VAPE: A Program Designed to Screen and Educate Pediatric Patients about Electronic Cigarettes

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Abstract

The purpose of this project was to determine if a quality improvement (QI) project, known as the *Vaping Assessment and Provider Education* (VAPE) program, could improve assessment and education about vaping in the pediatric population. The QI project involved using a vaping screening tool at every well-child visit for patients 11-18 years old. To examine providers' views on vaping and the effectiveness of the screening tool, they were also interviewed. A retrospective chart review was done before VAPE was introduced to determine the number of children ages 11-18 years who were assessed for and educated about vaping. Providers were educated about short- and long-term health effects, and how to use the screening tool. The tool was implemented at each well-child visit among those who met the criteria. Following implementation of the tool, providers were interviewed. The primary outcome was for providers to utilize a system-wide screening tool to identify the risk behavior (vaping in children ages 11-18). The secondary outcomes were to increase the number of children assessed for vaping, increase the number of children educated about vaping, and use content analysis to analyze providers' views on the tool and vaping. The QI project resulted in a statistically significant increase in the number of children assessed for vaping, as well as those educated about e-cigarettes and their harmful effects.

Keywords: vaping; pediatric population; providers; screening tool; quality improvement

VAPE: **A Program to Screen and Educate Pediatric Patients about Electronic Cigarettes**

E-cigarettes, also known as vapes or electronic nicotine delivery systems (ENDS), have become one of the latest trends nationally, and their use has increased dramatically during the last decade (Young-Wolff et al., 2017). What began as a method for adult smoking cessation has become a hobby, especially among adolescents. A total of $6.48 billion were spent on e-cigarettes in 2016 compared to $573 million spent in 2009 (MacDonald et al., 2016). With the popularity of these devices increasing, middle and high school students have become a population of interest that research is now targeting (Ahern & Mechling, 2014).

According to the American Academy of Pediatrics, the number of students in middle school and high school who had ever vaped increased from 3.3% to 6.8% between 2011 and 2012 (Duffy & Jenssen, 2014). The trend then decreased but was followed by another surge from 2017-2018, when the number of middle school students and high school students using e-cigarettes increased by 48% and 78%, respectively (Cullen et al., 2018). As the use of these devices continues to climb, advanced practice nurses must begin to screen more adequately for vaping as a risk behavior and educate the pediatric population on the dangers of these devices (Young-Wolff et al., 2017).

E-cigarette use and its harmful effects on adolescents are subjects of continuing research, but evidence shows that teens who have used e-cigarettes are more likely to smoke conventional cigarettes (Zhong et al., 2016). There are also long-term health effects correlated with e-cigarette use. Nicotine, which is in most e-cigarettes, can interfere with adolescent brain development, and e-cigarette or vaping-associated lung injury (EVALI) can develop. This lung disease can result in hospitalization and death (Centers for Disease Control & Prevention, 2020). Due to the rapidly increasing rate of e-cigarette use, there is a great need for documentation of vaping use in the

electronic health record (EHR). Cigarette smoking has been screened routinely for some time in health care assessment, but ENDs use is often under-assessed (Young-Wolff et al., 2017). As there is still a great need for additional research on the effects of e-cigarette use in adolescents, accurate screening and assessment need to occur (Young-Wolff et al., 2017).

To establish the goals of the QI project, the objectives of this practice change are to increase: (1) provider knowledge, (2) the number of patients assessed, and (3) education on vaping. A potential inability to create and integrate an electronic template that populated into the EHR was considered, so the option of using a screening tool on paper that could be scanned into the chart was developed. Implementing the project took place, and the goals of the project were realized.

Literature Review

Nicotine delivery devices are gaining traction, and their use has implications for the pediatric population and their health (Selekman, 2019). Research has examined short- and long-term effects of vaping, the risks and implications associated with vaping, the reasons teens vape, providers' opinions on assessment, and their knowledge of vaping.

Vapes and their Harmful Effects

E-cigarettes are electronic devices that house liquid cartridges, typically filled with nicotine and flavorings. The e-cigarette has an atomizer and a rechargeable battery. The contents of the cartridge can be inhaled, similar to cigarette smoke (Duffy & Jenssen, 2014). With over 460 brands of e-cigarettes available, a variety of designs make these devices marketable and ubiquitous (Dai & Hao, 2016). The liquid in the cartridge contains nicotine and the base, propylene glycol. Other chemicals, along with flavorings and colorings, are also present in the mixture (Selekman, 2019). Propylene glycol and glycerol are two of the primary solvents in e-

cigarettes. At a temperature of 215^{o} C or greater, formaldehyde and acetaldehyde, two toxic carbonyl compounds, form. The amount of formaldehyde emitted at this temperature was found to be greater than the recommendations of average daily exposure by the U.S. Environmental Protection Agency (Wang et al., 2017). One of the toxins in e-cigarettes is the same as an ingredient of antifreeze and is carcinogenic (Selekman, 2019). It is evident that there is a need for further research regarding e-cigarettes as a carcinogen (Wang et al., 2017).

Effects from the heated metals in the coils of these devices include damage to lung tissue (Clapp & Jaspers, 2017). Diacetyl, a common flavoring agent used in vapes, is known to cause pulmonary toxicity, which can cause bronchiolitis obliterans (Cao et al., 2020). E-cigarettes can also lead to asthmatic-like symptoms and other respiratory disorders that are continuing to be explored (Clapp & Jaspers, 2017).

Vaping devices also have the potential to deliver illicit substances, such as cannabis and hashish oils (Selekman, 2019). Nearly one-third of teens who have used an e-cigarette in the past have inhaled marijuana (Chadi et al., 2019), including high potency cannabis oils, also known as a ‘dab’ (Dharmapuri et al., 2020). This dangerous, novel use of e-cigarettes negatively affects adolescents’ developing brains and overall health (Dharmapuri et al., 2020). The nicotine in e-cigarettes can reduce activity in the prefrontal cortex, for example, and harm concentration and memory (Selekman, 2019).

There are both short- and long-term health effects of vaping. Short-term effects include dizziness, coughing, sneezing, headaches, choking, and several other effects. Long-term effects include seizures, congestive heart failure, pneumonia, cataracts, and rhinitis (Ahern & Mechling, 2014). There are several known effects of conventional cigarette smoke exposure, but there is still little known about the impact of vapor from e-cigarettes (Mastrota, 2017). Vaping allows

vapor particles to taken deeper into the lungs, depositing chemicals, and altering lung tissue in chronic vapers (Selekman, 2019). The extent of damage that vaping has on the lungs is yet to be determined, but research has found that vitamin E acetate, which is in vaping liquid, is a thickening agent that was found in the lungs of those hospitalized related to vaping (National Institute on Drug Abuse, 2019). Lung tissues lack the ability to metabolize or absorb vitamin E acetate, resulting in e-cigarette or vaping use-associated lung injury (EVALI). As of February 2020, EVALI was the diagnosis given to 2,807 hospitalizations in the U.S. (Cao et al., 2020).

Implications of Vaping

There is evidence to support the assumption that adolescents and young adults are more likely to use conventional cigarettes after initial e-cigarette use (Wills et al., 2016). The use of e-cigarettes increases the risk of cigarette smoking initiation and has also been associated with a greater risk of past 3-day cigarette smoking (Soneji et al., 2017). E-cigarette use influences future cigarette use, despite confounding factors such as demographics and socio-behavioral factors (Soneji et al., 2017). With closer examination, e-cigarettes are a ‘nicotine starter’ (Zhong et al., 2016). Adolescents have sensitive brains that are especially vulnerable to damage by addictive substances such as nicotine (Zhong et al., 2016).

While many people believe that vaping is a healthier choice, the amount of nicotine found in e-cigarettes is sometimes higher (Ramôa et al., 2016). In a JUice USB Lighting® (JUUL) pod, there are 40-59mg of nicotine, equivalent to the amount in a pack of cigarettes. A pod has approximately 200 puffs (Selekman, 2019). Some individuals believe that e-cigarettes can help people quit smoking. This assertion is very controversial considering that research showed that only 9% of survey participants were able to successfully stop smoking traditional cigarettes after using a vape (Selekman, 2019).

Of never (and ever) e-cigarette users, studies have shown that ever e-cigarette users are significantly less likely to be worried about the harmful effects of e-cigarettes. Both ever and never e-cigarette users believed that e-cigarettes are less harmful than standard combustible cigarettes (Rohde et al., 2018). While research has demonstrated that e-cigarettes may be less harmful than combustible cigarettes, they are not risk-free, and researchers emphasize the need to monitor adolescents and their beliefs regarding addiction and e-cigarette use (Rohde et al., 2018).

Why Teens Vape

Initially developed as a smoking cessation tool for adults, e-cigarettes have had widespread use among adolescents as well. The number of high school students using vapes increased 10-fold between 2011 and 2015 (Soneji et al., 2017). There are several psychosocial effects to consider that may contribute to e-cigarette use, such as the need for immediate gratification, the desire to experiment, and the risk-taking attitude of adolescence (Ahern & Mechling, 2014).

There are also external influences that may increase an adolescent's likelihood of vaping. Youth exposed to low youth-appeal advertisements reported increased susceptibility to e-cigarette use compared to youth who were not exposed. This finding further indicates a need for stricter advertising regulations, and suggests that any promotion of e-cigarettes may influence teens to begin vaping (Padon et al., 2017). To a degree, the plasticity of teenage brains lets them stop using vapes as quickly as they started. However, plasticity also depends on the frequency of use (McKeganey & Barnard, 2018). Vaping is a social activity for most teens in which its frequency varies depending on the situation (McKeganey & Barnard, 2018). One of the main reasons youth use e-cigarettes is their flavors. Flavored products are more appealing and viewed

as less harmful to both tobacco users and non-users. The likelihood of quitting using non-menthol-flavored products decreased compared to those who used non-flavored tobacco. Fruity and sweet flavors are more likely to be tried by youth never smokers, indicating a strong appeal (Huang et al., 2017).

FDA's Actions

The American Cancer Society (2018) noted a briefing given by the FDA that discussed the steps the agency has taken to curb teen vaping. Warning letters were sent to popular vaping manufacturers prohibiting the sale of e-cigarettes or associated products to minors. In addition to the warning letters, the FDA issued letters that required producers to create a plan that would decrease the availability of their products to youth (American Cancer Society, 2018). As part of their measures to decrease vaping in teens, the agency announced a ban on the manufacture and sale of all flavors of vaping liquid other than tobacco and menthol last January. The FDA stated that producing flavored vaping liquid other than tobacco and menthol was illegal (U.S. Food & Drug Administration, 2020).

Providers and Vaping

Providers have different attitudes and varying degrees of knowledge about vaping. The majority expressed uncertainty about the use of electronic cigarettes, and lack knowledge about the products (Hurst & Conway, 2018). Due to the lack of standardization, electronic nicotine delivery systems (ENDS) screening may not occur in outpatient settings (Douglass & Solecki, 2017). Providers generally agree that it would be beneficial to have a standardized screening tool for ENDS use in primary care (Hurst & Conway, 2018). Adolescents feel comfortable discussing vaping with their pediatric providers, but because providers receive much of their current information from patients, advertising, and the media (Johnson et al., 2017), they feel that they

cannot adequately inform their patients about vaping and its risks. Providers believe that using a structured screening field in the EHR would most likely increase the number of patients screened for ENDS use (Hurst & Conway, 2018). Providers are in a unique position to counsel patients about vaping, but need additional education to inform their adolescent patients about it (Johnson et al., 2017).

The attractive trend of vaping is rapidly growing among adolescents, but there is little known about the impact or severity of its effects. The lack of assessment of this risky behavior and the extent of provider knowledge and education associated with it in the pediatric primary care setting needs to be addressed (Hurst & Conway, 2018).

Project Aim

The purpose of this QI project was to develop a procedural change in a pediatric office in response to the increased use of e-cigarettes in middle school and high school students between the ages of 11 and 18 years. This program included developing and implementing an e-cigarette screening questionnaire at each well-child visit that helped identify patients at risk for complications related to vaping (according to the screening tool), such as nicotine addiction, substance abuse, and respiratory issues. Education was provided based on the patient's risk.

The primary outcome was to establish a change system-wide by creating and implementing a standardized tool to screen for vaping, thereby allowing providers to intervene when pediatric patients were at risk of vaping and providing preventative education to all adolescents who were not at risk. Secondary outcomes were to increase the number of patients screened for and educated about vaping and to identify significant provider views on vaping and screening for the risk behavior. A retrospective chart review and content analysis of provider interviews demonstrated that the outcomes of the project were met.

Methodology

A mixed-method, sequential explanatory design (Quant/Qual) examined if a change had occurred following the intervention. The following process measures were developed and applied.

Participants

The VAPE Program was a 3-month QI project in a pediatric primary care setting in a rural community. Pediatric providers within Wilkes County, North Carolina were the targeted population in this project. Inclusion criteria included being a pediatric provider in the rural pediatric office. All providers were included in the QI project.

Measures

Vaping assessment. Vaping assessment was defined as screening patients during well-child visits for current and past use of e-cigarettes. A pediatric e-cigarette screening tool was developed as a way to assess for vaping in adolescents (see Figure 1, Appendix B). This screening tool determined if patients were at risk of vaping. The tool included closed-ended dichotomous questions about their current and past use of vaping, secondhand exposure to vaping, peer pressure to vape, harm associated with vaping, vape flavors, type of vape, appeal of vaping, and nicotine content of vaping. Closed-ended questions allowed users to analyze the results more easily, and responses could easily be entered into the EHR. The tool also included two open questions in which respondents were asked to write the number of times each day and each week that they vape. Before proceeding with implementation, the screening tool was modified to meet the needs of the clinic.

Vaping Education. Vaping education was defined as verbal or written communication that the providers gave the patients during their well-child visits. A vaping brochure was developed

using recent research. The brochure could be given during each well-child visit. Documentation that education was provided was included in the patient's chart.

Provider Views. Providers' views about vaping were explored. Viewpoints were collected through open-ended questions regarding vaping and the screening tool emailed to them. This was done to allow adequate time for their responses. Education was provided through an interactive, one-hour presentation. Questions were sent following education and implementation of the screening tool

Retrospective Chart Review. A retrospective chart review was conducted pre-intervention of children's charts ages 11-18 years with a chief complaint of "Well visit" to determine the number screened for vaping and educated about it. Following the intervention, another chart review was completed, and patients who met the criteria were selected. Their charts were reviewed to determine if vaping screening and/or vaping education was done.

Procedure

The Institutional Review Board at Lenoir-Rhyne University, Hickory, North Carolina approved the project. The permission from the practice was received as well. The charts reviewed were kept confidential for all reporting purposes, and no patient identifiers were used in presenting the data.

After speaking with stakeholders and introducing the QI project, a multidisciplinary approach was used to implement the project. Seven providers implemented the education program. The EHRs of children ages 11-18 years who had a chief complaint of "well visit" or "wellness" within the last year were reviewed for the pre-intervention examination, and 300 charts were selected that met the criteria. The principal investigator (PI) identified if vaping was screened for and education occurred during the visit, based on documentation in these charts.

The PI provided education to the providers about vaping, its harmful health indications, the importance of screening, and use of the screening tool and education program. Children ages 11-18 years, who presented to the office for a well visit, received screening by providers for e-cigarette use using the tool as part of the QI. Patients were asked to fill out the *Pediatric E-Cigarette Screening Tool* as part of their visit. Providers and office staff reviewed the screening and documented it in the EHR. Following the screening, providers presented education to all children based on the screening. Preventative education was given to those who were found to not be at risk. Those who had positive answers on the screening tool received both education and treatment. Providers documented screening and education. With the assistance of office administrative staff, the screening tool was scanned into the patient's EHR. Following implementation of the VAPE program, 289 EHRs were reviewed to determine the number the number of children ages 11-18 years who received screening and education about vaping.

Intellectus Statistics® software was utilized for the data gathered. Data obtained from the EHRs was input into a secure spreadsheet and was anonymized by eliminating names and birthdays. ThePI had access to the names of patients for re-evaluation after implementing the project. Data was stored on the principal investigator's computer, which was password-protected and on an encrypted jump drive. Data was accessible only to the project team. No funds were required for data management and analysis

Data Analysis

A chi-square test compared pre- and post-intervention vaping assessment as well as the frequency with which vaping education was provided pre- and post-intervention. Descriptive statistics reported the number of charts in which well children ages 11-18 years were screened for e-cigarette use and the number of charts in which well children were educated on the risks of

vaping and about vaping cessation before and after the QI project. During the retrospective chart review, several variables were examined, including gender, race, insurance status, risk behaviors, and vaping status. In order to examine relationships between ever or current vaping and these variables, binary linear regressions were chosen.

A qualitative method (content analysis) was used to report providers' views on vaping and vaping screening. The PI identified themes from email interviews.

Results

Seven providers received education about vaping. After education about vaping was provided, it was expected that they would begin utilizing the standardized e-cigarette screening tool during each well-child visit with those 11-18 years old. A chi-square test of independence examined whether pre-/post-intervention and screening were independent. There were two levels in intervention: pre and post. There were also two levels of screening: yes and no. Results were significant at alpha=0.05, $\chi^2(1) = 483.62$, $p < .001$, suggesting that pre- and post-intervention and screening are related to one another (see Table A1).

Chi-square was used to also test whether pre- and post-intervention and education were independent. There were two levels in pre-/post-intervention: pre and post. There were two levels of education: yes and no. Results were significant at alpha=0.05, $\chi^2(1) = 114.96$, $p < .001$, suggesting that pre-intervention and post-intervention and education are related to one another (see Table A2). This implies that the VAPE program did have an impact on vaping screening and vaping education. The QI project met the objectives of increasing vaping screening and education while establishing a system change that was utilized successfully, as evidenced by the relationship demonstrated in the chi-square analyses.

Based on the data collection from the pre-intervention chart review, the most frequently observed category of "screened for vaping" was no (*n*=294, 98%). Only 2% of charts reviewed screened for vaping (*n*=6). Ever fewer patients were educated on vaping (*n*=5, 1.67%). In comparison, post-intervention data demonstrated that the most frequently observed category of "Educated on Vaping" was no (*n* = 185, 64%), and the most frequently observed category of "Screened for vaping" was yes (*n* = 267, 92%) (see Table 3, Appendix A). The frequency with which the screening tool for vaping was used and documented increased when compared to pre-intervention statistics. The number of charts in which education about vaping was provided and documented also increased in comparison to pre-intervention statistics.

A binary logistic regression examined relationships between variables that were assessed during the QI project. The variables "age" and "current vaping status" were compared. The model was evaluated based on alpha=0.05. The overall model was significant, $\chi^2(1) = 31.37$, $p < .001$, suggesting that age had a significant effect on the likelihood of having a "yes" under the category of "current vaping status". McFadden's R-squared was calculated (0.37) to examine the model fit, where values greater than .2 indicate models with excellent fit (Louviere et al., 2000). The regression coefficient for age was significant ($B = 1.62$, OR = 5.05, $p = .001$), indicating that as age increased by one year, the likelihood of observing "yes" in the category of "current vaping status" would increase by approximately 405%.

Binary logistic regressions examined whether age had a significant effect on the probability of observing "yes" in the category of "ever vaped." The overall model was significant, $\chi^2(1) = 31.94$, $p < .001$, suggesting that age had a significant effect on observing the "yes" in the category of "ever vaped." The regression coefficient for age was significant ($B =$

0.49, OR = 1.64, $p < .001$), indicating that for every year age increased, the odds of observing "yes" in the category of "ever vaped" would increase by approximately 64%.

Results demonstrated that gender was not a predictor of observing "yes" in the categories of "current vaping status or "ever vaped." Binary logistic regression models for "gender" and "current vaping status," as well as "ever vaped," were not significant for an alpha of 0.05 ($\chi^2(1) = 0.04$, $p = .837$ and $\chi^2(1) = 0.06$, $p = .803$), respectively.

To determine whether "ever vaped" had a significant effect on the odds of observing the "yes" in the category of "current vaping status," a binary logistic regression model was used. The overall model was significant ($\chi^2(1) = 40.33$, $p < .001$), suggesting that "ever vaped" had a significant effect on whether "yes" was seen in the category of "current vaping status." Another relationship that the data suggests is significant is that of "social vaping" and "current vaping status." The model was evaluated based on an alpha of 0.05. The overall binary logistic model was significant ($\chi^2(1) = 23.32$, $p < .001$), suggesting that "social vaping" had a significant effect on the odds of observing "yes" in the category of "current vaping status." Data indicated that the odds of observing "yes" in "current vaping status" increase if the adolescent has also vaped socially.

Content analysis from the qualitative data found several underlying themes about provider views. A convenience sample of seven providers was obtained from the project site. Five of the seven providers provided answers to the interview questions. Each provider was asked to respond to the following statements via email:

- Share with me your thoughts about assessing adolescents for vaping.
- Share with me your thoughts about the safety of vaping.
- How do you feel about current research with vaping?

- Tell me about how you usually educate and treat adolescents for vaping.
- Describe to me how you feel about the quality improvement project.

The following themes were identified by content analysis of the providers' responses:

- Vaping assessment is important.
- Vaping is unsafe.
- There is a lack of research.
- Better vaping assessment and education as a result of the QI project.

Vaping Assessment is Important

Of the five providers who responded to the principal investigator's questions, each stated that assessing adolescents for vaping was necessary and stated that it is "important to assess all adolescents for vaping and smoking." Some replied that they felt vaping assessment "may be able to prevent long-term health problems related to vaping." Prov
ider responses also supported that assessment of vaping was crucial to providing additional information for research.

Vaping is Unsafe

All respondents believed that vaping is very unsafe. Words used to describe vaping were "addictive" and "harmful." Providers also shared that they are still unsure of the long-term effects, but with the information provided, they concluded that long-term use posed dangers. Based on the interview responses, providers educated adolescents about the known harmful effects of vaping. Providers felt that the brochures developed as part of the QI project were useful education tools that provided information about why vaping is unsafe.

Lack of Research

Qualitative data also suggested that providers felt there is still a lack of research on vaping, including its short-term and long-term negative effects. Vaping was identified in the provider interviews as “an important subject of research,” but providers stated that they “don’t believe enough research has been done yet.” Based on the feedback given, areas that research could focus on include “short term and long term negative effects,” “effects of the novel coronavirus or other respiratory illnesses concomitantly with vaping,” and “advertising, flavorings, and peer pressure.” A provider also commented, “I have not done any research about vaping,” indicating there is a lack of knowledge about current research on vaping.

Vaping Assessment & Education

Another theme from the data was that of improved vaping assessment and education resulting from the QI project. All providers believed the QI allowed them to focus on the assessment of vaping instead of only tobacco use generally. Many providers felt they now had more resources to share with patients, including the education brochure. The QI project allowed providers to be more “specific” when screening for vaping and created an “open dialogue” about the risk behavior.

Discussion

As e-cigarettes are the most common form of tobacco use in adolescents (Aoyama & Mcgrath-Morrow, 2020), screening and counseling on the potential harm of them is vital. The results of the VAPE program demonstrate a need for consistent screening and education in the pediatric setting. Pre-intervention data highlighted a lack of assessment and education. Previous research found this is due to the uncertainty surrounding e-cigarettes and the consequences of their use (Hurst & Conway, 2018). While this project provided data suitable for future research, there remains a lack of investigation into the harm vaping causes and how to quit. Data collected

during the QI project was inconclusive as to the effects of peer pressure on vaping, as well as patients' concurrent use of other substances.

Qualitative data implied that providers were satisfied with having a standardized screening tool for vaping during well-child visits for adolescents. The tool provided specific documentation of adolescents' vaping status and education received about vaping that became part of the EHR. Based on quantitative data analyses of EHRs, screening and educating about vaping will lead to increased assessment of this trend and early identification of unhealthy behaviors. Creating a standardized screening tool for vaping and educating providers about vaping created a system change in which the practice routinely assessed for vaping and its associated risk factors.

The VAPE QI project identified a risk behavior in the local community and variables associated with it. New resources given to providers let them offer counseling and education to their adolescent patients. Many of the adolescents that vape are unable to quit due to the addictive properties of the devices. A closer look at vaping cessation is necessary so providers can begin adding cessation techniques for pediatric patients. The fear tactics that providers often use have not proven effective and teens continue to be unable to quit despite hearing the harmful effects of vaping. Current research notes that education and counseling are effective ways to aid in vaping cessation (Superville & Prothero, 2019). To develop effective cessation strategies for teens that vape, patterns and behaviors have to be identified. The VAPE program can successfully help providers do this and battle the epidemic of vaping in adolescents.

The rigor of the project was established by analyzing the tool's design. The PI created the vaping screening tool based on the literature. Item analysis was done to pilot the screening tool.

Limitations

Despite the robust data collected by this practice change, the study does have a number of limitations. The screening tool applies only to the pediatric population and is not suited to adults without further research. The demographics of a rural pediatric practice will also vary from other areas of the state and country. Therefore, the tool may require further modification before being useable by other sites. The study used only a small convenience sample of providers, and not all contributed qualitative data. A larger sample may give different results. Quantifying the number of times children vaped each day was at times difficult to determine due to the varying terms used. In future screening, the term "hit" could describe the act of vaping as well.

Limitations were minimized by incorporating broadly based vaping terminology and developing a screening tool that was on a 5th-6th grade reading level. Patients still failed to answer the questions correctly at times, voiding some of the screening tool's data. In an effort to address this, graphics were added to assist them in answering questions, but did not seem to help.

Conclusions

Vaping is a risk behavior affecting youth across the nation. Yet, providers and patients often lack awareness of its risks. By using an electronic screening tool, vaping can be easily assessed and documented so more accurate research can be gathered on how many youths are affected by harmful vape substances. An increase in diseases associated with vaping will likely occur due to failure to assess children for this risk behavior. With proper assessment and education, patients and their parents will become more knowledgeable.

Developing a sustainable change within the pediatric clinic required process evaluation throughout the project. Provider feedback on how to improve the vaping screening tool was incorporated to increase provider satisfaction with the tool and increase efficiency. Effective communication skills to educate providers on vaping and the tool made the project sustainable.

The practice was also able to add vaping to the EHR as electronic documentation as well as having the tool scanned into the chart.

The number of adolescents using e-cigarettes has increased dramatically within the last several years (Young-Wolff et al., 2017), but there is still much research needed to determine the risks to them. Many health providers fail to assess for vape use when screening for tobacco products, and this is likely due to a lack of knowledge about it. An education program for providers that encourages their using a screening tool for vaping followed by material given to pediatric patients may prevent use of tobacco products generally, in addition to the chronic illnesses related to e-cigarette use.

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Appendix A

Tables

Table A1

Observed and Expected Frequencies-Screening

	Screening				
Pre/Post	No	Yes	χ^2	*df*	*p*
Pre	294[160.95]	6[139.05]	483.62	1	< .001
Post	22[155.05]	267[133.95]			

Note. Values formatted as Observed[Expected].

Table A2

Observed and Expected Frequencies-Education

	Education				
Pre/Post	No	Yes	χ^2	*df*	*p*
Pre	295[244.48]	5[55.52]	114.96	1	< .001
Post	185[235.52]	104[53.48]			

Note. Values formatted as Observed[Expected].

Table A3

Frequency Table for Education & Screening for Vaping

Variable	*n*		%	
Educated on Vaping	Pre	Post	*Pre*	Post
No	295	185	98.33	64.01
Yes	5	104	1.67	35.99
Missing	0	0	0.00	0.00
Screened for Vaping				
No	294	22	98.00	7.61
Yes	6	267	2.00	92.39
Missing	0		0.00	0.00

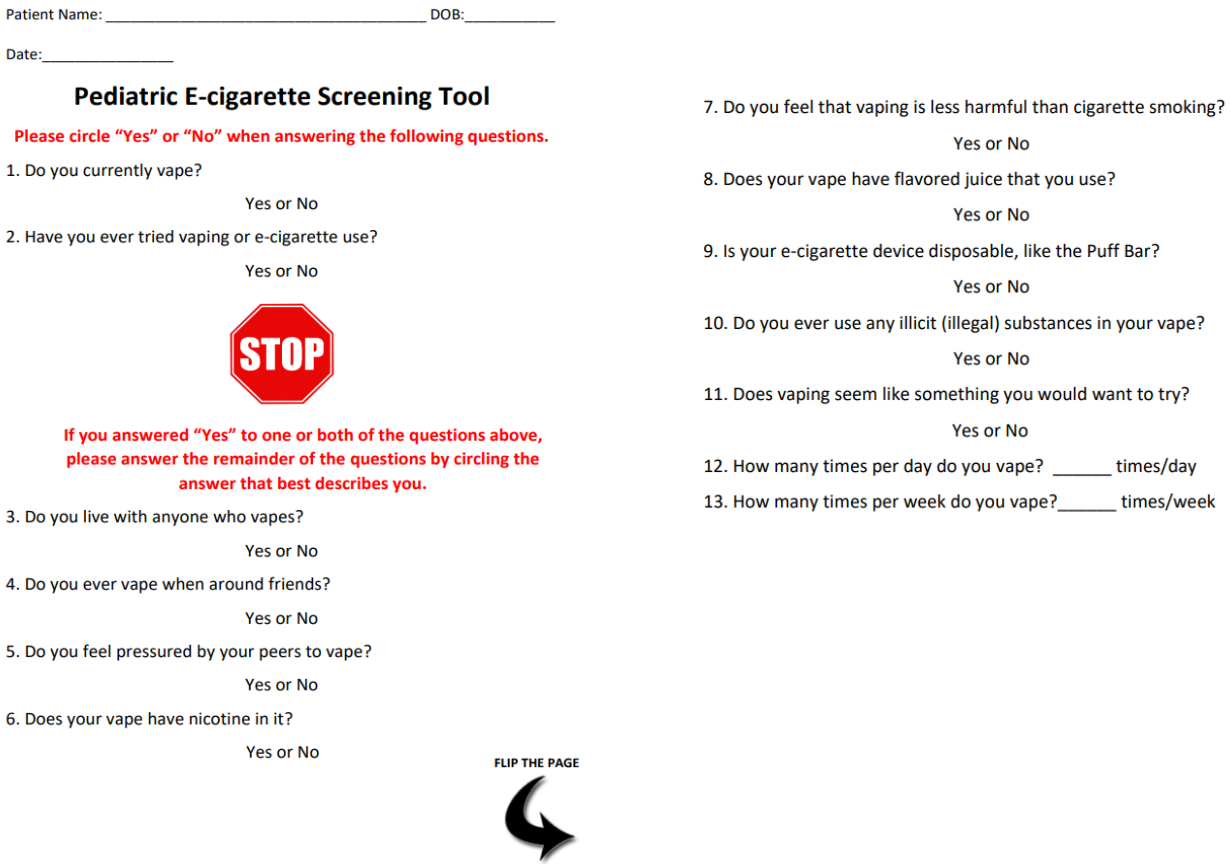
Note. Due to rounding errors, percentages may not equal 100%.

Appendix B

Screening Tool

Figure B1

Pediatric E-cigarette Screening Tool



Patient Name: _____ DOB:_____

Date:_____

Pediatric E-cigarette Screening Tool

Please circle "Yes" or "No" when answering the following questions.

1. Do you currently vape?

Yes or No

2. Have you ever tried vaping or e-cigarette use?

Yes or No

STOP

If you answered "Yes" to one or both of the questions above, please answer the remainder of the questions by circling the answer that best describes you.

3. Do you live with anyone who vapes?

Yes or No

4. Do you ever vape when around friends?

Yes or No

5. Do you feel pressured by your peers to vape?

Yes or No

6. Does your vape have nicotine in it?

Yes or No

FLIP THE PAGE

7. Do you feel that vaping is less harmful than cigarette smoking?

Yes or No

8. Does your vape have flavored juice that you use?

Yes or No

9. Is your e-cigarette device disposable, like the Puff Bar?

Yes or No

10. Do you ever use any illicit (illegal) substances in your vape?

Yes or No

11. Does vaping seem like something you would want to try?

Yes or No

12. How many times per day do you vape? _____ times/day

13. How many times per week do you vape?_____ times/week

Note. For permission to use this tool, please contact the author.