Adolescent Vaping and Education: Does it Make a Difference?

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Table of Contents

List of Tables

Abstract

E-cigarette use and vaping has increased dramatically in the U.S. since 2011 among high school students and is a serious public health concern. Nicotine is an addictive substance and nicotine may harm teen brain development. Adolescents are vulnerable to nicotine addiction and often discount the addiction risks associated with vaping because teens believe water is being vaped. The purpose of this project was to assess current vaping practices and measure the effectiveness of an educational campaign about the potential risks of vaping among high schools students. Students in grades 9-12 from one Midwestern high school voluntarily participated in a pre- and post-survey quality improvement project. An education intervention was provided once a week over four consecutive weeks. Following the education campaign, the students completed a post-survey.

Independent *t*-tests were conducted on pre- and post-survey answers. Pre-survey sample included results from 411 students and post-survey results included 284 student responses. E-cigarette use and vaping was found in 33% of the sample population; 13% higher than the reported 2018 U.S. e-cigarette use. JUUL® was the device most frequently identified by brand name. Survey results were grouped into four constructs: knowledge, peer influence, health concern and willingness to use in the future. The constructs of knowledge, t (627) = -3.91, p=0.00, and health concern, t (578) = -2.71, p=0.00, resulted in statistically significant responses. Education increased student's knowledge about the risks associated with e-cigarette use and vaping. E-cigarette use and vaping is a public health concern positively influenced by educating adolescents.

Keywords: e-cigarettes, vaping, adolescents, education, teenagers

Adolescent Vaping and Education: Does it Make a Difference?

The dangers of tobacco use are well documented in the literature and most tobacco use is established during adolescence (U.S. Food and Drug Administration [FDA], 2018). E-cigarette use is a significant public health concern because unlike combustible tobacco products, such as conventional cigarettes, teenagers are uneducated about the risks associated with electronic cigarettes. Several terms are used interchangeably to describe electronic cigarettes including e-cigarettes, electronic nicotine delivery systems (ENDS), and vaporizers. A popular e-cigarette device among teenagers is referred to by the brand name, JUUL®. E-cigarette use among high schoolers increased 900 percent between 2011 and 2015 (U.S. Department of Health and Human Services, 2016).

E-cigarettes produce a vapor, hence the term "vaping" or "JUUL®ing" is used to describe the use of e-cigarettes. Vaping has escalated rapidly among the adolescent population. Vaping can cause exposure to nicotine and teenagers may not be aware of the potential exposure to addictive substances. One pod of e-liquid used with the JUUL® electronic device contains the same amount of nicotine that is found in one package of conventional cigarettes (JUUL Labs, Inc., n.d.) Unlike conventional cigarettes, newer vaping devices do not permeate the air with an odor and the vapor dissipates quickly making it difficult to detect if used in a classroom or high school.

Background

A rapid rise in vaping among middle and high school students poses a danger of exposure to potentially harmful constituents, including nicotine which can harm the adolescent brain (U.S. Department of Health and Human Services, 2016). On a national

level, one in five high school students used a tobacco product in 2017 and e-cigarettes were the most commonly used tobacco product among middle and high school students (U.S. Food and Drug Administration, 2018). Nebraska's Youth Tobacco survey conducted in 2017 reported a 7% increase in e-cigarette use in a two-year period between 2015 and 2017 (Nebraska Department of Health and Human Services [DHHS], 2017).

Vaping requires an electronic device to heat oils, liquids, cannabis or other plant materials to a certain temperature causing vaporization of active ingredients such as nicotine, and flavored liquids (Douglass & Solecki, 2017). Nicotine causes increases in blood pressure, heart rate, and vasoconstricts arteries and vessels; nicotine is a highly addictive substance and addiction to nicotine can cause behavioral, memory, inattention, and cognitive impairments (Douglass & Solecki, 2017). Vaping could potentially lead to performance issues in school and a fall in grades. A study of teenage e-cigarette users found those with higher levels of nicotine at baseline concentrations were associated with progression to cigarettes (Goldenson, Leventhal, Stone, McConnell & Barrington-Trimis, 2017).

Experimentation was the most common reason for vaping reported by 53% of adolescents who had ever used an electronic cigarette, followed by taste, boredom, having a good time, and relaxation (Patrick et al., 2016). Additionally, Douglass and Solecki (2017) reported that more than half of the students indicated they vaped out of curiosity and more than 60% reported they were vaping flavors and didn't realize the e-cigarettes they were using contained nicotine. The vapor from e-cigarettes and vaping devices is not harmless and users can be exposed to several chemicals leading to adverse health effects (U.S. Department of Health and Human Services, 2016).

Problem Statement

Studies reveal teenagers begin vaping because of curiosity or experimentation and are often unaware of the potential harm of vaping (Douglass & Solecki, 2017). Suppliers of vaping devices utilize effective marketing tactics that appeal to the adolescent population. Efforts to decrease the incidence of tobacco use among adolescents may be compromised due to the significant rise in e-cigarette use. Educating students is essential to draw awareness of the negative consequences of vaping, inadvertent exposure to nicotine, and potential progression to cigarette use. How does implementation of an educational campaign about vaping in high school students impact knowledge and use of vaping devices 30 days' post campaign?

Purpose Statement

The purpose of this project was to assess current vaping practices and measure the effectiveness of an educational campaign about the potential risks of vaping among high school students.

Outcomes

Outcomes associated to this project were related to teenager's knowledge and perceived risks about e-cigarettes and vaping. Specific outcomes were aimed at improved student knowledge of health risks and side effects related to vaping. Additionally, decreased student use of vaping devices 30 days post educational campaign was measured.

Review of Literature

Search Methods

An initial literature review using the search terms "vape*", "JUUL®*", "e-

cigarettes", "electronic nicotine", "education", "education program", "education campaign", and "adolescents" using three databases, CINAHL Complete, Medline Complete and Health Source Consumer Edition was completed. The Boolean search strategy was used to identify potential studies for use in this capstone project (see Appendix A). The literature search was limited to studies from 2008-2018, and included vaping with teenagers and adults as inclusion criteria. Adults was added due to the relatively new introduction of e-cigarettes and vaping in society. The search resulted in one article about the impact of vaping among mental health patients and was not applicable to the topic.

A second literature review was conducted using the same search terms and databases, and expanded to include the following databases: Academic Search Elite, Health Business Elite, Psychology and Behavioral Sciences Collection, Rehabilitation and Sports Medicine Source, AHFS Consumer Medication Information, Chochrane Clinical Answers, Chochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, GreenFILE, EBSCOhost and Library, Information Science & Technology Abstracts. Using the search procedure, a total of 854 articles about vaping and education resulted. The Boolean search strategy for applicable articles between 2008-2018 resulted in 131 articles. Exclusion criteria included adults, e-cigarette use for smoking cessation, and references to social media promoting e-cigarette use. Inclusion criteria included teenagers, adolescents, perceptions and attitudes of e-cigarettes use.

Further review of applicability to the project resulted in thirteen Level III articles published in 2016-2018 used for the capstone project. The John Hopkins Nursing Evidence-based Practice Model was used to determine the level of evidence (Baker,

2008). Research articles published in 2016-2018 were used for the literature review and included qualitative, systematic reviews and non-experimental studies. Several of the analyses were derived from larger, national studies sponsored by governmental agencies.

The websites for the Centers for Disease Control and Prevention (CDC) and the U.S. Department of Health and Human Services (U.S. DHHS) were also searched for current reports and studies related to teenage vaping (CDC, 2018; U.S. DHHS, 2016). Information about e-cigarettes was found within several studies about teenage tobacco use at both the national and state level. (Nebraska DHHS, 2017; U.S. DHHS, 2016). The 2016 Surgeon General's Report on e-cigarette use and the 2017 Nebraska Youth Tobacco Survey Report were used to highlight statistical data and trends. (Nebraska DHHS, 2017; U.S. FDA, 2018). A total of thirteen, Level III research articles and two government reports were used for this capstone project (see Appendix B).

Themes in Literature

Themes derived from the literature review that were applicable to the project included nicotine exposure, perceptions of e-cigarettes, and peer influence. Teenagers are easily influenced by their peer group and make uninformed decisions to begin vaping. Teenagers misperceive the harmful effects of vaping and exposure to nicotine. The need to educate teenagers regarding all aspects of e-cigarettes and vaping is necessary.

Nicotine. Several reports and studies explored the addictive effects of nicotine (CDC, 2018; U.S. DHHS, 2016). Nicotine addiction is intense and can harm brain development and the brain continues to develop until the age of twenty-five (CDC, 2018). The 2016 Surgeon General's report noted the potential for widespread nicotine exposure due to the increase in e-cigarette use, resulting in nicotine addiction. (U.S.

DHHS, 2016). The report noted youth are vulnerable to nicotine addiction and the potential for reduced impulse control, deficits in attention, cognition, and mood disorders. (U.S. DHHS, 2016). A study by Rohde et al. (2018) examined adolescent's knowledge and belief about e-cigarettes and found teenagers who had used e-cigarettes were more likely to discount addiction risks associated with vaping.

Nicotine is an addictive substance and adolescents who are exposed to nicotine may experience behaviors that can interfere with school, social and family activities. Each JUUL® pod, the cartridge that contains the flavored solution, contains the same amount of nicotine found in one package of cigarettes; another product contains nicotine equivalent to two packages of cigarettes (Gibson-Young & Martinasek, 2018).

Adolescents may dismiss the risks associated with vaping; however, one study documented the link between e-cigarette use and intention to smoke conventional cigarettes (Park, Dong-Chul, & Hsein-Chang, 2016). Willis et al. (2017) studied high school students and found teens who used e-cigarettes were more likely to start smoking conventional cigarettes. Several hypotheses for the transition were suggested: inhaling and exhaling the aerosol from vaping produces the same sensory experience, the look and feel of devices, and addiction to nicotine from exposure (Willis et al., 2017). Nicotine may sensitize teenagers to its effects and may lead teens to shift to conventional cigarettes to experience a higher hit of nicotine (Willis et.al, 2017).

Perceptions of e-cigarettes. Several studies have researched adolescent perceptions of e-cigarette use (Kowitt et al., 2017; Johnson, Mays, Hawkins, Denzel, &Tercyak, 2017; Zare, Nemati & Zheng, 2018). A qualitative study of adolescents age 12-17 found 72% of participants perceived e-cigarettes as a healthier option than

conventional cigarettes (Johnson et al., 2017). A systematic review completed by Zare et al. (2018) examined consumer preference for the main attributes of e-cigarettes and concluded adolescents consider flavor the most important reason for initiating vaping. Another systematic review found adolescents and young adults positively perceive flavored tobacco products and believe flavored tobacco products are less harmful than cigarettes (Kowitt et al., 2017).

A study by Allen et al. (2016) examined the vapor from 51 different flavored e-cigarette products and found 92% of the sampled flavors contained additional chemicals. The study included testing for diacetyl, a flavoring compound that has been associated with a severe respiratory disease called bronchiolitis obliterans (Allen et al., 2016). The study found diacetyl in 76% of the flavors sampled (Allen et al., 2016).

Marketers of e-cigarettes also play a role in teenage perception of their products. A small qualitative study of 12-17 years olds found more than half of participants believe sleek designs, flavors, and bright colors appeal to the teenage demographic (Johnson et al., 2017). Popular vaping devices, such as the JUUL®, produce a very small vapor cloud and can be used discreetly, a popular feature among adolescents. Contributing to the perception that e-cigarettes are less harmful than conventional cigarettes is both users and non-users of e-cigarettes believe only flavored water is vaped (Case, Crook, Lazard & Mackert, 2016). Adolescents prefer flavored products and assume e-cigarettes are less harmful than conventional cigarettes because they believe there are no chemicals in the products they vape. Misperceptions of health risks related to vaping clearly indicate the need for education among the teenage population.

Peer Influence & Education. Teenage use of vaping can also be influenced by

peer groups (Martinasek, Bowersock, & Weldon, 2018; McKeganey & Barnard, 2018). A qualitative study of 989 university students found peer influence, and the curiosity to try something new, as the most common reason for initiating the use of an electronic nicotine device (Martinasek et al., 2018). A small qualitative study examined the use of e-cigarettes over a six-month period and recognized peer groups can be an important positive and negative determinant (McKeganey & Barnard, 2018).

Key strategies for health education campaigns are to debunk the myth "vaping only exposes individuals to flavored water", which decreases the perceived risks of e-cigarettes (Case et al., 2016). The use of peer groups to influence adolescent knowledge and health education about the risks of vaping may deter students from vaping (McKegany & Barnard, 2018). Case et al. (2016) note cost, social stigma, and the potential for addiction as important themes for education campaigns related to e-cigarettes for both users and non-users of e-cigarettes. Additionally, acknowledging that e-cigarettes are marketed as a healthier option than conventional cigarettes. However, e-cigarettes still contain additives and chemicals is also an important message to deliver when providing education (Case et al., 2016).

Adolescent e-cigarette use and vaping are on the rise. The literature review supports the need for education among adolescents about nicotine addiction. The perceived belief that e-cigarettes are less harmful than conventional cigarettes and teenagers are only vaping flavored water contributes to the need for education. Peer influence can also deter vaping and may be an important strategy when developing an education program.

Theoretical Framework

The goal of Evidence Based Practice (EBP) is to translate research into clinical practice by improving outcomes. An education program about the risks of vaping for teenagers may impact long-term health outcomes. The National Association of School Nurses (NASN) published the conceptual framework for school nurses in 2016 (National Association of School Nurses, 2015). NASN's Framework for 21st Century School Nursing Practice provided the framework for this project (see Appendix C). At the center of the model is the health and safety of the student and involves five key principles that require a collaborative approach to health (NASN, 2015). The five principles include leadership, quality improvement, public health, care coordination and standards of practice (NASN, 2015).

Specific to the topic of adolescent vaping, the principle of community/public health involves health education, health promotion, risk reduction, and disease prevention. Educating the student about the risks of e-cigarettes and vaping fits within this principle. Following completion of the project, the school nurse can continue to reinforce the risks of e-cigarettes and vaping.

Organizational Assessment

Students attending high school are at risk for e-cigarette use and vaping experimentation, therefore a high school was selected and assessed as the project site. An electronic message was sent to the principal at a Midwestern high school inquiring about interest in conducting a project about teenage electronic cigarette use and vaping education. The principal responded immediately to the email and expressed interest in the project and agreed to meet with the project coordinator. The high school is located in a

district that consists of 300 square miles within four counties. Five-hundred and ninety students were enrolled in grades 9-12 during the 2016-2017 school year, and 5% of the students were minorities.

The project concept was introduced in the first semester of the academic year, with the project, including surveys and educational campaign occurring in the second semester of the academic year. This allowed several weeks of preparation, and the ability to work collaboratively with school administration to answer questions prior to project implementation.

The principal requested all students in grade 9-12 participate in the project. Project approval was gained from the principal and no institutional review board review was required from the rural high school. The immediate email response, in-person meeting, and the interest to involve all high-school students in this project, indicated the school was supportive of the project. The principal suggested an education program that would hold the attention of the adolescent population. As a result, an extensive review of existing programs about electronic cigarettes and vaping was conducted.

The potential negative image of the high school due to e-cigarette use by students could have been a possible barrier to participation by high school administrators. School administrators were interested in educating their students about e-cigarettes and vaping and placed the students' needs before the reputation of the school. Another barrier could have been the need to obtain parental consent for student's completing the questionnaires affecting the sample size. To address this barrier, an opt-out consent was utilized to maintain the sample size. The principal noted if the project would have required parental consent, approximately 65% of the students would have participated.

Schools must become informed and embrace the challenge of vaping among students. Facilitators for this project included school administration, parents and teachers. The high school setting provided an opportunity to educate teenagers about the risks of e-cigarette use and vaping. Students gained knowledge about e-cigarettes and vaping through participation in this project. No identifiable risks or unintended consequences resulted from participating in this project.

Methodology

This project focused on adolescents enrolled in grades 9-12. This project explored current adolescent knowledge related to e-cigarette use and vaping before and after an educational campaign. The project was designed to inform and educate adolescents about e-cigarette use and vaping therefore, is was a quality improvement project.

Quantitative data was analyzed from a pre-and post-survey administered to high school students. The pre-test survey was delivered before an educational campaign about vaping and the post-test survey was completed 30 days post campaign. The classroom setting was used to provide education and obtain data about current vaping knowledge and use among teenagers.

Setting

The setting for this project was a rural, Midwestern high school. Collaboration and communication between the project coordinator and high school administration determined the best method for student participation in the project. Enlisting teacher support for the project was instrumental in gaining access to the students. Every student in the high school spent the fifth period of the day in an advisory class for 30 minutes. The same teacher was the advisor to approximately 18-22 students throughout the school

year. The surveys and educational video were shown to students during their advisory classroom period. All students in the advisory classroom period had access to a computer to complete the project survey and a paper survey was also available.

Sampling

Male and female students between the ages of 13-19 in grades 9-12 from one rural Midwestern high school were asked to voluntarily participate in the project. All students received the education, but only those students who volunteered to complete the surveys were included in the sample population.

Implementation Procedures

During a two-week period during the second semester, an information letter for the project was emailed to all parents and legal guardians of students in grades 9-12 by school administration via an email list serv. If parents or legal guardians determined they did not want their child to participate in the project after they read the informational letter, they could opt out their child from the project by signing the letter. The child was responsible for returning the signed letter to their class advisor. Each advisory teacher maintained a list of students whose parents or legal guardian opted-out of the project.

After the informational letters were sent to the parents, a letter explaining the project was delivered to students whose parents or legal guardian did not opt out of the project. Students provided assent for the project by completing the online survey. As students logged onto the survey, a statement appeared indicating students were providing assent for the project by completing the survey. The email link to the survey was only made available after students received the informational letter explaining the project.

Teachers in the advisory classroom determined which students opted out of the survey and did not email the link for the survey to those students. If a computer was not available, students had the option to complete a paper and pencil survey. Students provided assent by completing the paper and pencil survey. The forms were maintained in the front office and the project coordinator collected the forms at the end of the project. The project coordinator maintained the forms in a locked filing cabinet and destroyed the forms after the data was collected and entered into the electronic survey.

A week after the surveys were collected, an educational campaign about teenage e-cigarettes and vaping was presented to all students during the advisory class period. The education consisted of four short videos. One educational video was shown each week during the campaign. Students were exposed to the education campaign, even if they did not participate in completing a survey. The education videos were offered to all advisory classes during the same four-week time span during the second semester. Thirty days following the beginning of the project, the survey was administered a second time to the students who completed the first survey and watched the education videos.

Data Collection Procedures

An online survey tool was used to collect the data. The initial survey was provided to the students via an electronic survey link. All surveys were completed during the advisory class period. Survey Monkey®, a survey tool was used to create a web-based survey. The survey was beta tested prior to delivery to the students for ease of use, understandability, and function of the online survey tool. Each student created a unique four-character identification code based on four questions unique to each student. This code was created at the beginning of the pre-and post-survey and remained constant for

each student. The code was used to match pre- and post-survey responses. Teachers provided an electronic survey link only to those students whose parents did not opt their student out of the project.

A paper and pencil version of the survey was also available for students who did not want to use a computer to complete the survey. For students using the paper and pencil survey, they were instructed not to place their name on the paper survey form. The teacher was instructed to collect the paper surveys and place them into a designated envelope that was sealed with no identifiers on it. The envelope was delivered to the front office at the end of the advisory class period. The surveys were maintained in a locked room in the front office, where the school administrative offices are located. The project coordinator collected the surveys at the end of the week. The completed paper surveys were maintained in a locked filing cabinet by the project coordinator.

Thirty days following the beginning of the project, the survey was administered a second time to students who completed the first survey and watched the educational videos. The same procedure for completing the second survey was used. No paper surveys were completed during the post-survey period. Student knowledge level about e-cigarettes was analyzed before and after the education campaign. Differences among students who vape and those who have not vaped were analyzed.

Intervention Description

A video presentation provided education about e-cigarette use and vaping in the adolescent population. The principal requested an electronic format for the educational information, noting the importance of keeping the students engaged in the presentation and consistent information delivered to several different classrooms. An animated

educational video presentation about the risks of electronic cigarettes and vaping was produced by a group of cardiologists at the University of California Los Angeles (UCLA) and approval was given to utilize the video for this project. Additionally, the Truth Initiative® gave approval to utilize their materials which are targeted specifically for the adolescent population. School administration requested a variety of videos that appealed to the teenage population and kept them engaged. Two additional videos found on YouTube were utilized for this project.

The content of the videos included definitions of e-cigarettes and vaping and included data about current use among adolescents. Additionally, information about the type of e-cigarettes currently available on the market, attractive features and functions of different devices was covered. The majority of the presentations included information about the risks of vaping and included information about the addictive property of nicotine, exposure of chemicals and propensity toward tobacco use in the future.

Measurement Instrument

To measure the outcomes of this project, the Adolescent E-cigarette Pilot Study Survey was used (Rohde et al., 2018). The survey was developed and used in a pilot study about the knowledge and risk beliefs of adolescents on the use of e-cigarettes. The original survey was delivered electronically. Approval to use the survey tool for this project was provided by the survey developer,

Strengths of the survey tool included the breadth of information gathered related to the PICO question. The survey asked general knowledge questions about e-cigarettes and vaping and questions about e-cigarette susceptibility, e-cigarette intention, and e-cigarette expectations. The survey instrument had been used to gather data in two

previously published studies related to adolescent e-cigarette use (Noar et al., 2019; Rohde et al., 2018).

Reliability of the tool had been demonstrated in the consistency of the outcomes across studies. The study performed by Rohde et al. (2018) referenced three studies that found similar results, further supporting the reliability and validity of the survey tool. The risk beliefs section of the survey tool resulted in a coefficient alpha greater than 0.80; thereby indicating good internal consistency. A study by Noar et al. (2019) adapted portions of the survey related to dangers and harmful effects of e-cigarettes and willingness to use e-cigarettes. Alpha coefficients for both pretest and posttest resulted in results greater than 0.80 supporting the reliability and validity of the tool.

Ethical Considerations/Protection of Human Subjects

The Nebraska Methodist College Institutional Review Board (IRB) determined the project classification as a Quality Improvement Project. Parents and students were informed of the educational plan and surveys through a letter. All student surveys were anonymous. A unique identification code was assigned to students completing the surveys, so data from pre- and post-survey could be analyzed for statistical significance. No personal information was collected during the survey process. Electronic data will be analyzed and maintained using password protected computer programs and systems. After three years, all paper material for the project will be shredded and computer files will be deleted.

Data Analysis

Data for this project was obtained through an online survey platform, Survey Monkey®. Data was organized and analyzed using software programs including Excel

and Statistical Package for the Social Science (SPSS). Collaboration with a statistician determined that inferential statistics would be used for this project. Pre- and post-survey questions were analyzed and independent *t*-tests were used to determine effectiveness of education related to adolescent vaping, using $p < .05$ as the criterion for statistical significance.

Six-hundred students in grades 9-12 from a Midwestern high-school were invited to participate in the project. Two parental opt-out letters were signed, and those students were excluded from completing the pre-and post-education survey. A total of 471 pre-surveys and 303 post-surveys were completed. If students indicated their answers were untruthful when asked the honesty question at the end of the survey, the survey data was excluded from analysis. Results included 411 pre-surveys and 284 post-surveys for analysis. Students were instructed that they did not have to answer any question they were uncomfortable answering, resulting in variable participant numbers for each question.

Results

Demographic Pre-Survey Data

There were 399 students who provided a response to the question: "What grade are you in?" Responses included 80 (20%) Seniors, 94 (24%) Juniors, 88 (22%) Sophomores, and 136 (34%) Freshman. Students in all grade levels responded to the survey, the highest response rate was from students in the 9th grade (34%) and the lowest response rate was from students in the 12th grade (20%). A total of 398 students responded to the question: "What is your gender?" The response options were Male or Female. Responses included 205 (51.5%) females and 193(48.5%) males (see Table 1).

Table 1

Demographic Data

	Pre-Survey Group *n*=398			Post-Survey Group *n*=284		
	M	F	Total	M	F	Total
Freshmen	70	66	136	48	49	97
Sophomore	40	48	88	40	38	78
Junior	49	45	94	35	33	68
Senior	34	46	80	21	19	41

Pre-Survey Use of e-cigarettes or vaping devices

The pre-survey assessed use of e-cigarettes or vaping devices by asking, "How many times have you used an e-cigarette or vaping device in your lifetime?" The response options were: never, once, 2-5 times, 6-10 times, 11-20 times, 21-30 times, 31-40 times, 41-50 times or 51 or more times. A total of 406 students responded to the question, 66% (273) students responded never and 33% (133) students indicated they had vaped one or more times. Additionally, 13% (52) students indicated they had vaped greater than 51 times.

When students were asked: "What is the vaping device used most often in the past 30 days?" Students were asked to fill in the blank, 70.5% of students did not respond or answered not applicable to the question. Eighty-eight (21%) students identified the vaping device by brand name, including 34 students identifying JUUL® by the brand name, followed by Suorin (17), NOVO SMOK® (13), and Aspire Breeze (6). Additionally, 33 (8%) of students responded with a name they had given their device; e.g.

"White Dragon" "Juliette", "Julius Caesar", "Fog Machine", "Big Hoss" and "My Nicotine Stick".

Students were asked what flavor they used most often with their e-cigarette or vaping device in the past 30 days. One hundred students (24%) responded to the question. Fruit flavored (36%), followed by menthol (15%), and candy (14%) were the most popular responses.

When asked "On the days you used your device, how many times per day did you use it?" Answer options included not applicable, 1 time, 1-5, 6-10, 11-15, 16-20, and >25 times. A total of 384 students responded to the question, 292 (76%) of students replied not applicable, 27 (7%) answered one time and 66 (17%) of students answered anywhere from 1 to >25 times per day. Students were also asked: "On the days you used your device, how many puffs did you take?" Answer options included not applicable, 1 puff, 2-5, 6-10, 11-20, 21-30, 31-40, 41-50 and 51 or more puffs. A total of 384 students responded to the question, 293 (76%) responded not applicable, 18 (5%) answered one puff and 91 (24%) responded 2-51 puffs or more per day.

Students were asked about the type of device they used: "What type of device did you use the most often in the past 30 days?" Response options included not applicable, one you recharge, one you throw away and other. A total of 393 students responded, 302 (77%) of students responded not applicable, 82 (21%) indicated one you recharge and a total of nine (2%) students responded other or one you throw away. Students were asked: "Please think about the e-cigarette or vaping device you use most often, does the device or e-liquid contain nicotine?". A total of 398 students responded to the question, 278

(70%) responded not applicable, 17 (4%) responded don't know, 22 (6%) answered no and 81 (20%) answered yes.

Tobacco Products

Students were asked: "Which of the following tobacco products have you used in your lifetime?" Answers included cigarette, hookah, little cigars, traditional cigars, chewing tobacco, moist or dry snuff, snus, pipe tobacco, other, or none. A total of 391 students responded to the question, 331 (85%) answered none and 60 (15%) identified another form of tobacco listed. Of the 60 students who provided an answer, chewing tobacco (38), traditional cigars (35), and cigarettes (30) were the most frequently selected tobacco products.

Demographic Post-Survey Data

There were 284 students who provided a response to the question: "What grade are you in?" Responses included 41 (14%) Seniors, 68 (24%) Juniors, 78 (28%) Sophomores, and 97 (34%) Freshman. Students in all grade levels responded to the survey, the highest response rate was from students in the 9th grade (34%) and the lowest response rate was from students in the 12th grade (14%), consistent with the pre-survey response rate. A total of 284 students responded to the question: "What is your gender?" The response options were Male or Female. Responses included 139 (49%) females and 144 (51%) males (see Table 1).

Students were asked: "How many e-cigarette and vaping educational videos did you watch in the past 30 days?" Response options included 4 or more, 3, 2, 1, or 0. A total of 284 students responded, with 161 (57%) 4 or more, 60 (21%) 3, 26 (9%) 2, 17

(6%), and 0 (7%). More than 75% of the student population watched at least three educational videos about e-cigarettes and vaping in the previous 30 days.

Adolescent E-cigarette Pilot Study Survey Results

Survey answers were categorized into four constructs for data analysis; knowledge, peer influence, health concern and willingness to use in the future. Several answer options were available to students. All answers were dichotomized into correct or incorrect answers and analyzed as independent groups. Responses were summed for all questions, which created mean scores for the pre-survey group and the post-survey group. Pre- and post-survey questions were analyzed with independent *t*-tests to determine effectiveness of education related to adolescent vaping, using $p < .05$ as the criterion for statistical significance (see Table 2).

Table 2

Results of Independent t-tests

Construct	Pre-Group *M*	(SD)	*n*	Post-Group *M*	(SD)	*n*	*t*	*df*	*p*-value
Knowledge	6.42	(2.79)	380	7.23	(2.50)	284	-3.91	627	**0.00**
Peer Influence	4.18	(2.13)	392	4.08	(2.19)	279	0.55	588	0.58
Health Concern	4.34	(2.70)	394	4.93	(2.83)	278	-2.71	578	**0.00**
Willingness	5.01	(2.87)	403	5.17	(2.75)	284	-0.74	624	0.45
30 Day Use	1.49	(1.19)	396	1.53	(1.23)	264	-0.40	546	0.68

Note. Sample size varied for each construct or question, students were told they could skip any question they did not want to answer. *p*-values in bold are significant.

Knowledge. A total of ten questions were analyzed for knowledge and contained questions such as: "E-cigarettes and vaping devices usually contain nicotine, an addictive chemical; may harm teen brain development; are not risk free; have unknown long-term

health effects and use liquid that contain harmful chemicals." Answers available included true, false and don't know. All true answers were dichotomized into one (correct) option for analysis and false and don't know answers were dichotomized into a second option (incorrect). The pre-survey mean was 6.42 and the post-survey group mean was 7.23, indicating students answered more questions correctly following the educational sessions. The results were statistically significant, t (627) =-3.91, p=0.00.

Peer Influence. Peer influence was analyzed through six questions and was assessed by asking the following type of questions: "Do you think that if one of your best friends were to offer you an e-cigarette or other vaping device you would use it?" or, "Suppose you are with a group of friends and there were some e-cigarette or vaping devices if you wanted. How willing would you be to use one for a while; take one puff; take one and try later?" Options for answering these questions included not at all willing, a little willing, somewhat willing, very willing or extremely willing. Answers were dichotomized into two options where not at all willing was the correct option and all other answers fell into the incorrect category. The pre-survey mean was 4.18 and the post survey mean was 4.08. No statistically significant difference was found between the pre- and post-surveys, t (588) = 0.55, p=0.58.

Health Concerns. Nine questions assessed student's health concerns related to e-cigarette use and vaping. Students were asked: "In the past week, how much have you thought about the dangers, addictiveness or harmful effects of using e-cigarettes and vaping devices?" Answer options included not at all, a little bit, somewhat, quite a bit and very much. Answers were dichotomized into two options where not at all was the incorrect answer and all other answers were considered correct. Additionally, students

were asked: “If you were to use an e-cigarette or vaping device, I would worry about my health, be concerned about the risks, harm my lungs, damage my brain and wonder what I was inhaling?” Answer options included definitely wouldn’t, probably wouldn’t, not sure, probably would and definitely would. Answers were dichotomized into two options where definitely wouldn’t was the incorrect answer and all other answers were considered correct. The pre-survey mean was 4.34 and the post survey mean was 4.93. The results were statistically significant, t (578) = -2.71, p=0.00.

Willingness. Willingness to use e-cigarettes or vaping devices in the future was analyzed by students answering three questions: “Do you think that you will use and e-cigarette or other vaping device soon; you will use an e-cigarette or other vaping device in the next year; or in the future you might experiment with e-cigarettes or other vaping devices?” Answer options included definitely no, probably no, probably yes and definitely yes. Definitely no answers were analyzed as correct and all other responses were analyzed as incorrect. The pre-survey mean was 5.01 and the post survey mean was 5.17. No statistically significant difference was found in students willingness to use e-cigarettes or vape as a result of the education, t (624) = -0.74, p=0.45.

Use in past 30 days. A question was asked about e-cigarette or vaping use. Students responded to the question: “In the past 30 days, how many days did you use an e-cigarette or vaping device?” A 5-point Likert scale was used to represent 0 days, 1-7 days, 8-14 days, 15-21 days and 22-30 days. A sum score for all answers resulted in the mean scores for the pre-survey group and the post-survey group. The pre-survey mean was 1.49 and the post survey mean was 1.53, results were not statistically significant

between the two groups, t (546) =-0.40, p=0.68. Students use of e-cigarettes and vaping devices did not change as a result of the education provided.

Data was measured to determine if differences existed between gender and grade level as it relates to the education provided for the constructs of knowledge, peer influence, health concern, willingness to use in the future, and use in the past 30 days. Analysis resulted in no consistent or meaningful differences between groups.

Discussion

Nearly 79% of the student population in grades 9-12 completed the pre-survey questionnaire. Approximately 10% of the questionnaires were not included in the data analysis because students were asked if they were truthful when completing the questionnaire and if they indicated they were not truthful, the questionnaire was not included in the final analysis. More freshmen completed the pre-survey (34%) when compared to their upper-class counterparts. Slightly more females (51.5%) completed the pre-survey than males.

Importantly, it should be noted that students were told they could skip any question they did not want to answer. Did students skip questions because they didn't want to reveal truthful answers, or did they skip answers because they felt the question didn't pertain to them? Answers to these questions may never be known, but the data gleaned interesting findings.

If a student has used an e-cigarette or vaping device even one time, it is considered ever-use. In this survey, 33% of respondents indicated they had vaped one or more times; therefore, one third of the study sample are ever-users. Additional related questions of how many times per day have you used an e-cigarette and how many puffs

did you take in a day, found 24% of students used one or more times per day and 29% of students took one or more puffs per day.

JUUL® was the most identified vaping device in this survey. Identified by its brand name by 34 students. Additionally, 33 students offered the personal name of their vaping device including “Juliette” and “Julius Caesar”, which one could infer also represents JUUL® products.

The most popular flavor of e-liquid was fruit followed by menthol and candy. Fruit flavors are seen as enticing to adolescents and often lead uneducated youth into a false sense of security to experiment with vaping devices. Nicotine is highly addictive and when ever-users were asked if e-liquid contained nicotine, 39 students did not know the correct answer.

Sixty students responded to the question about tobacco products and only 30 students indicated they had ever tried a cigarette, compared to 133 students who indicated they had ever used a vaping device. Vaping use is more than fourfold higher than cigarette use in this survey population.

Fewer students completed the post-survey, 284 usable post surveys were received, representing approximately 47% of the student population. Similar to the pre-survey population, more freshmen completed the post-survey (34%), yet unlike the pre-survey more males (51%) completed the post-survey.

Once a week for four weeks, an educational video about e-cigarettes and vaping was shown during a class period. The videos were selected based on the educational content, ability to keep the student’s attention and entertainment factor. More than 75%

of the students completing the post-survey indicated they had watched an educational video about e-cigarettes and vaping at least 3 or more times during the course of 30 days.

The results support the positive impact of education on the student's knowledge related to e-cigarettes and vaping. Students answered more questions correctly on the post-survey related to the impact of nicotine on brain development, risks and long-term health effects. These results are encouraging, increasing student's knowledge related to the effects of nicotine and the harmful effects nicotine are powerful. Student's increased their awareness about e-liquid, nicotine, long-term health effects and the risks of e-cigarette use and vaping.

While peer influence was not found to be statistically significant, the role of peer influence in adolescent behavior is readily understood. The skyrocketing increase in e-cigarette use and the belief that vaping is safe, has been attributed to peer pressure. The results in this study are encouraging and may be representative of a new way of thinking for the Generation Z students. Are generation Z individuals more self-assured and not as prone to peer pressure?

Increasing the student's awareness and knowledge about health concerns as it relates to e-cigarettes and vaping is another positive finding from this project. Finding significant results in both the knowledge and health concern constructs are complementary of education influencing adolescent's insight into the dangers and risks of e-cigarettes and vaping.

Although the willingness to use in the future was not found to be significant, the questions may not have adequately assessed the theme. Students who currently use an e-cigarette or vaping device, did not decrease their use over a 30-day period because of the

education provided. Students currently vaping are likely to be reticent to any educational influence and a 30-day period of time is a short window of time to see any appreciable change in behavior.

Limitations

The goal of the data analysis for the project was to match paired pre-and post-survey answers and conduct dependent *t*-tests to measure the effectiveness of the education. Students were asked to create a unique four-letter identification code known only to the student prior to completing the pre-and post-surveys. Initial analysis of the data resulted in less than 100 paired matches between the pre- and post-surveys, despite nearly 400 pre-surveys and 300 post-surveys.

Several factors may have influenced the ability to match pre-and post-surveys. The entire student population of grades 9-12 consisted of over 600 students. Completing the survey was not required. Approximately one hundred fewer students completed the post-survey than the pre-survey. The project began in January 2019 and it was an especially harsh winter with several missed school days due to ice, snow, and blizzard conditions in the Midwest. Additionally, flu season was at an all-time high in the Midwest and students may have missed school due to illness during the project period. Students who completed the pre-education survey, may have missed school on the day the post-survey was administered to their class. Conversely, students may have completed the post-survey after participating in education about e-cigarette use and vaping and may not have completed a pre-survey. Finally, the use of a four-question code may have caused confusion for the student to accurately and completely answer the questions or students may have well-known what they were doing and purposefully

sabotaged their entries so matching the surveys would be impossible. In fact, a few students wrote in the name of the principal, used names of classmates or used emoji's which resulted in the survey being thrown out.

After thoughtful discussion with the statistician and input from faculty, a decision was made to analyze the pre-survey and post-survey results independently, using a larger data set and using independent *t*-test for data analysis. The larger sample size in each group was more representative of the entire student population and the larger data set increased the statistical rigor of the project.

This project was conducted in one Midwestern High School with very little diversity among students. To achieve a more representative sample of e-cigarette use and vaping among high school students, a larger urban sample across many schools with a more diverse student population is required.

Only high school students were included in this project. Expanding the project to include middle-school students and compare the differences between high school and middle school populations is important. Education specific to e-cigarettes and vaping provided at an earlier age may result in decreased vaping as a high-school student.

Plans for Sustainability

The curriculum for all freshman, where the project was conducted, includes a health class. The education about e-cigarette use and vaping could be incorporated into the freshman health class curriculum and expanded to junior high students if school administration deemed the subject matter appropriate. The health teachers and school nurses were given a list of resources available from state and federal agencies. Resources from those agencies include both electronic and print materials, therefore, access to the

most current research as it relates to e-cigarettes and vaping is always available. These materials could be used to supplement the education videos if the school wished to incorporate print materials.

Implications for Practice

The implications for practice are related to the importance of education about the risks associated with e-cigarette use and vaping in the teenage population. Findings of this project included statistically significant results in adolescent's knowledge and health concerns related to e-cigarettes and vaping. This project supported the use of education to increase student's knowledge regarding the public health concern of e-cigarettes and vaping among adolescents. Findings of this project may influence healthcare providers, school administration, school nurses and teachers about the impact of providing health education to address the public health concern of e-cigarette use and vaping among today's adolescent population.

Conclusion

E-cigarette use and vaping is on the rise in the teenage population. Experimentation is common in the adolescent population and adolsecents are subjected to peer influence in the school setting. Teenagers may choose to vaping because of peer-pressure and may not realize the risks associated with the use of e-cigarettes. The purpose of this project was to assess teenager's knowledge and use of e-cigarettes and vaping in a Midwestern high school before and after an education campaign.

Statistically significant results support continued efforts to provide education to adolescents about the risks associated with e-cigarettes and vaping. Nicotine is addictive and may cause damage to the developing adolescent brain. E-cigarette use and vaping is a

growing public health concern. Enlisting the use of educational resources to develop adolescent's knowledge are steps in the right direct to address this growing community health crisis.

References

Allen, J. G., Flanigan, S. S., LeBlanc, M., Vallarino, J., MacNaughton, P., Stewart, J. H., & Christiani, D. C. (2016). Flavoring chemicals in e-cigarettes: Diacetyl, 2,3-pentanedione, and acetoin in a sample of 51 products, including fruit-, candy-, and cocktail-flavored e-cigarettes. *Environmental Health Perspectives*, *124*(6), 733-738. doi:10.1289/ehp.1510185

Baker, S. (2008). Johns Hopkins Nursing Evidence-Based Practice Model and Guidelines. *Nursing Education Perspectives (National League for Nursing)*, *29*(4), 234.

Case, K., Crook, B., Lazard, A., & Mackert, M. (2016). Formative research to identify perceptions of e-cigarettes in college students: Implications for future health communication campaigns. *Journal of American College Health: J of ACH*, *64*(5), 380-389. doi:10.1080/07448481.2016.1158180

Centers for Disease Control and Prevention. (2018). *Smoking and youth*. Retrieved from https://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/pdfs/fs_smoking_youth_508.pdf

Douglass, B.L. & Solecki, S. (2017). Teen vaping: Time to clear the air. *Contemporary Pediatrics, 34*(8), 24-38.

Gibson-Young, L. & Martinasek, M. (2018). Juuling: What kids don't know will hurt them. *Contemporary Pediatrics*, *35*(6), 5-39.

Goldenson, N. I., Leventhal, A.M., Stone, M.D., McConnell, R.S., & Barrington-Trimis, J. L. (2017). Associations of electronic cigarette nicotine concentration with subsequent cigarette and vaping levels in adolescents. *JAMA Pediatrics, 171*(12), 1192-1199. doi:10.1001/jamapediatrics.2017.3209

Johnson, C. Mays, D., Hawkins, K., Denzel, M. & Tercyak, K. (2017). A qualitative study of adolescent perceptions of electronic cigarettes and their marketing: Implications for prevention and policy. *Children's Health Care, 46*(4), 379-392. https://doi.org/10.1080/02739615.2016.1227937

JUUL Labs, Inc. (n.d.) *JUULpod Basics*. Retrieved September 30, 2018, from https://support.juul.com/home/learn/faqs/juulpod-basics

Kowitt, S. D., Meernik, C., Baker, H. M., Osman, A., Huang, L., & Goldstein, A. O. (2017). Perceptions and experiences with flavored non-menthol tobacco products: A systematic review of qualitative studies. *International Journal of Environmental Research and Public Health*, *14*(4), 338. doi:10.3390/ijerph14040338

Martinasek, M. P., Bowersock, A., & Wheldon, C. W. (2018). Patterns, perception and behavior of electronic nicotine delivery systems use and multiple product use among young adults. *Respiratory Care*, *63*(7), 913-919. doi:10.4187/respcare.06001

McKeganey, N., & Barnard, M. (2018). Change and continuity in vaping and smoking by young people: A qualitative case study of a friendship group. *International Journal of Environmental Research and Public Health*, *15*(5), doi:10.3390/ijerph15051008

National Association of School Nurses (2015). *NASN's Framework for 21st Century School of Nursing Practice* (the Framework). Retrieved from https://www.nasn.org/nasn/nasn-resources/professional-topics/framework

Noar, S., Rohde, J., Horvitz, C., Lazard, A., Cornacchione, J. & Sutfin, E. (2019). Adolescents' receptivity to E-cigarette harms messages delivered using text messaging. *Addictive Behaviors, 91*, 201-207. doi:10.1016/j.addbeh.2018.05.025

Nebraska Department of Health and Human Services. (2017). *Nebraska Youth Tobacco Survey Report 2015-2017*. Retrieved from http://dhhs.ne.gov/publichealth/Pages/tfn_tfnpubrep.aspx

Park, J., Dong-Chul, S. & Hsein-Chang, L. (2016). E-cigarette use and intention to initiate or quit smoking among U.S. youths. *American Journal of Public Health, 106*(4), 672-678.

Patrick, M., Miech, R., Carlier, C., O'Malley, P., Johnston, L. & Shulenberg, J. (2016). Self-reported reasons for vaping among 8th, 10th, and 12th graders in the US: Nationally-representative results. *Drug and Alcohol Dependence*, (165), 275-278. doi: https://doi.org/10.1016/j.drugalcdep.2016.05.017

Rohde, J.A., Noar, S.M., Horvitz, C., Lazard, A.J., Cornacchione, R.J., & Sutfin, E. L. (2018). The role of knowledge and risk beliefs in adolescent e-cigarette use: A pilot study. *International Journal of Environmental Research and Public Health, 15*(4), doi:10.3390/ijerph15040830

U.S. Department of Health and Human Services (2016). *E-Cigarette use among youth and young adults: A report of the Surgeon General*. Retrieved from https://e-cigarettes.surgeongeneral.gov/documents/2016_SGR_Full_Report_non-508.pdf

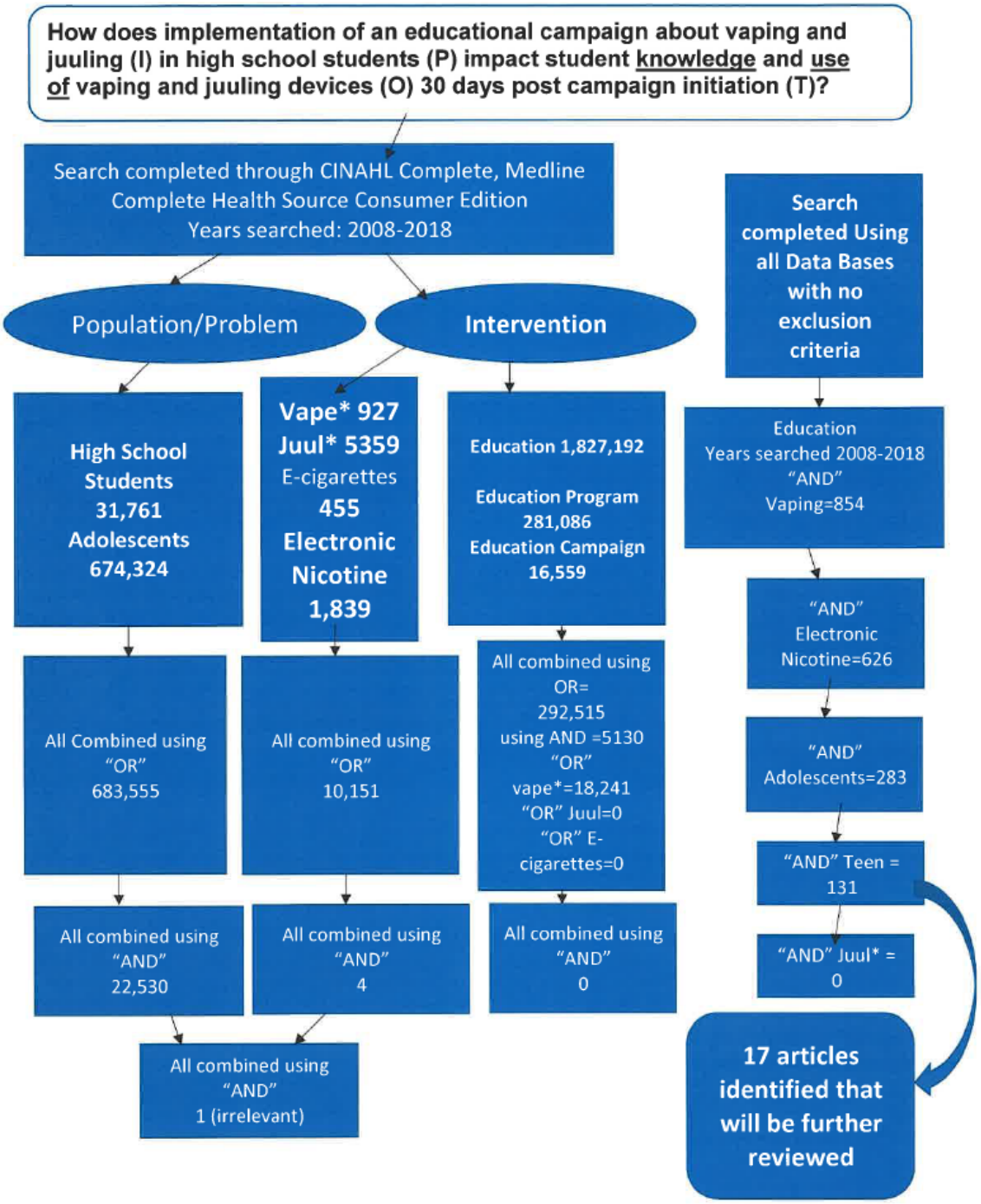
U.S. Food and Drug Administration (2018). *Youth tobacco use: Key findings from the 2017 National Youth Tobacco Survey.* Retrieved from https://www.fda.gov/TobaccoProducts/PublicHealthEducation/ProtectingKidsfromTobacco/ucm405173.htm

Willis, T., Knight, R., Sargent, J., Gibbons, F., Pagano, I. & Williams, R. (2017). Longitudinal study of e-cigarette use and onset of cigarette smoking among high school students in Hawaii. *Tobacco Control, 26*, 34-39. doi:10.1136/tobaccocontrol-2015-052705

Zare, S. Nemati, M., & Zheng, Y. (2018). A systematic review of consumer preference for e-cigarette attributes: Flavor, nicotine strength, and type. *Plos ONE*, 13(3), 1-18. doi:10.1371/journal.pone.0194145

Appendix A

Literature Search



Appendix B

Research Articles

Citation/Level of Evidence	**Participants/Setting Sample Size**	**Purpose/ Background**	**Methods/Design & Limitations**	**Findings/Summary Strengths/Weakness**	**Applicability to Own Research**
Case, K., Crook, B., Lazard, A., & Mackert, M. (2016). Formative research to identify perceptions of e-cigarettes in college students: Implications for future health communication campaigns. *Journal of American College Health: J Of ACH*, *64*(5), 380-389. doi:10.1080/07448481.2016.1158180 Formative qualitative study Level 3	Thirty undergraduate students from a large southwestern university. Ages between 18 – 26 and enrolled as an undergraduate student.	Purpose was to examine theoretical constructs with respect to e-cigarette use in college students to inform future health campaigns.	***Inclusion criteria*** Enrolled in undergraduate studies, age 18-26, equal number of e-cigarette users and non-users entered the study. Extra credit was given for participation and upon completion of the study, a $20.00 gift card was given ***Limitations*** Only 3 participants reported current use; thus, results regarding perceptions and attitudes may not be applicable to college students. Small sample of college students from one university.	• Provides insight into the beliefs of nonusers. • Social stigma of e-cigarettes perceived as a disadvantage to e-cigarette use. • Results support previous findings that reduced harm is the prominent theme with respect to e-cigarette perceptions among young adults. • Results will help inform the development of future health campaigns aimed at informing users and non-users about the potential consequences of e-cigarette use.	Adolescents may perceive vaping as less harmful than smoking. Information will help to develop survey questions and education program.
Goldenson, N. I., Leventhal, A. M., Stone, M. D., McConnell, R. S., & Barrington-Trimis, J. L. (2017). Associations of	181 students, 96 boys and 85 girls from the 10th grade in the Los Angeles	Is the use of electronic cigarettes with higher nicotine	Prospective longitudinal study. ***Limitations***	• Study provides preliminary evidence that use of e-cigarettes with higher nicotine concentrations by youths may increase	Information will help to develop survey questions and Education

electronic cigarette nicotine concentration with subsequent cigarette smoking and vaping levels in adolescents. *JAMA Pediatrics*, *171*(12), 1192-1199. doi:10.1001/jamapediatrics.2017.3209 Prospective longitudinal study.	California metropolitan area.	concentrations prospectively associated with greater frequency and intensity of combustible cigarette smoke and vaping in adolescents?	Relatively small sample size. Reliance on self-reported data. Lack of biochemical verification of reported e-cigarette nicotine concentration levels vaped by youths.	subsequent frequency and intensity of smoking and vaping. • Use of e-cigarettes with higher nicotine concentrations at baseline were associated with progression of smoking and vaping frequency and intensity at six-month follow-up.	program. Adolescents may not be aware of association between
Johnson, C. Mays, D., Hawkins, K., Denzel, M. & Tercyak, K. (2017). A qualitative study of adolescent's perceptions of electronic cigarettes and their marketing: Implications for prevention and policy. *Children's Health Care, 46*(4) 379-392 Qualitative Study	25 participants age 12-17 years of age located in Washington D.C. area	Examine in depth youths' perceptions of e-cigarettes, and investigate how e-cigarette advertising and marketing and other exposures may influence these perceptions.	Qualitative Study Search words ***Limitations*** Small, convenience sample of adolescents recruited from a single clinical site and geographical area. Did not gather data about exposure to other factors that may have affected youths' responses. Data was self-reported	• 72% of participants perceived e-cigarettes as healthier than cigarettes. • Participants reported advertisements portray e-cigarettes as less harmful than cigarettes and novel products. • 72% of the participants indicated they prefer to receive e-cigarette risk information from their doctor. • Findings highlight important areas of research needed to better understand risk factors associated with youth e-cigarette use.	

Kinnunen, J. M., Ollila, H., Lindfors, P. L., & Rimpelä, A. H. (2016). Changes in electronic cigarette use from 2013 to 2015 and reasons for use among Finnish adolescents. *International Journal of Environmental Research and Public Health*, *13*(11) 3	10,200 surveys analyzed from 12-18 year olds in Finland.	Report changes from 2013-2015 in the awareness and use of e-cigarettes and in the use of nicotine and non-nicotine e-liquids. Have the determinants for e-cigarette ever-use have changed during the two-year period.	Search words: electronic cigarette, electronic nicotine delivery systems, adolescents, tobacco use, Finland ***Inclusion criteria*** Data pulled from cross-sectional online survey from the 2013-2015 Adolescent Health and Lifestyle Survey. Pulled representative samples from different ages born on certain days of June, July and August. ***Limitations*** Low response rate may compromise the generalizability of the study. Key questions used in the questionnaire may have limited the scope and may not have captured all the possible responses. Not able to capture all the determinants for e-cigarette use and number of e-cigarette users weekly was small, weakening the	• Adolescents use e-cigarettes with other tobacco products, not to quit smoking. • Most common reason for e-cigarette use was to try something new. • Nicotine containing e-cigarettes are also quite commonly used and tried by those who have never tried conventional cigarettes. • E-cigarettes can pose a risk for nicotine addiction for smokers and those without a previous history of conventional tobacco products.	Important findings that will be used to develop survey questions about why the adolescents vape; trying something new.

			generalizability of the results.		
Kowitt, S. D., Meernik, C., Baker, H. M., Osman, A., Huang, L., & Goldstein, A. O. (2017). Perceptions and experiences with flavored non-menthol tobacco products: A systematic review of qualitative studies. *International Journal of Environmental Research and Public Health*, *14*(4), 338. doi:10.3390/ijerph14040338 Systematic review of qualitative studies Level 3	20 articles contained in the final analysis and included populations of any age, race, sex, ethnicity, or country and described individuals' experiences with or perceptions toward non-menthol flavored tobacco products.	Systematic review of qualitative studies examining perceptions of and experiences with flavored non-menthol tobacco products.	Search words: other tobacco products, tobacco control, flavored tobacco products, regulation ***Limitations***	• All 20 studies included in the review found participants reported positive perceptions of flavored tobacco products and noted flavors led to experimentation or initiation of flavored tobacco products. • All but 4 studies focused on adolescents for young adults and all but one study focused on non-cigarette flavored tobacco products, such as e-cigarettes, suggesting that flavored tobacco products are widely appealing to this population. • Findings provide additional support to ban non-menthol flavors of tobacco products in the US and internationally to curb tobacco use among youth.	Provides support that flavored vaping liquids may increase attraction or likelihood of vaping among adolescents. Important information to include in data collection questions and education.

Martinasek, M. P., Bowersock, A., & Wheldon, C. W. (2018). Patterns, perception and behavior of electronic nicotine delivery systems use and multiple product use among young adults. *Respiratory Care*, *63*(7), 913-919. doi:10.4187/respcare.06001 Cross-sectional study. Level 3	989 student surveys from a mid-size private university were analyzed.	Explore the perception of harm from firsthand and secondhand vapor. Explore patterns of use, initial use and differences between ENDS users and non-users.	Cross-sectional survey developed. ***Inclusion criteria*** Enrolled at Private University and age ≥ 17y. If participants did not respond to the honesty question at the end of the survey, the survey was thrown out. ***Limitations*** Data collected from one university. Self-reported and from 1 university, results may not be generalizable	• 51.4% of subjects reported ever using and ENDS product. • ENDS users were most likely male, perceived e-cigarettes as less harmful than traditional cigarettes and to perceive ENDS to have fewer secondhand effects. • Trying ENDS was very common among current tobacco users. • 26.1% of subjects used ENDS for one year or longer. • Most common reason for initiating ENDS was peer influence (36.9%).	Additional study that found peer influence as the most common reason for vaping. Could peer influence also be used to NOT vape? Possible strategy to consider or use in the Education campaign.
McKeganey, N., & Barnard, M. (2018). Change and continuity in vaping and smoking by young people: A qualitative case study of a friendship group. *International Journal*	8 participants 16-17 years old. Selected from part of a larger study.	Explore the possible fluidity in young peoples' perspectives and	Search words: Smoking vaping, young people, transition. ***Inclusion Criteria*** Selected from part of a larger study who	• Results show how mutable perceptions and engagement with e-cigarettes can be amongst teens and how much these elements can change over a relatively short period.	Peer influence is impactful, will use for education campaign. Notes importance or

of Environmental Research and Public Health, *15*(5), doi:10.3390/ijerph15051008 Level 3		engagement with e-cigarettes by re-interviewing the members of a small teenage friendship group in Scotland, focusing on how their relationship and perception of e-cigarettes changed over a six-month period	described vaping as a fun activity that was appealing to both smokers and non-smokers, which formed part of their social and leisure activities with friends ***Limitations*** Based on self-report with no independent confirmation of vaping or smoking. Small group, may not be representative of other young people.	• Underscores the importance of differentiating between long-term, frequent, consistent use and more episodic, experimental and infrequent use by young people. • Undertake measurement of actual e-cigarette use at multiple points in both quantitative and qualitative studies. • Illustrates the powerful impact which peers can have on teenager's use of e-cigarettes.	ascertaining if use is long-term or experimental and episodic. Information will inform survey.
Nan, J., Man Ping, W., Sai Yin, H., Lok Tung, L., Tai Hing, L., Jiang, N., & ... Lam, T. H. (2016). Electronic cigarette use among adolescents: a cross-sectional study in Hong Kong. *BMC Public Health*, *16*(1), 1-8. doi:10.1186/s12889-016-2719-4	Data analyzed from a school based survey from 2012/2013. 45,857 secondary students grade 7-12 from 75 secondary school.	Examine prevalence of e-cigarette use and associated factors in Chinese adolescents	Search words electronic cigarettes, E-cigarettes, smoking, adolescents, students, Hong Kong ***Limitations*** Cross-sectional study design does not allow causality inferences. Study based on self-reported data. 19% response rate.	• Current e-cigarette use is associated with male sex, poor knowledge about the harm of smoking, cigarette smoking, and use of other tobacco products. • Tobacco interventions and school programs must target the full array of tobacco products and not just cigarettes.	Intervention, education should target all tobacco products. E-cigarettes appeal to never cigarette smokers. Info will inform education & survey.

Level 3			Data collected from students with visual, hearing or physical impairment were excluded from the survey.	• Findings suggest e-cigarettes appeal to experimenters or never cigarette smokers. • Policies may help to prevent the uptake in adolescents.	Sample questions provided, will assist with survey development
Park, J., Dong-Chul, S. & Hsein-Chang, L. (2016). E-cigarette use and intention to initiate or quit smoking among US youths. *American Journal of Public Health, 106*(4), 672-678. Level 3	Participants from the 2012 National Youth Tobacco Survey. N=20193; never smoking youth n=16238; youth experimenters n=3248; and current youth smokers=707.	Are e-cigarettes associated with the intent to smoke cigarettes among never-smoking youths and youth experimenters Are e-cigarettes associated with the intention to quit smoking among current youth smokers?	Participants were categorized from the 2012 National Youth Tobacco Survey. ***Limitations*** Data obtained from a cross-sectional data, caution is warranted inferring a causal relationship. E-cigarette market is changing quickly and growing rapidly and more recent data is needed.	• A close link is associated with e-cigarettes among US youths and intention to smoke cigarettes in the future. • E-cigarette users who had never smoked traditional cigarettes or experimented with smoking were more likely to have intention to smoke cigarettes in the future.	Information will inform education program about the risks of vaping leading to cigarettes in the future.
Rohde, J. A., Noar, S. M., Horvitz, C., Lazard, A. J., Cornacchione Ross, J., & Sutfin, E. L. (2018). The role of knowledge and risk beliefs in adolescent e-	69 adolescents Drawn from a registry of adolescents originally developed from	Study designed to examine adolescent's knowledge and beliefs	Search words e-cigarette, vaping, knowledge, beliefs ***Inclusion criteria*** 14-18 years of age; smartphone and agreed to	• Majority of adolescents knew about the many risks of e-cigarettes, but that knowledge played little or no role in their e-cigarette use behavior.	Misperceptions exist about the risks of e-cigarettes. Information will inform

cigarette use: A pilot study. *International Journal of Environmental Research and Public Health*, *15*(4), doi:10.3390/ijerph15040830 Multivariable logistic regression study Level 3	a national phone survey. Letters were mailed with a $2.00 bill to 200 adolescents who were susceptible to or had used tobacco at the time of the 2014-2015 survey.	about e-cigarette risks; and whether knowledge and risks are associated with e-cigarette use	send and receive text messages ***Limitations*** Modest sample size, potentially reducing statistical power. Cross-sectional; therefore, causal conclusions can't be made.	• Adolescents who had ever used e-cigarettes were more likely than never-users to discount the risks of addiction that e-cigarettes pose. • Adolescents generally view e-cigarettes as less harmful than combustible cigarettes. • Prior combustible cigarette use, mother's education, and addiction risk beliefs about e-cigarettes are significant predictors of adolescent's e-cigarette use.	education program.
Weishaar, H., Trevisan, F., & Hilton, S. (2016). 'Maybe they should regulate them quite strictly until they know the true dangers': a focus group study exploring UK adolescents' views on e-cigarette regulation. *Addiction (Abingdon, England)*, *111*(9), 1637-1645. doi:10.1111/add.13377 Focus Group Level 3	16 focus groups conducted. 11 in Scotland and 5 in England A total of 83 teenagers between the ages of 14 and 17 years were included	Explores adolescents' perceptions and opinions about e-cigarette regulation.	Search words adolescents, age of sale, e-cigarettes, focus groups, marketing, regulation, and use in public places. ***Inclusion Criteria*** Purposive sampling was used to recruit a diverse sample. Recruited through youth organizations. Sample included affluent and more deprived backgrounds ***Limitations***	• Overwhelming support for strong e-cigarette regulation and endorsed restrictions on sales to minors, marketing and e-cigarette use in public places.	Evidence that youth can endorse restrictions for e-cigarettes. Important perspective that can be used to inform education program.

			UK is an international leader in tobacco control policy and participants' views were probably influenced by the legal and socio-cultural context.		
Yoong, S. L., Stockings, E., Chai, L. K., Tzelepis, F., Wiggers, J., Oldmeadow, C., & ... Wolfenden, L. (2018). Prevalence of electronic nicotine delivery systems (ENDS) use among youth globally: a systematic review and meta-analysis of country level data. *Australian And New Zealand Journal of Public Health*, *42*(3), 303-308. doi:10.1111/1753-6405.12777 Systematic review Level 3	Data used from 36 surveys from 13 countries.	Describe prevalence of ENDS use in people $\leq$ 20y by country and by combustible tobacco smoking status during 2013-2015 and describe changes in ENDS use in youth over time (2008-2015) by country	Search terms used electronic nicotine delivery systems, smoking, youth. ***Inclusion criteria*** Employed a probability sampling method, recruited general population samples of people $\leq$ 20 years. Report prevalence of ENDS of samples between 2013-2015. ***Limitations*** Review pooled a variety of measures for assessment of current use and may have influenced prevalence measures in several countries. Examined ENDS use among current non-smokers rather than never smokers Majority of studies did not record whether the ENDS	• Considerable heterogeneity in ENDS use among youth globally across countries, and between current smokers and non-smokers. • Prevalence of ENDS ever use was highest in Poland 62.1%; lowest in Italy 5.9%. • Among non-smoking youth, the prevalence of ENDS ever use in 2013-2015 varied ranging from 4.2% in US to 14% in New Zealand. • Prevalence of ENDS ever use among current tobacco smoking youth was highest in Canada 71.9% and lowest in Italy 29.9%	This research study will inform use in a Midwestern city in the United States.

			use included nicotine and/or non-nicotine liquids		
Zare, S. Nemati, M., & Zheng, Y. (2018). A systematic review of consumer preference for e-cigarette attributes: Flavor, nicotine strength, and type. *Plos ONE, 13*(3), 1-18. doi:10.1371/journal.pone.0194145 Level 3	Search identified 12, 933 articles. 66 articles met inclusion criteria.	Purpose of the review was to examine consumer preference for the main electronic cigarette attributes, namely flavor, nicotine strength, and type.	Search terms used electronic cigarettes, electronic nicotine delivery systems, E-Cig in five data bases. Humans of any age, race/ethnicity, and gender were ***Inclusion criteria*** for articles included peer-reviewed, written in English and addressed consumer preference for one or more e-cigarette attributes. ***Limitations*** External validity limited due to 53/66 studies done in the US. Only four studies found on preference for flavored e-cigarettes by race.	• Consumers preferred flavored e-cigarettes, and such preference varied with age groups and smoking status. • Adolescents considered flavor the most important factor in their decision to try e-cigarettes and were more likely to initiate vaping through flavored e-cigarettes (especially fruit and sweet ones for non-smokers). • Several flavors were associated with decreased harm perception while tobacco flavor was associated with increased harm perception. • Some flavor chemicals and sweeteners in e-cigarettes could be of toxicological concern. • Consumer preference for nicotine strength and types depends on smoking status, e-cigarette use history and gender.	Information about the use of flavors will be used in the development of survey questions. Information will inform development of the Education program.

Appendix C

NASN's Framework for 21st Century School of Nursing Practice