question pre-survey and demographics survey 2) ten-minute educational video and 3) seven question post-survey. Potential participants were contacted via a post to the American College Health Association discussion board to inform them about the survey and to invite them to participate. Per the Terms and Conditions of the American College Health Association discussion board (ACHA Connect) the primary investigator does not need additional permission to post within the discussion board. The discussion board post contained a link to begin the pre-survey. Subjects were asked to complete the pre-education questionnaire via Qualtrics survey platform. After completion of the

questionnaire subjects participated in an evidence-based educational intervention in the form of a PowerPoint presentation with voiceover which was accessed via YouTube. Immediately after completion of the educational intervention subjects were asked to complete a post-education questionnaire via Qualtrics survey platform.

Measures

Data collection for this study occurred via electronic surveys on Qualtrics. Pretest surveys examining demographics and knowledge questions were given prior to the educational tool. After completing the pretest, the participants were given the educational tool. Immediately following the educational tool, the participants responded to post test questions.

This study obtained demographic information on age, sex, ethnicity/race, education level of participants, credentials, and rural/urban setting to describe the sample. The pre-survey assessed their screening practices surrounding e-cigarette use as well as their knowledge about e-cigarettes (Appendix A) in seven Likert type questions. Response options ranged from 1 to 5 with 1 being strongly disagree and 5 being strongly agree. The post survey contained the same seven Likert type questions (Appendix A).

The educational intervention was developed by the principle investigator and based on an integrative review of the literature to identify components of interventions that may be effective in evaluating understanding of e-cigarette use and its dangers (Cano et. al, 2020, Chadi et. al, 2019, Copeland et. al, 2017, Hein et. al, 2020, Liu et. al, 2021, Mathues et. al, 2021). The ten-minute educational video discussed what defines e-cigarettes, rates of e-cigarettes use in young adults, risks to young adults who use e-cigarettes, FDA regulation of e-cigarettes, and screening tools for e-cigarettes in young adults.

Institutional Review Board

Institutional Review Board (IRB) approval was obtained from the University of Kentucky Office of Research Integrity: Medical IRB in November 2022.

Data Collection

The data from the surveys was transported to an excel spreadsheet from Qualtrics and transferred to SPSS software, a data analysis software. Missing data was addressed by using means or modal substitutions for continuous or categorical variables.

Data Analysis

Descriptive statistics using means with standard deviations or frequencies with percentages was used to describe the demographic distribution of the sample. All analyses were conducted using IBM SPSS with an alpha level of 0.5 used to indicate statistical significance.

Feasibility and Sustainability

This project did not have a budget, nor did it require a significant time commitment from participants. These factors enhanced the feasibility of this study. To support the sustainability of the project, after the study the education was available to any members of ACHA discussion board. Furthermore, the information gathered in the first stage of data collection was made available on the discussion board as well. By increasing the understanding of the health risks, healthcare professionals may encourage young adults not to use e-cigarettes which could save patients, taxpayers, and healthcare institutions money.

Results

The study includes a total of 40 healthcare professionals who met the inclusion criteria and completed the pre-test (Table 1), with a total of 23 healthcare professionals who completed

the post-test. The most common age group was 45-55 years old with (n = 12). Most participants were white (n= 35, 89.7%) and female (n= 32, 80%). Most individuals had a master's degree (n= 26, 65%). Nurse Practitioners were the most represented profession (n=11, 27.5%) with seven other professions also represented. Most health professionals surveyed practice in an urban setting (n=27, 67.5%).

Table 1. Descriptive summary of participant characteristics (n = 40)

Characteristic	n (%)
Age	
18-24	3 (7.5%)
25-34	10 (25.0%)
35-44	8 (20.0%)
45-55	12 (30.0%)
56-70	7 (17.5%)
Ethnicity	
Black or African American	1 (2.6%)
Latino or Hispanic	2 (5.1%)
White	35 (89.7%)
Asian	1 (2.6%)
Gender	
Male	7 (17.5%)
Female	32 (80.0%)
Prefer not to say	1 (2.5%)
Highest Level of Education	
Associate Degree	1 (2.5%)
Bachelor's Degree	6 (15.0%)
Master's Degree	26 (65.0%)
Doctoral Degree	6 (15.0%)
Other	1 (2.5%)
Health Profession	
Physician	3 (7.5%)
Physician Assistant	3 (7.5%)
Administrator	2 (5.0%)
Nurse	5 (12.5%)
Nurse Practitioner	11 (27.5%)
Nurse Director	3 (7.5%)
Mental Health Professional	3 (7.5%)
Health Educator	4 (10.0%)
Pharmacist	2 (5.0%)
Student	2 (5.0%)
Other	2 (5.0%)
Practice Setting	

Rural	13 (32.5%)
Urban	27 (67.5%)

Specific Aim One

To address specific aim one which was “to assess electronic cigarette knowledge and screening rates from college healthcare professionals”, 40 healthcare professionals completed the pre-intervention survey. Of those surveyed 57.5% ($n=23$) reported that they screen for electronic cigarette use in young adults. In those that do screen they reported using a variety of strategies and tools. Participants reported using the CRAFFT tool, the RABE tool, and EPIC (their electronic health record to document electronic cigarette use. Six participants reported using an intake form or questionnaire. Lastly, 12 individuals reported that they screen for electronic use in young adults by “just asking” about use. The pre-intervention survey knowledge questions revealed that participants were aware that electronic cigarettes are addictive (mean 4.95, sd 0.22) and that electronic cigarettes can cause lung injury (mean 4.76, sd 0.62). Participants were less knowledgeable about the safety of electronic cigarettes compared to traditional cigarettes (mean 1.77, sd 1.11), the use of electronic cigarettes as a quit tool (mean 1.90, sd 1.30), and the regulation of electronic cigarettes by the FDA (mean 2.43, sd 1.25).

Specific Aim Two

To address specific aim two which was “evaluate changes in knowledge after delivery of an educational intervention about e-cigarettes”, the postintervention survey was given immediately after participants watched a ten-minute video. In the preintervention results 57.5% of participants reported that they already screen for e-cigarette use. Postintervention responses revealed seventeen (73.9%) participants reported that they would be either somewhat likely or extremely likely to screen for electronic cigarette use.

Table 2. Post-intervention likelihood to screen (n = 23)

How likely are you to screen for electronic cigarette use in young adults?	n (%)
Extremely unlikely	1 (4.3%)
Somewhat unlikely	1 (4.3%)
Neither likely or unlikely	4 (17.4%)
Somewhat likely	8 (34.8%)
Extremely likely	9 (39.1%)

Next, participants were asked how likely they were to offer resources for cessation of electronic cigarette use to young adults (Table 3), of which n=19, 82.6% of individuals reported they were somewhat or extremely likely to offer cessation resources.

Table 3. Post-intervention likelihood to offer cessation resources (n = 23)

How likely are you to offer resources for cessation of electronic cigarette use to young adults?	n (%)
Extremely unlikely	3 (13.0%)
Somewhat unlikely	0 (0.0%)
Neither likely or unlikely	1 (4.3%)
Somewhat likely	4 (17.4%)
Extremely likely	15 (65.2%)

Comparisons in survey responses from pre to post survey revealed statistically significant changes in two questions. The first question was “Electronic Cigarettes are safer than traditional cigarettes for young adults”. There was a negative trend in the mean for the answers from pre to post intervention surveys. This suggests an increase in knowledge as individuals were more likely to strongly disagree that electronic cigarettes are safer than traditional cigarettes after

watching the educational video. This difference in means was statistically significant with $p=0.038$.

The second statistically significant change was in question three which stated, “Electronic Cigarettes are an effective tool to quit using traditional cigarettes in young adults”. There was a negative trend in the mean for the answers from pre to post intervention surveys. This indicates an increase in knowledge as individuals were more likely to strongly disagree that electronic cigarettes are an effective tool to quit using traditional cigarettes in young adults after watching the educational video ($p= 0.013$).

The statement “Electronic Cigarettes are addictive in young adults” showed a positive trend in the mean for the answers from pre to post intervention surveys. This suggests an increase in knowledge as individuals were most likely to strongly agree that electronic cigarettes are addictive in young adults after watching the educational video. In fact, the mean increased from 4.95 to 5.0 which indicates that every participant strongly agreed that electronic cigarettes are addictive in young adults.

Table 4. Comparison of attitudes about e-cigarette..... (n = 22)

	Pre-education Mean (SD)	Post-education Mean (SD)	<i>p</i> <i>p</i> <0.05
Electronic Cigarettes are safer than traditional cigarettes for young adults	1.77 (1.11)	1.32 (0.72)	.038
Electronic Cigarettes are addictive in young adults	4.95 (0.22)	5.00 (0.00)	.329
Electronic Cigarettes are an effective tool to quit using traditional cigarettes in young adults	1.90 (1.30)	1.10 (0.44)	.013
Electronic Cigarettes are regulated by the FDA	2.43 (1.25)	2.10 (1.58)	.339
Electronic Cigarettes can cause lung injury in young adults	4.76 (0.62)	4.85 (0.48)	.162

Note: Response options range from 1) ‘Strongly disagree’ to 5) ‘Strongly agree’

Discussion

This study revealed that participants had a baseline knowledge about electronic cigarette use in young adults which was better than what reflected in the literature. The educational video intervention suggested improvement in the participants baseline knowledge. There were positive trends in the questions about the addictive nature of e-cigarettes and the possibility of lung injury in e-cigarette users. There were negative trends in the answers for questions about the safety of e-cigarettes, their use as a quit tool, and the regulation of e-cigarettes by the FDA. These trends demonstrated the effectiveness of the educational tool in increasing the knowledge of healthcare professionals regarding electronic cigarettes.

The baseline knowledge may have been higher than what was expected based on the literature review due to the participants exposure to individuals who use e-cigarettes as they work with the population who utilizes these devices the most. Additionally, the study showed that video format can be an effective way to provide education to healthcare professionals as demonstrated by the appropriate trend in data pre and post intervention. It is my hope that the participants will implement this knowledge into their patient care by educating their patients about the potential harms of e-cigarettes, screening for e-cigarette use, and offering cessation resources to those who do use. Overall, this study showed an increase in intent to screen, a high willingness to offer cessation resources, and an increase in knowledge after the educational video.

Implications for Practice

This study highlights the need for further education about electronic cigarettes. The ten-minute educational video may be an effective format to increase knowledge in the short term. Video education is a useful tool for busy clinicians as it provides an opportunity for

asynchronous learning. It is also easy to disseminate to large groups. The literature is clear that e-cigarettes may be harmful to young adults and it is essential that primary care providers are knowledgeable about the risks and safety issues of e-cigarette use.

Implications for Research

Future research should focus on replicating this study with a larger sample size and studies able to look at differences between individual healthcare professions could also enlighten needs for future education. Research should also attempt to further study the entire young adult population, not just those who are in college because this may not be an accurate representation of the young adult population. An evaluation of the retention of knowledge post educational intervention would also be beneficial to further evaluate the effectiveness of the intervention.

Limitations

The limitations of this study include the small sample size, the time of year the study was performed, the amount of time between the pre and post intervention survey, and the limitation to the population sampled. A larger sample size would improve the power to detect statistical significance. The study was performed in December 2022 to January 2023, a time that most universities and colleges are on winter break. It is possible that the timing of this study limited the number of participants as many individuals may have been away from work, not checking the discussion board of the organization, or simply did not want to participate due to limited time in the office. This study did not evaluate for retention of knowledge over time as participants took the post-intervention survey immediately after watching the educational video. Lastly, the surveys were given to professionals who are members of the American College Health Association, these individuals are working with young adults who are in college. The study does

not assess professionals who work with young adults who are not in college which limits the ability to generalize the results to all young adults.

Conclusion

This study established baseline knowledge about electronic cigarettes of healthcare professionals caring for young adults and their screening practices. The educational video seemed to increase the knowledge of these professionals and seemed to increase their willingness to screen for electronic cigarette use. The results of this study suggest the use of a brief educational intervention to increase knowledge about and screening for electronic cigarette use in young adults.

The need for education of healthcare professionals about electronic cigarettes, how to screen for use, and what cessation tools to offer is growing in importance as this epidemic grows. The daily use of electronic cigarettes has increased from 1.5% in 2017 to 2.3% in 2020, with the largest growth seen in those age 21 to 24 years old (Boakye et al., 2022). Young adults report that they try electronic cigarettes due to curiosity, flavoring, social acceptance, lack of odor, quick use, easy concealment, and the perception that they are safer than cigarettes (Burt & Li, 2020). The epidemic of electronic cigarette use, as declared by the US Surgeon General in 2018, is only growing (Burt & Li, 2020). Moving forward, healthcare professional should focus on screening for e-cigarette use, offering cessation resources to those who do use, and educating patients on the risks and safety issues of e-cigarette use.

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Appendices

Appendix A: Pre and Post Intervention Questions

Instructions: Please read each item below and select a number to indicate how strongly you agree or disagree with the statement. (1. Strongly Disagree, 2. Somewhat Disagree, 3. Neither Agree or Disagree, 4. Somewhat Agree, 5. Strongly Agree)

1. Electronic Cigarettes are safer than traditional cigarettes for young adults
2. Electronic Cigarettes are addictive in young adults
3. Electronic Cigarettes are an effective tool to quit using traditional cigarettes in young adults
4. Electronic Cigarettes are regulated by the FDA
5. Electronic Cigarettes can cause lung injury in young adults.

Appendix B: Risk and Benefit of E-Cigarette Use Tool

Instructions: Please read each item below then circle the number to the right to indicate how strongly you agree or disagree with the likelihood of the statement.

- 1. Totally disagree**
- 2. Moderately disagree**
- 3. Slightly disagree**
- 4. Neither agree or disagree**
- 5. Slightly agree**
- 6. Moderately agree**
- 7. Totally agree**

1. E-cigarettes can be used anywhere, even indoors. 1 2 3 4 5 6 7
2. Liquid cartridges for e-cigarettes contain nicotine. 1 2 3 4 5 6 7
3. Kids who use e-cigarettes are more likely to continue smoking. 1 2 3 4 5 6 7
4. Nicotine is addictive, regardless of whether ingested through e-cigarettes or regular cigarettes. 1 2 3 4 5 6 7
5. E-cigarettes are an effective way to quit smoking regular cigarettes. 1 2 3 4 5 6 7
6. E-cigarettes contain fewer chemicals than regular cigarettes. 1 2 3 4 5 6 7
7. Switching to e-cigarettes is better than smoking tobacco. 1 2 3 4 5 6 7
8. E-cigarettes are a good way to “beat” smoking bans. 1 2 3 4 5 6 7
9. E-cigarettes are less harmful than regular cigarettes. 1 2 3 4 5 6 7
10. “Vaping” (smoking e-cigarettes) can lead to smoking more regular cigarettes. 1 2 3 4 5 6 7

11. Children and pets can become seriously ill if they drink or touch e-cigarette fluid. 1 2 3 4 5 6 7
12. E-cigarettes are safe. It's tobacco—not nicotine—that makes regular cigarettes dangerous. 1 2 3 4 5 6 7
13. Compared to second-hand smoke from regular cigarettes, there are no known risks to second-hand vapor from e-cigarettes. 1 2 3 4 5 6 7
14. There are more effective ways to quit smoking than e-cigarettes. 1 2 3 4 5 6 7
15. E-cigarette users exhale only water vapor that contains no toxins. 1 2 3 4 5 6 7
16. Many local communities have started to ban the use of e-cigarettes wherever tobacco cigarettes are prohibited. 1 2 3 4 5 6 7
17. E-cigarettes are safe. 1 2 3 4 5 6 7
18. There is risk in inhaling the hot mix of chemicals (propylene glycol, glycerin, and nicotine) contained in e-cigarettes. 1 2 3 4 5 6 7
19. The lithium batteries used to power e-cigarettes can explode or overheat. 1 2 3 4 5 6 7
20. E-cigarettes do not have the same adverse effect as regular cigarettes after smoking (i.e., mouth and throat irritation, nausea headache and dry cough).
1 2 3 4 5 6 7
21. The FDA has not approved e-cigarettes as a quit device. 1 2 3 4 5 6 7
22. Kids who use e-cigarettes are more likely to quit smoking. 1 2 3 4 5 6 7
23. Dual use of regular cigarettes and e-cigarettes places the smoker/vapor at risk for heart problems, lung problems, and cancer 1 2 3 4 5 6 7
24. Kids who use e-cigarettes smoke less regular cigarettes. 1 2 3 4 5 6 7
25. E-cigarettes contain toxic chemicals. 1 2 3 4 5 6 7

26. E-cigarettes contain some of the same toxins as regular cigarettes, such as formaldehyde. 1 2
3 4 5 6 7
27. Many people who start vaping smoke cigarettes as well. 1 2 3 4 5 6 7
28. People can use e-cigarettes to quit smoking. 1 2 3 4 5 6 7
29. The nicotine in liquid cartridges for e-cigarettes is toxic to small children and pets. 1 2 3 4 5
6 7
30. E-cigarettes heat a mixture of propylene glycol, nicotine, and flavoring. 1 2 3 4 5 6 7

Appendix C: Penn State Electronic Cigarette Dependence Index

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

Scoring: 0-4 times/day = 0, 5-9 = 1, 10-14 = 2, 15-19 = 3, 20-29 = 4, 30+ = 5

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

Scoring: 0-5 mins = 5, 6-15 = 4, 16-30 = 3, 31-60 = 2, 61-120 = 1, 121+ = 0

3. Do you sometimes awaken at night to use your electronic cigarette?

Scoring: Yes = 1, No = 0

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

Scoring: 0-1 nights = 0, 2-3 nights = 1, 4+ nights = 2

5. Do you use an electronic cigarette now because it is really hard to quit?

Scoring: Yes = 1, No = 0

6. Do you ever have strong cravings to use an electronic cigarette?

Scoring: Yes = 1, No = 0

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

Scoring: None/Slight = 0, Moderate/Strong = 1, Very Strong/Extremely Strong = 2

8. Is it hard to keep from using an electronic cigarette in places where you are not supposed to?

Scoring: Yes = 1, No = 0

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?

Scoring: Yes = 1, No = 0

10. Did you feel nervous, restless or anxious because you couldn't use an electronic cigarette?

Scoring: Yes = 1, No = 0

Total Scoring: *0-3 = not dependent, 4-8 = low dependence, 9-12 = medium dependence, 13+ = high dependence*

Appendix D: Electronic Cigarette Dependence Scale

1. I find myself reaching for my e-cigarette without thinking about it
2. I drop everything to go out and buy e-cigarettes or e-juice
3. I vape more before going into a situation where vaping is not allowed
4. When I haven't been able to vape for a few hours, the craving gets intolerable
5. When I'm really craving an e-cigarette, it feels like I'm in the grip of some unknown force that I cannot control
6. I crave vaping at certain times of day
7. My urges to vape keep getting stronger if I don't vape
8. After not vaping for a while, I need to vape in order to avoid feeling any discomfort
9. My desire to vape seems overpowering
10. Cravings for an e-cigarette make it difficult for me to quit
11. It is hard to ignore urges to vape
12. When I go without vaping for a few hours, I experience craving
13. I frequently crave e-cigarettes/vaping
14. The idea of not vaping causes me stress
15. When I run out of e-cigarettes or e-juice, I find it almost unbearable
16. I get a real gnawing hunger for an e-cigarette when I haven't vaped in a while
17. I vape even when I am so ill that I am in bed most of the day
18. When I go too long without vaping, I feel impatient
19. It is hard for me to go without vaping for a whole day
20. When I go too long without vaping, I get strong urges that are hard to get rid of
21. Vaping is a large part of my daily life

22. I am tempted to vape when I realize I haven't vaped for a while

Appendix E. Cover Letter for Survey

To Whom It May Concern:

Researchers at the University of Kentucky are inviting you to take part in a survey and educational presentation about electronic cigarette use and perceptions in young adults. The purpose of this survey is to gather information about healthcare providers knowledge about electronic cigarette use and rate of screening for electronic cigarette use in young adults before and after the educational presentation. You are receiving this survey because you are a member of the American College of Health Association.

Although you may not get personal benefit from taking part in this research study, your responses may help us understand more about electronic cigarette use and perceptions and the effectiveness of the educational presentation. Some volunteers experience satisfaction from knowing they have contributed to research that may possibly benefit others in the future. If you do not want to be in the study, there are no other choices except not to take part in the study. Please delete this email if you choose not to participate.

The pre and post survey will take about 3 minutes to complete each. The educational presentation will take about 10 minutes to complete.

There are no known risks to participating in this study. Your response to the study is anonymous which means no names, IP addresses, email addresses, or any other identifiable information will be collected with the survey responses. We will not know which responses are yours if you choose to participate. Your information collected for this study will NOT be used or shared for future research studies.

We hope to receive completed surveys from about 300 people, so your answers are important to us. Of course, you have a choice about whether or not to complete the survey, but if you do participate, you are free to skip any questions or discontinue at any time. You will not be penalized in any way for skipping or discontinuing the survey. Please be aware, while we make every effort to safeguard your data once received from the online survey company, given the nature of online surveys, as with anything involving the Internet, we can never guarantee the confidentiality of the data while still on the survey company's servers, or while en route to either them or us. It is also possible the raw data collected for research purposes will be used for marketing or reporting purposes by the survey/data gathering company after the research is concluded, depending on the company's Terms of Service and Privacy policies.

If you have questions or complaints about the study, please contact the primary investigator Kayla Chelf at the contact information provided below. Thank you in advance for your assistance with this important project. To ensure your responses will be included, please submit your completed survey by January 31, 2023.

Sincerely, Kayla Chelf
College of Nursing, University of Kentucky
PHONE: 502-758-8779

E-MAIL: kemu227@uky.edu

Academic Advisor Dr. Julianne Ossege PhD, FNP-BC, FNAP, FAANP

College of Nursing, University of Kentucky

PHONE: 859-250-3239

EMAIL: julianne.ossege@uky.edu

If you have complaints, suggestions, or questions about your rights as a research volunteer, contact the staff in the University of Kentucky Office of Research Integrity at 859-257-9428 or toll-free at 1-866-400-9428.