

The Role of Healthcare Providers in Adolescent Vaping Prevention

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Abstract

Background and Objectives: Electronic cigarette use, known as vaping, among adolescents was declared a public health epidemic in 2018 and has acute and chronic health consequences. Healthcare providers (HCP) play a pivotal role as health-related educators, including counseling against vaping. Primary HCPs report a lack of adequate knowledge, confidence, and screening for adolescent vaping. Increasing HCP's vaping awareness and knowledge may increase rates of adolescent vaping prevention screening and counseling. Rosswurm & Larrabee Model and Health Belief Model were utilized in project design and implementation.

Methods: Primary HCPs ($n = 8$) that provide care to adolescents at a pediatric clinic in Phoenix, Arizona completed online pre- and post- education surveys measuring vaping knowledge before and after viewing an evidence based online educational video. Participation was voluntary, open to all clinic HCPs, and informed consent was provided before the intervention. Data analysis was completed with Intellectus Statistics using descriptive and inferential statistics.

Results: Results of the paired samples t -test was significant based on $\alpha=.05$, $t(7) = -3.56$, $p = .009$. The mean of the post-education survey (12.38) was significantly higher than the mean of the pre-education survey (9.62). Descriptive statistics found 85.71% of HCPs reported increased intent to counsel for vaping and 57.14% of HCPs reported increased implemented vaping counseling with their adolescent patients four-weeks post intervention.

Conclusions: HCP vaping knowledge rates and vaping-related counseling and surveillance significantly increased after viewing the educational video. Implementing mandatory HCP vaping education training could increase adolescent vaping prevention interventions and counseling within primary care settings.

Keywords: Adolescent, counseling, education, prevention, vaping

The Role of Healthcare Providers in Adolescent Vaping Prevention

Electronic cigarettes, also known as e-cigarettes or a vape, have gained popularity in recent years, particularly among adolescents. Over 2 million middle and high school students reported using e-cigarettes in 2021, making it the most used tobacco product among adolescents (Parks-Lee et al., 2021). E-cigarette use is not deemed safe for adolescents and puts them at risk for various acute and chronic health consequences. Vaping amongst America's youth was recognized as a public health epidemic by the U.S. Surgeon General in 2018 (CDC, 2019). Parents, HCPs, individual communities, and states have been called upon to educate themselves and play an active role in protecting our nation's youth by reducing e-cigarette use.

Background and Significance

Problem Description

E-cigarettes are battery-operated devices that produce a heated aerosol containing nicotine carcinogens and potentially other harmful drugs that the user inhales. One vaping pod can contain 59 mg/mL of nicotine, equivalent to a pack of cigarettes, or 200 puffs (Truth Initiative, 2019). E-cigarettes are known by a variety of other names, including e-cigs, electronic nicotine delivery systems (ENDS), e-hookahs, hookah pens, vapes, vape pens, JUULs, mods, and tank systems (CDC, 2020b). They come in various forms and are designed to look like regular cigarettes or resemble everyday items such as pens, USB sticks, lipstick, key fobs, and inhalers.

Although initially marketed for adults as a smoking cessation aid to traditional tobacco products, e-cigarette misuse among nicotine-naïve adolescents has become a public health concern (CDC, 2020b; Hwang et al., 2020). Exposure to robust marketing strategies on social media, high nicotine content, appealing flavors, discreet designs, and affordability contribute to

the appeal of vaping among the adolescent population (Substance Abuse and Mental Health Services Administration [SAMHSA], 2019). Vaping use increases the risk of subsequent use of cigarettes, marijuana, Tetrahydrocannabinol (THC), alcohol, and other drugs, with one-third of vaping adolescents reporting they have also vaped marijuana, high potency cannabis oils and concentrates, or other drugs (Chadi et al., 2019).

The risks associated with e-cigarettes include nicotine and drug addiction, nicotine toxicity, long-term effects on the developing brain such as long-term learning, attention, and mood impairments, risk-taking and reward-seeking behaviors, increased rates of other substance use, chemical and heavy metal exposure which can lead to cancer, increased risk of COVID-19, stroke, myocardial infarction, seizures, e-cigarette and vaping associated lung injury (EVALI), and death (CDC, 2020b; Chadi et al., 2019; Gaiha et al., 2020; Selph et al., 2020). Tobacco use remains the leading cause of preventable disease and death within the United States (U.S.), while nearly all tobacco product use begins during youth (CDC, 2020b; Selph et al., 2020). It is estimated that 5.6 million adolescents alive today will die prematurely of smoking-related illness, including 115,000 children in Arizona alone (Campaign for Tobacco-Free Kids, 2020; U.S. Preventive Services Task Force [USPSTF], 2020).

Healthcare providers (HCPs) “lack an evidence-based framework with which to approach health implications of e-cigarette use, to the potential detriment of patient counseling and education” (Hwang et al., 2020, p. 6), while most providers who screen their patients for e-cigarette use do not use appropriate language or questioning techniques to get an accurate assessment of adolescent e-cigarette and nicotine use (Hendricks et al., 2018). Many HCPs report that instead of staying up to date on research through literature reviews, they instead get most of their knowledge about e-cigarettes from sources such as news outlets and social media, which is

tailored for the general public, not HCPs, and may lead to biased, inaccurate, or incomplete knowledge (Hwang et al., 2020). Although the 2011 American Academy of Pediatrics (AAP) recommendation is to screen all adolescents for tobacco and other drug abuse, Dai et al. (2018) discovered the prevalence of tobacco screening is only at 37.9% during primary healthcare visits. It was also noted that there was a decrease in the prevalence of advising adolescent patients not to use tobacco, down from 31.4% in 2011 to 26.9% in 2015 (Dai et al., 2018).

Internal Evidence/Setting Generated Data

A primary care pediatric office in Phoenix has identified increased rates of adolescent vaping and failure to deliver comprehensive, consistent education regarding vaping prevention and cessation. Internal evidence regarding this practice gap comes from collaborative discussion among the HCPs within the organization and recognizing the need for improvement within the care and resources they can use for this specific population. An identified factor contributing to this gap in care is a lack of proficient knowledge regarding vaping, such as its adverse effects and appropriate interventions for cessation. With increased knowledge and awareness regarding vaping, providers will be better equipped to assess and provide assistance and treatment options for their patients that vape. The primary clinic does not currently have any established policies or identified screening tools to assess adolescent vaping use. This identified knowledge deficit among HCPs and lack of standardized policies and screening could lead to many missed opportunities to help this at-risk population.

Purpose and Rationale

Primary pediatric HCPs are on the front lines against adolescent vaping with frequent interactions with this population throughout childhood. Improper screening and surveillance from these providers contribute to the increased prevalence of vaping. Lack of provider

education and awareness regarding vaping, its associated effects and risks, and evidence-based recommendations related to vaping prevention and cessation also contribute to this growing epidemic. The purpose of this project is to determine whether increasing pediatric HCPs' awareness and knowledge regarding vaping influence overall adolescent vaping prevention.

The identification of this problem has led to the clinically relevant PICOT question, how does the implementation of a screening tool with augmented HCP education regarding vaping compare to current health practices in the identification of adolescents who vape?

Evidence Synthesis

Search Strategy

A literature review was conducted using the following databases: PubMed, Cumulative Index of Nursing and Allied Health Literature (CINAHL), and PsycINFO. The databases were searched using a combination of keywords relevant to the PICOT question, including *adolescents, teenagers, vaping, e-cigarettes, primary care, screening, intervention, quitting, and cessation*. Filters included articles about the pediatric population published within the past five years (2016-2021), primary research from peer-review journals, and articles in the English language.

Initial results of *adolescents OR teenagers, vaping OR e-cigarettes, primary care, quitting OR cessation* resulted in a robust number of results, including 9,288 on PubMed, 47,026 on CINAHL, and 485,269 on PsycINFO. Narrowing the search of the keywords to *adolescents AND vaping OR e-cigarettes AND primary care* resulted in 1,031 results in PubMed, eight results in CINAHL, and 246 results in PsycINFO. To obtain more relevant results related to the PICOT, the keywords *screening OR assessment* was added to the search to yield 56 results in PubMed, six results in CINAHL, and 48 results in PsycINFO.

Results from all three databases included a variety of both qualitative and quantitative research studies. A review of the titles and abstracts of the narrowed search results narrowed it down to 20 studies, which then underwent rapid critical appraisal to narrow them down to eleven high-quality studies that may address the proposed PICOT question. Grey literature, including government publications from the CDC, AZDHS, USPSTF, SAMHSA, the Truth Initiative, and Campaign for Tobacco-Free Kids were also searched and obtained.

Critical Appraisal

Selected research articles were evaluated for their quality and level of evidence using rapid critical appraisal (RCA) tools (Melynk & Fineout-Overholt, 2019). Qualitative and quantitative studies were obtained, ranging from evidence levels I-VI. The quantitative studies examined the effectiveness of various interventions and screenings to identify and influence e-cigarette use. Although qualitative studies are considered a lower level of evidence, examining current HCP knowledge, beliefs, and practices related to e-cigarette use in their adolescent population were more adequately explored through qualitative methods. The evaluation of qualitative (see Appendix A, Table A1) and quantitative studies (see Appendix A, Table A2) were included in evaluation and synthesis tables (see Appendix A, Table A3) to examine the role of HCP education and screening tools in the identification of adolescents who vape.

Sample sizes varied in number from 20 to 51,233 subjects. The age of subjects ranged depending on whether the subjects were adolescents or HCPs, with the average age of 14.3 years and 37.7 years, respectively. HCPs had a reported mean of 10.1 years of practice and included attending and resident physicians, advanced practice providers, medical and nursing students. Of the studies that reported sex and ethnicity demographics, homogeneity of female and Caucasian subjects were revealed. Although all studies were conducted within the US, the specific study

settings revealed heterogeneity within clinical practice sites, individual homes, and schools. Almost all the studies were conducted with subjects on an individual basis via a survey, interview, or screening tool, except few studies within the meta-analysis by Duncan et al. (2018) that examined parent-child dyad or school-based educational interventions. While some studies consisted of only the amount of time required to complete a survey or screening tool, other studies lasted up to two years. Common variables included adolescent's knowledge, attitudes, and external factors that influenced their frequency, dependence, and cessation likelihood of vaping. Studies revealed that social-environmental influences such as peer groups and parental smoking are prominent factors that contribute to adolescent e-cigarette use. It was determined that most screening interventions positively identified youth either at risk for or currently using ENDS. The Hooked on Nicotine Checklist (HONC) and the E-cigarette Dependence Scale (EDS) were found to be reliable and validated screening tools evaluating nicotine dependence in the adolescent population (see Appendix A, Table A2). The interventions found most effective in preventing vaping initiation among adolescents were those conducted in the primary health care setting, such as providing tailored education about risks associated with e-cigarettes, such as adverse health effects and addiction, facilitating interpersonal discussions regarding the prevention of their use, and teaching cognitive-behavioral techniques for how to refuse e-cigarette offers among peers. In the examination of HCPs, studies identified striking homogenous themes, including an overall lack of knowledge regarding vaping, poor confidence in their abilities to accurately educate on ENDS, and inadequate time, resources, and screening tools available for the prevention and identification of adolescents vaping.

Foundations of Evidence

The need to improve the quality of primary HCP knowledge regarding e-cigarettes and provide them with effective strategies in the identification and counseling of adolescents currently using or at risk for vaping use is apparent. Although many HCPs are aware of the current vaping epidemic, evidence has shown that many providers do not possess an adequate foundation of knowledge on the topic to properly counsel adolescents regarding the adverse effects and risks associated with e-cigarette use. Overall screening rates for e-cigarette use are subpar due to inadequate resources and incompetent ability to discuss vaping with identified individuals accurately. Accurate identification of adolescents at risk for e-cigarette use and implementing interventions to prevent future use are most effective in reducing ENDS use in this patient population. Primary care settings are the most effective in implementing interventions geared towards the prevention of e-cigarette use. By administering effective screening tools, providing tailored education through interpersonal discussions, and teaching cognitive-behavioral techniques to assist in the refusal of social pressures, evidence has shown the incidence of adolescent vaping rates can be reduced. Providing a tailored educational program to primary HCPs that includes information on vaping devices, their adverse effects, effective screening tools and interventions, and reputable available resources available to providers would increase the incidence of identifying adolescents who vape.

The need for this quality improvement project was identified when the key stakeholders at the project site noted increased rates of adolescent vaping within their patient population and collectively identified overall deficiencies in their abilities to deliver comprehensive and consistent education related to vaping prevention and cessation. The purpose of this project is to increase pediatric primary HCPs' knowledge levels regarding adolescent vaping to increase effective identification of adolescents at risk for or currently vaping. By increasing HCP

knowledge regarding vaping, their confidence in discussing vaping and providing appropriate counseling and resources will increase and improve the quality of care to their adolescent patient population and decrease adolescent vaping rates.

Theoretical Framework

The Health Belief Model (HBM) examines health behaviors concerning specific belief patterns (Rosenstock, 1974). It suggests that one's belief of a personal threat of a particular health problem, combined with their belief of the effectiveness of proposed health behavior, ultimately predicts adopting the behavior (Rosenstock, 1974). Six theoretical constructs within the Health Belief Model influence whether health-promoting behaviors will occur. These constructs include perceived risk susceptibility, perceived risk severity, benefits to action, barriers to action, self-efficacy, and cues to action (see Appendix A, Figure A1). Perceived risk severity is a subjective assessment of the severity of the proposed health problem and its potential consequences. At the same time, perceived risk susceptibility refers to the subjective assessment of the individuals' risk of developing the health problem (Rosenstock, 1974). If perceptions of the severity and susceptibility of a health problem increase, the likelihood of engaging in behaviors to prevent the health problem will likely increase as well (Rosenstock, 1974). An individual will also assess the benefit of engaging in health-promoting behaviors to decrease their health risk and the perceived barriers that may prevent them from engaging in the health-promoting behavior (Rosenstock, 1974). Modifiable variables such as demographic, psychosocial, and structural variables can affect ones' perceptions of health-related behaviors (Rosenstock, 1974). As research on the HBM evolved, two additional constructs were included. Self-efficacy refers to the individual's perception of their abilities to successfully perform a behavior; increased self-efficacy correlates with successful health behavior change (Rosenstock et al., 1988). For health-promoting

behaviors to occur, a cue to action or trigger must occur. These may be either internal or external cues to action, and the intensity of cues vary among individuals based on their perceived susceptibility, seriousness, benefits, and barriers (Rosenstock et al., 1988). The HBM model can be used within the primary care setting to encourage change in HCP belief patterns and health-related behaviors focused on identifying adolescents who vape. By increasing HCPs' awareness of the severity of vaping use, patient susceptibility to vaping, benefits of surveillance, addressing practice barriers, and improving HCP self-efficacy, the incidence of surveillance and counseling against vaping will increase.

Implementation Framework

The implementation of this project is guided by the Rosswurm & Larrabee Model to effectively guide HCPs in the change to evidence-based practice (EBP) (see Appendix A, Figure A2). It allows for EBP changes derived from quantitative and qualitative data, clinical expertise, and contextual evidence (Rosswurm & Larrabee, 1999). This model guides the systematic process for change, in six steps, beginning with the initial assessment and recognition of a need for change within current practices with eventual integrating and maintaining change into practice. The key stakeholders within the primary care clinic first identified a need for change within their practice by recognizing a gap in vaping knowledge among their HCPs. Interventions focused on vaping education and awareness were developed after an exhaustive literature search and evaluation of evidence-based studies in the second and third steps of the model. The evidence synthesis combined with site resources led to an intervention design using the fourth step of the model. The intervention will be implemented within the primary care clinic and evaluated for efficacy, dissemination of evidence will occur, and recommendations for

sustainability will be provided to the site stakeholders using the fifth and sixth steps of the model.

Methods

Setting and Population

The project setting is a primary care pediatric office in the southwest area of Phoenix, Arizona. The clinic provides care to pediatric patients from newborn to 18 years of age and averages approximately 30,000 patient visits annually for both the sick and well-child. The identified clinic aims to be a medical home for the pediatric population and values quality care, positive healthcare experiences, accessible, up-to-date, and knowledgeable HCPs for their patient population and their families. Six physicians, one physician's assistant (PA), and six nurse practitioners (NP) currently practice at the clinic location. The length of practice among the providers ranges from one to 32 years. The participants that the intervention will focus on are the HCPs practicing at the identified project site since they are responsible for the evaluation and treatment of the patients.

Through collaborative discussion, the HCPs identified increased rates of adolescent vaping and a failure to deliver comprehensive, consistent education regarding vaping prevention and cessation to their patient population. The HCPs (physicians, PAs, and NPs) are key stakeholders since they are primarily responsible for comprehensive healthcare to the adolescent population including the responsibility to survey and accurately identify vaping among patients and provide appropriate counseling, resources, and treatments. Adolescent patients and their family members are also stakeholders with a right to comprehensive care for optimum health, including standardized screening and surveillance for vaping by HCP; by increasing the incidence of vaping surveillance, it will promote a trusting patient-provider relationship and

could increase overall compliance with vaping prevention recommendations. Clinic administration is responsible for recognizing the need for improvement in routine screening and the overall improvement in comprehensive care and treatment for adolescents. These recognitions can lead to higher patient satisfaction scores, increased patient referrals to the practice, interprofessional collaboration with other HCPs and practices, and healthcare reimbursement, making the administration staff key stakeholders. By increasing vaping surveillance rates among adolescents and increasing prevention and cessation counseling and resources provided, the overall health of Arizona's youth would ultimately improve, making the Arizona Department of Health Services (AZDHS) a significant stakeholder.

Intervention Planning

The project evaluated the following question: Does HCP adolescent vaping knowledge and surveillance rates improve with an online educational intervention upon completion and at 4 weeks post intervention? The need for a change in adolescent patient care was identified through a collaborative discussion among the stakeholders within the clinical site. Upon completion of the evidence synthesis, it was found that interventions implemented within a primary care setting were most effective in decreasing adolescent vaping rates (Duncan et al., 2018; Selph et al., 2020). It was found that by educating primary HCPs on appropriate vaping terminology, e-cigarette contents and adverse effects, appropriate surveillance and screening, and resources for vaping cessation counseling increased their overall recognition of vaping risks and confidence when counseling adolescent patients about vaping (Hendricks et al., 2020; Selph et al., 2020). An educational tool was developed and delivered to provide up-to-date evidence based (EB) education on vaping, adolescent use, and its associated health risks that HCPs can use to improve

their awareness and overall efficacy to educate their patient population and prevent adolescent vaping initiation or promote vaping cessation.

Before the intervention, an informational handout was disseminated among all HCPs at the clinic that will detail the reason for the intervention, an explanation of the proposed intervention requirements, informed consent information, a proposed timeline of the intervention, and personal contact information for any questions, concerns, or troubleshooting issues providers may have during the intervention. An email was then sent to participants that contained links to a pre-education survey, visual educational tool, and post-education survey for each HCP to complete individually and within one sitting. The pre-education survey assessed current HCP adolescent vaping knowledge and consisted of fifteen questions developed via an online survey site. Upon completion of the pre-education survey, participants viewed an online educational tool geared towards pediatric primary HCPs in the form of a voiced-over PowerPoint presentation. Topics addressed within the educational tool include background and significance of adolescent vaping, appropriate vaping terminology, e-cigarette contents and their associated adverse health effects, recommended validated and reliable screening tools, and effective evidence-based interventions such as providing tailored education, facilitating interpersonal discussions, and cognitive-behavioral counseling.

Immediately following the completion of the educational tool, the HCPs completed a fifteen question post-education survey via an online survey site to evaluate the effectiveness of the tool increasing vaping knowledge. Four weeks after the intervention was completed, a final online survey link was emailed to the HCPs to assess if the intervention led to increased surveillance and counseling or other management among adolescents at risk for vaping. Data analysis and interpretation of the results occurred upon the completion of the intervention to

evaluate the efficacy of the intervention, provide recommendations for the sustainability of the practice change, and ultimately disseminate the study findings.

Ethical Considerations

HCP participation was voluntary, with all individuals having the right to refuse or stop the study before completion. Inclusion criteria required provider participants to be active providers (physicians, PAs, and NPs) to adolescent patients at the project site. There was no exclusion criteria among those that meet the inclusion criteria such as gender, sex, or ethnicity to ensure fairness and avoid potential bias. Participant anonymity was maintained throughout the study as no personal identifiers or demographics were collected, nor IP addresses monitored. Use of Survey Monkey, an online site for survey completion, prevented personal identifiers such as participant email addresses from being linked to participant survey responses. Surveys were answered confidentially and autonomously by each participant, and results were stored with the project facilitator on a private external flash drive. For data analysis, participants were randomly assigned a subject ID.

Data Collection and Outcome Measurement

Data was collected through the pre- and two post-education surveys through the online survey site. The pre and immediate post-education surveys contained fifteen questions and the four-week post-education survey consisted of only three questions. The pre- and post-education surveys to test the knowledge of the HCPs were developed specifically for this project by the project facilitator and site consultants, thus face validity for this data collection tool was utilized. Upon completion of the proposed intervention, two main outcomes were evaluated. First, the evaluation of whether there was a change in HCP knowledge regarding adolescent vaping following the educational tool was assessed. This outcome was measured by examining the

differences between the pre- and post-education survey responses using descriptive statistics to summarize the data and help show relationships and patterns. A paired sample t-test was used to determine if the responses from the pre- and post-education surveys had statistical significance. The second measurable outcome was if the intervention led to a change in the HCPs' daily clinical practice among adolescent patients to survey, screen, and counsel on vaping use and prevention. This outcome was measured based on the four-week post-education survey using Likert scale responses. Descriptive statistics were used to describe the participant's responses. Upon examination of these two outcomes, a demonstrated statistical significance between HCP vaping education and increased surveillance rates of adolescents for vaping use would indicate a change in HCP belief patterns and health-related behaviors focused on the identification of adolescents who vape.

Budget

The implementation of this project intervention included two direct costs: the purchase and utilization of survey development and SPSS analysis technology (see Appendix C). The survey development technology was necessary for the creation and dissemination of the pre and two post-education surveys and was purchased at a student rate. The SPSS software was necessary for data analysis after completion of the intervention and was also purchased at a student rate. The HCPs and clinical administration that partook in the intervention are salary staff and their participation is optional, so budgeting for their time to complete the intervention was not necessary. There were no projected indirect costs associated with the identified project implementation, nor were there not any anticipated interruptions within daily clinical flow processes that would impact productivity costs within the clinic site. The identified costs were incurred by the student.

The potential revenue that could be generated with the implementation of the project included increased use of CPT billing codes and ICD-10 codes for the use of screening tools or diagnoses identified through increased surveillance and screening. Early identification of patients at risk for electronic cigarette use and its associated adverse health effects can result in increased disease prevention and overall decreased treatment expenses to the healthcare clinic.

Results

Survey Outcomes and Significance

To compare the changes in vaping knowledge results from the pre-education survey to the post-education survey results, a paired samples *t*-test was conducted ($n = 8$). There was a significant difference seen in the pre-education total score ($M=9.62$, $SD=2.20$) and the post-education total score ($M=12.38$, $SD=1.41$); $\alpha=.05$, $t(7) = -3.56$, $p = .009$, Cohen's $d=1.26$, indicating a strong effect size.

Descriptive statistics were used to examine HCP responses from the four-week post-education survey regarding changes in vaping counseling intent and implementation ($n = 7$). The most frequent response for increased intent to counsel was Yes ($n = 6$, 85.71%) and the most frequent response for increased implemented counseling was Yes ($n = 4$, 57.14%). These findings are significant clinically, as they indicate increased surveillance and counseling rates for vaping use among adolescent patients to contribute to overall adolescent vaping prevention strategies within the community.

Project Impact and Sustainability

Increased vaping knowledge among HCPs allows for increased awareness and confidence regarding vaping, thus generating increased frequencies of anti-vaping discussions with adolescents. By educating the adolescent and their family members about the harms of vaping,

dispelling vaping myths commonly encountered in advertising and social media, and arming them with tools to resist peer pressured use of e-cigarettes, the vaping epidemic could be reduced. Implementation of policies requiring mandatory vaping knowledge education for annual staff trainings and on-boarding for new hires would allow for HCPs to remain up to date on evidence-based vaping knowledge to educate their patients about. The resulting increased rates of anti-vaping and tobacco counseling will impact overall revenue generated for the project site by allowing increased use of CPT billing codes and ICD-10 codes for tobacco prevention interventions and increased healthcare reimbursement. More comprehensive adolescent health visits could lead to higher patient satisfaction scores, increased patient referrals to the practice, and interprofessional collaboration with other HCPs and practices. As successful vaping prevention interventions increase in frequency, vaping-related healthcare expenditures would decrease as the overall health of the adolescent population improves.

The continued use of the developed educational tool within staff trainings would allow for sustainability of this intervention. As current EB vaping education comes out within the literature, educational tools can be updated accordingly. The easily accessible online format and the minimal time requirement required to complete the educational tool increases the likelihood of sustainability of its use within a busy primary care practice among its HCPs. Dissemination of the video to adjacent clinics within this organization can also allow for further sustainability of this project intervention.

Discussion

Summary

Evidence reveals that many HCPs do not possess adequate vaping knowledge or competent abilities to properly counsel adolescents against e-cigarette use, leading to

substandard screening, surveillance, and counseling rates for e-cigarette use among adolescents. The accurate identification of adolescents at risk for e-cigarette use and implementation of interventions within primary healthcare settings to prevent future use are most effective to reduce vaping in this patient population. Internal evidence at a pediatric primary care clinic in Phoenix, AZ found that HCPs lacked adequate vaping knowledge despite the noticeable increased rates of vaping among the adolescents within their community.

The implementation of an EB video for primary pediatric HCPs providing the background and significance of vaping, associated health effects from their use, and recommendations for vaping surveillance and counseling with their patients such as utilizing appropriate vaping technology, providing tailored education through interpersonal discussions, administering effective screening tools, and teaching cognitive-behavioral techniques to assist in the refusal of social pressures was found to be impactful among HCPs. Results revealed there was a significant increase in vaping knowledge among HCPs after viewing the EB video and that the intent and implementation of vaping counseling increased four weeks after the EB video intervention. The findings initially presented by Hendricks et al. (2018) and Hwang et al. (2020) stating HCPs do not have an EB framework to use when approaching patient education and counseling related to health implications of vaping was evidenced from the project findings of a low pre-education mean score with significant improvement after viewing the EB educational video.

Future recommendations would be to implement the EB vaping knowledge videos into pediatric primary HCP annual staff trainings and new hire on-boarding orientation to keep providers up to date on vaping use and recommendations to prevent e-cigarette use.

Strengths and Limitations

Strengths of this project included a design that was easy to implement as the participating HCPs were able to complete it at their own convenience. Minimal cost and time requirements were necessary to design and complete the intervention. The organization was very supportive and responsive with the project team throughout the process which allowed implementation to run smoothly. Limitations to the project was the relatively small sample size of eight HCPs for the pre- and post-education surveys. One initial participant did not end up completing the four-week post intervention survey, thus the sample size for the follow-up survey was seven HCPs.

Recommendations

For future study, resurveying HCPs implemented vaping counseling rates in approximately one year would help examine the long-term effects of vaping EB educational tools within daily practice. Collection of demographic information among participants such as educational background, profession (physician, NP, or PA), number of years practicing, age, sex, and ethnicity would provide additional information to examine and interpret. Implementing various delivery styles of EB vaping education such as in-person educational sessions or real-time Zoom sessions and determining the associated differences in pre/post-education knowledge levels would allow examination of what type of educational tool would be most beneficial in the primary care setting.

The use of vaping products among adolescents continues to be a significant health crisis that can have short- and long-term health implications. Providing EB vaping education to pediatric primary HCPs has been found to make significant improvements in vaping knowledge that they can in turn confidently educate their adolescent patients with to promote vaping prevention. Implementation of these educational tools to other pediatric clinics within the

Phoenix, AZ area could increase the overall success in the current fight against the adolescent vaping epidemic.

References

- Arizona Department of Health Services. (2021). *Tobacco, vape & e-cigarettes*.
<https://www.azdhs.gov/prevention/tobacco-chronic-disease/tobacco-vape-e-cigarettes/index.php>
- Bascombe, T.M., Scott, K.N., Ballard, D., Smith, S.A., Thompson, W., & Berg, C.J. (2016). Primary healthcare provider knowledge, beliefs and clinic-based practices regarding alternative tobacco products and marijuana: A qualitative study. *Health Education Research, 31*(3), 375-383. <https://doi.org/10.1093/her/cyv103>
- Campaign for Tobacco-Free Kids. (2020, October 20). *The toll of tobacco in Arizona*.
<https://www.tobaccofreekids.org/problem/toll-us/arizona>
- Centers for Disease Control and Prevention. (2019, April 9). *Surgeon General’s advisory on e-cigarette use among youth*. https://www.cdc.gov/tobacco/basic_information/e-cigarettes/surgeon-general-advisory/index.html
- Centers for Disease Control and Prevention. (2020a, September 18). *E-cigarette use among middle and high school students – United States, 2020*.
<https://www.cdc.gov/mmwr/volumes/69/wr/pdfs/mm6937e1-H.pdf>
- Centers for Disease Control and Prevention. (2020b, November 16). *Smoking and tobacco use: About Electronic Cigarettes (E-Cigarettes)*.
https://www.cdc.gov/tobacco/basic_information/e-cigarettes/about-e-cigarettes.html
- Chadi, N., Hadland, S.E., & Harris, S.K. (2019). Understanding the implication of the “vaping epidemic” among adolescents and young adults: A call for action. *Substance Abuse, 40*(1), 7-10. <https://doi.org/10.1080/08897077.2019.1580241>

- Dai, H., & Cements, M. (2018). Trends in healthcare provider advice on youth tobacco use, 2011-2015. *American Journal of Preventative Medicine*, 55(2), 222-230.
<https://doi.org/10.1016/j.amepre.2018.04.015>
- DiFranza, J.R., Savageau, J.A., & Fletcher, K. (2002). Measuring the loss of autonomy over nicotine use in adolescents: The DANDY (Development and Assessment of Nicotine Dependence in Youths) study. *Archives of Pediatric and Adolescent Medicine*, 156(4), 397-403. <https://doi.org/10.1001/archpedi.156.4.397>
- Duncan, L.R., Pearson, E.S., & Maddison, R. (2018). Smoking prevention in children and adolescents: A systematic review of individualized interventions. *Patient Education and Counseling*, 101(3), 375-388. <https://doi.org/10.1016/j.pec.2017.09.011>
- Gaiha, S.M., Cheng, J., & Halpern-Felsher, B. (2020). Association between youth smoking, electronic cigarette use, and COVID-19. *Journal of Adolescent Health*, 67(4), 519-523.
<https://doi.org/10.1016/j.jadohealth.2020.07.002>
- Galderisi, A., Ferraro, V.A., Caserotti, M., Quatrini, L., Perilongo, G., & Baraldi, E. (2020). Protecting youth from the vaping epidemic. *Pediatric Allergy and Immunology*, 31(26), 66-68. <https://doi.org/10.1111/pai.13348>
- Gorzkowski, J.A., Whitmore, R.M., Kaseeska, K.R., Brishke, J.K., & Klein, J.D. (2016). Pediatrician knowledge, attitudes, and practice related to electronic cigarettes. *Journal of Adolescent Health* 59, 81-86. <https://dx.doi.org/10.1016/j.jadohealth.2016.03.036>
- Hartwell, G., Thomas, S., Egan, M., Gilmore, A., & Petticrew, M. (2016). E-cigarettes and equity: A systematic review of differences in awareness and use between sociodemographic groups. *Tobacco Control*, 26(2), 85-91.
<https://doi.org/10.1136/tobaccocontrol-2016-053222>

- Henricks, K.J., Temples, H.S., & Wright, M.E. (2020). JUULing epidemic among youth: A guide to devices, terminology, and interventions. *Journal of Pediatric Health Care*, 34(4), 395-403. <https://doi.org/10.1016/j.pedhc.2019.12.008>
- Hwang, J., Lee, C., Mastrodonardo, E., & Frasso, R. (2020). Where there's smoke, there's fire: What current and future providers do and do not know about electronic cigarettes. *BMC Public Health*, 20(1), 1-11. <https://doi.org/10.1186/s12889-020-09265-5>
- Levy, S.J., Williams, J.F., & Committee on Substance Use and Prevention. (2016). Substance use screening, brief intervention, and referral to treatment. *Pediatrics*, 138(1), 1-15. <https://doi.org/10.1542/peds.2016-1211>
- Melnyk, B.M., & Fineout-Overholt, E. (2019). *Evidence-based practice in nursing and healthcare: A guide to best practice* (4th ed.). Lippincott, Williams & Wilkins.
- Morean, M.E., Krishnan-Sarin, S., Sussman, S., Foulds, J., Fishbein, H., Grana, R., & O-Malley, S.S. (2019). Psychometric evaluation of the E-cigarette Dependence Scale. *Nicotine & Tobacco Research*, 21(11), 1556-1564. <https://doi.org/10.1093/ntr/ntx271>
- Park-Lee, E., Ren, C., Sawdey, M.D., Gentzke, A.S., Cornelius, M., Jamal, A., & Cullen, K.A. (2021). E-cigarette use among middle and high school students – National Youth Tobacco Survey, United States, 2021. *Morbidity and Mortality Weekly Report*, 70(39), 1387-1389. <https://doi.org/10.15585/mmwr.mm7039a4>
- Peterson, E.B., Fisher, C.L., & Zhao, X. (2018). Pediatric primary healthcare providers' preferences, experiences and perceived barriers to discussing electronic cigarettes with adolescent patients. *Journal of Communication in Healthcare*, 11(4), 245-251. <https://doi.org/10.1080/17538068.2018.1460960>

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-cigarette use: A pilot study.

International Journal of Environmental Research and Public Health, 15(4), 830-839.

<https://doi.org/10.3390/ijerph15040830>

Romijnders, K.A., van Osch, L., de Vries, H., & Talhout, R. (2018). Perceptions and reasons

regarding e-cigarette use among users and non-users: A narrative literature review.

International Journal of Environmental Research and Public Health, 15(6), 1-20.

<http://dx.doi.org.ezproxy1.lib.asu.edu/10.3390/ijerph15061190>

Rosenstock, I.M. (1974). Historical origins of the health belief model. *Health Education*

Monographs, 2(4), 328-335. <https://doi.org/10.1177/109019817400200403>

Rosenstock, I.M., Strecher, V.J., & Becker, M.H. (1988). Social learning theory and the health

belief model. *Health Education Quarterly*, 15(2), 175-183.

<https://doi.org/10.1177/109019818801500203>

Rosswurm, M.A. & Larrabee, J.H. (1999). A model for change to evidence-based practice.

Journal of Nursing Scholarship, 31(4), 317-322. <https://doi.org/10.1111/j.1547->

[5069.1999.tb00510.x](https://doi.org/10.1111/j.1547-5069.1999.tb00510.x)

Selph, S., Patnode, C., Bailey, S.R., Pappas, M., Stoner, R., & Chou, R. (2020). Primary care-

relevant interventions for tobacco and nicotine use prevention and cessation in children

and adolescents: Updated evidence report and systematic review for the U.S. Preventive

Services Task Force. *Journal of American Medical Association*, 323(16), 1599-1608.

<https://doi.org/10.1001/jama.2020.3332>

Stalgaitis, C.A., Navarro, M.A., Wagner, D.E., & Walker, M.W. (2020). Who uses tobacco

products? Using peer crowd segmentation to identify youth at risk for cigarettes, cigar

products, hookah, and e-cigarettes. *Substance Use & Misuse*, 55(7), 1045-1053.

<https://doi.org/10.1080/10826084.2020.1722698>

Substance Abuse and Mental Health Services Administration. (2019). *Reducing vaping among youth and young adults*.

https://store.samhsa.gov/sites/default/files/SAMHSA_Digital_Download/PEP20-06-01-003_508.pdf

Truth Initiative. (2019, February 26). *How much nicotine is in JUUL?*

<https://truthinitiative.org/research-resources/emerging-tobacco-products/how-much-nicotine-juul>

U.S. Preventative Services Task Force. (2020). Primary care interventions for prevention and cessation of tobacco use in children and adolescents: U.S. Preventative Services Task Force Recommendation Statement. *Journal of the American Medical Association* 323(6), 1590-1598. <https://doi.org/10.1001/jama.2020.4679>

Yang, B, Owusu, D., & Popova, L. (2019). Effects of a nicotine fact sheet on perceived risk of nicotine and e-cigarettes and intentions to seek information about and use e-cigarettes. *International Journal of Environmental Research and Public Health*, 17(1), 131-142. <https://doi.org/10.3390/ijerph17010131>

Appendix A

Evaluation and Synthesis Tables

Table A1
Evaluation Table Qualitative Studies

Citation	Theoretical/ Conceptual Framework	Design/ Method/ Sampling	Sample/Setting	Major Themes Studied/Definitions	Measurement/ Instrumentation	Data Analysis	Findings/Themes	Level of Evidence; Decision for practice/ Generalization
<p>Bascombe et al., (2016) Primary healthcare provider knowledge, beliefs, and clinic-based practices regarding alternative tobacco products and marijuana: A qualitative study</p> <p>Country: US</p>	<p>None stated, inferred KAB, HBT, CM</p>	<p>Type: Qualitative Phenomenological Theory</p> <p>Sampling: Convenience</p>	<p>N = 20</p> <p>Demographics: Average age 45.25 years, 15.93 years' experience, 65% female, 60% Caucasian; 75% MD</p> <p>Setting: Rural and urban GA HC providers in Atlanta metropolitan area and rural southern GA</p>	<ol style="list-style-type: none"> 1) Most HC providers did not identify EC when asked about tobacco products 2) Belief some tobacco products less harmful than traditional cigarettes 3) Unsure of health effects of EC or their role in smoking cessation 4) Do not inquire about specific tobacco products during screening 5) Cessation tools: brochures, brief counseling, Quit 	<p>Interview: Individual face-to-face, semi-structured 25-45 minutes; recorded</p>	<p>SPSS, descriptive analysis, MaxQDA, deductive and inductive coding methods</p>	<p>Findings:</p> <ol style="list-style-type: none"> 1) Lack of knowledge about alternative tobacco products, health implications, and addictiveness 2) Lack of empirical evidence to inform their CPG or discussions 	<p>LOE: VI</p> <p>Strengths: Identifies need for increased education regarding alternative tobacco products and marijuana, their health risks, and potential addiction</p> <p>Weaknesses: Convenience sampling, lack of</p>

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<p>Funding: NCATI of NIH</p> <p>Bias: None identified</p>			<p>Inclusion: Physician, physician’s assistant, or nurse in PCS, practice in Atlanta or 32 county service area of Cancer Coalition of South Georgia</p> <p>Exclusion: Not disclosed</p> <p>Attrition: Not disclosed</p>	<p>Line, pharmacotherapy</p>				<p>generalizability, small sample size</p> <p>Feasibility/Application to practice: Generalizable within pediatric population and HC providers</p>
<p>Gorzowski et al. (2016) Pediatrician knowledge, attitudes, and practice related to electronic cigarettes</p> <p>Country: US</p> <p>Funding: American Academy of</p>	<p>None stated, inferred KAB, HBT, CM</p>	<p>Type: Qualitative KAP survey methodology</p>	<p>N= 37</p> <p>Demographics: 76% female; average 12 years practicing; 65% primary care</p> <p>Setting: AAP annual meeting (2014)</p> <p>Inclusion: Pediatricians that</p>	<p>1) Knowledge of EC and their health effects</p> <p>2) Perceptions and attitudes towards EC</p> <p>3) Clinical practices and experiences related to EC</p> <p>Definitions: EC: nicotine delivery devices which allow users to mimic some smoking behaviors without smoking combustible tobacco</p>	<p>Focus group: 4-8 participants</p> <p>Semi structured discussion guide</p> <p>Topical questions and structured prompts</p> <p>Audio recorded and transcribed</p>	<p>Taylor-Powell and Renner’s approach to content analysis</p>	<p>Themes:</p> <p>1) EC knowledge: general, users, health effects, sources of knowledge</p> <p>2) Attitudes: Feeling wary, comparison to traditional cigarettes, smoking cessation, harm reduction</p> <p>3) Practices: screening,</p>	<p>LOE: VI</p> <p>Strengths: Increased understanding helps to develop educational resources to address EC in practice</p> <p>Weakness: Small N; convenience sample; low level evidence;</p>

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<p>Pediatrics Friends of Children Fund</p> <p>Bias: None identified</p>			<p>attended October 2014 AAP annual meeting</p> <p>Exclusion: Work less than 20 hours/week</p> <p>Attrition: 21%</p>				<p>discussion frequency, barriers to discussion, confidence</p>	<p>population demographic homogeneity (limits generalizability)</p> <p>Feasibility/Application to practice: Could be easily reproduced</p>
<p>Hwang et al., (2020) Where there's smoke, there's fire: What current and future providers do and do not know about electronic cigarettes</p> <p>Country: US</p> <p>Funding: Jefferson College of Population of Health</p>	<p>None stated, inferred KAB, HBT, CM</p>	<p>Type: Qualitative grounded theory methodology</p>	<p>N= 91</p> <p>Demographics: 33 medical students, 28 nursing students, 15 resident physicians, 15 attending physicians; 51% age 18-25</p> <p>Setting: TJU and TJU hospital</p> <p>Inclusion: Employed or studying at facility June-October 2018</p>	<p>Common words/phrases associated with:</p> <p>1) EC 2) Health implications of EC use</p> <p><i>and</i></p> <p>1) Sources of EC-related information 2) Familiarity with evidence-based health implications of EC use</p> <p>Definitions: EC: tobacco product initially marketed as cigarette alternative</p>	<p>Freelisting interview: No limit on time or number of responses</p> <p>Survey: Forced-choice and Likert-type responses</p>	<p>Saliency index (Smith's S) and basic descriptive statistics</p>	<p>Themes:</p> <ol style="list-style-type: none"> 1) Overall lack of scientifically driven understanding of EC and health-implications among HC providers 2) Lack of standardized health-oriented approach with EC discussions 3) Misinformation about EC exists and can misinform patient counseling 	<p>LOE: VI</p> <p>Strengths: Knowledge gaps and inconsistencies regarding EC among HC providers identified to improve future curriculum development in schooling and Continued Medical Education</p> <p>Weakness: Convenience</p>

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<p>Bias: Potential bias with interpretation of meaning and categorizing synonymous ideas of free listing terms</p>			<p>Attrition: None</p>				<p>4) Global lack of familiarity with trends of tobacco use in youth (increased in AP)</p>	<p>sampling from single medical center; overall small sample size; small number of RP and AP</p> <p>Feasibility/Application to practice: Could be easily reproduced among other groups of HC providers to determine knowledge deficits regarding EC</p>
<p>Peterson et al., (2018) Pediatric primary healthcare provider preferences, experiences and perceived barriers to discussing electronic cigarettes with adolescent patients</p>	<p>None stated, inferred KAB, HBT, CM</p>	<p>Type: Qualitative grounded theory methodology</p>	<p>N = 25</p> <p>Demographics: 52% male; 80% White; median number years practicing: 8.2; 44% family care physician</p> <p>Setting: Three pediatric medical offices in AMA</p>	<ol style="list-style-type: none"> 1) Topics PPCPs believe are important to discuss in clinical encounter 2) Communicative strategies PPCPs use during conversations regarding EC 3) Identify barriers to EC counseling PPCPS encounter/anticipate 	<p>Interview: Skype, phone, or in person; semi-structured script; 15-38 minutes</p>	<p>NVino software; Constant comparison method; open coding</p>	<p>Topics to discuss: Debunking myths, addressing risks, identify behavior as potential gateway substance, lack of regulation</p> <p>Discussion strategies: Emphasize medical uncertainty, use of motivational interviewing,</p>	<p>LOE: VI</p> <p>Strengths: Identify barriers to discussion/screening of adolescent EC to address and improve</p> <p>Weaknesses: Lack of diverse sample</p>

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<p>Country: US</p> <p>Funding: Not disclosed</p> <p>Bias: Social desirability bias may have affected results</p>			<p>Inclusion: PPCP that regularly counsel adolescents</p> <p>Attrition: None</p>	<p>Definitions: Adolescent: Patient's age 13-19 years</p>		<p>provide outside resources</p> <p>Conversational barriers: Lack medical knowledge, unfamiliar motivations, slang, inadequate screening, lack time</p>	<p>Feasibility/Application to practice: Could be easily reproduced to identify perceived preferences and barriers discussing EC with adolescents</p>
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Table A2
Evaluation Table Quantitative Studies

Citation	Theory/ Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice/ application to practice
<p>DiFranza et al., (2002) Measuring the loss of autonomy over nicotine use in adolescents: The DANDY Study</p> <p>Country: US</p> <p>Funding: NCI</p> <p>Bias: None discussed</p> <p>***Outdated article but relevant study due to HONC being a validated and recommended screening tool</p>	<p>AT, IST, NRT, SMT</p>	<p>Type: Quantitative longitudinal design</p>	<p>N = 679</p> <p>Demographics: 7th grade student, mixed racial and ethnic background, mean age 13 years</p> <p>Setting: Central Massachusetts, two school systems</p> <p>Inclusion: Now or previous smokers, age of 12-15 years at start of study</p> <p>Attrition: Not disclosed</p>	<p>IV: HONC measurement</p> <p>DV1: Attempt at smoking cessation</p> <p>DV2: Continued smoking until end of FU</p> <p>DV3: Daily smoking</p>	<p>Quantitative: CI 95%, <i>P</i> value < 0.05</p>	<p>Quantitative: Pearson correlation coefficient, logistic regression analysis, principal component factor analysis, <i>t</i> test, nonparametric tests (Mann-Whitney <i>U</i> test),</p>	<p>Quantitative: DV1: + HONC and failed attempt at smoking cessation (OR 29, CI 13-65)</p> <p>DV2: Continued smoking until FU (OR 44, CI 17-144)</p> <p>DV3: Daily smoking (OR 58, CI 24-142) HONC score and correlation of maximum amount smoked ($r = 0.65, P < 0.001$); HONC score and maximum frequency</p>	<p>LOE: IV</p> <p>Strengths: Observed reliability and internal consistency of HONC, making it validated, theory-derived tool for measuring nicotine dependence in adolescents</p> <p>Weaknesses: Narrow sample size (age range), skewed results (reporting performance expectations or sociocultural influences), reliability of self-administered vs provider collection, sex differences</p> <p>Conclusion: A single positive result on HONC associated with nicotine dependence and lost autonomy, with failed</p>

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<p>for EC use by the AAP</p>							<p>smoking ($r = 0.79, P < 0.001$)</p>	<p>smoking cessation attempt, continued smoking, and daily smoking; correlated with maximum amount smoked and frequency</p> <p>Feasibility/Application to practice: Found to be appropriate for use in adolescents as measure for nicotine dependence and predictor of relapse in smoking cessation</p>
<p>Duncan et al., (2018) Smoking prevention in children and adolescents: A systematic review of individualized interventions</p> <p>Country: US</p> <p>Funding: No funding received</p>	<p>None stated: inferred TTM</p>	<p>Type: Quantitative mixed-method SR following PRISMA guidelines</p>	<p>N = 16 studies; 51,233 participants</p> <p>Databases: MEDLINE, PsycINFO, CINHAL, PubMed, SCOPUS, Sport Discus</p> <p>Inclusion: Primary trial/experiment, English written, published after</p>	<p>IV: Smoking prevention intervention</p> <p>DV1: Self-reported smoking behavior</p> <p>DV2: Attitudes towards smoking</p> <p>DV3: Intentions to initiate and/or quit smoking in future</p>	<p>Quantitative: CI 95%, $p < 0.05$</p> <p>Qualitative major themes: Impact of smoking prevention interventions on smoking behaviors, attitudes, intentions to start or quit smoking, and influences of smoking in settings outside of schools</p>	<p>PRISMA checklist</p>	<p>DV1: Self-reported smoking behavior: 6/14 studies positive preventive effects, 2/14 nonsignificant lower smoking rates, 6/14 no effect</p> <p>DV2: 7 studies, - positivity about drug effect, frequent smoking with favorable</p>	<p>LOE: I</p> <p>Strengths: Rigorous review, extraction, and bias assessment methods; identification of potential settings/strategies for smoking prevention and intervention</p> <p>Weaknesses: Limited focus on EC use, limited inferences for reliability and validity of some interventions; key outcomes operationalized differentially across studies</p>

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<p>Bias: Individual studies may have risk for bias; evaluated by two independent reviewers; Downs and Black instrument for bias risk assessment</p>			<p>1990, smoking prevention intervention applied, intervention applied towards children/adolescents aged 7-18 years</p> <p>Attrition: N/a</p>	<p>DV4: Social and environmental influences</p>			<p>attitudes, nonsignificant changes in attitudes</p> <p>DV3: Initiation factors: sleep < 8 hours, not wearing seatbelt, alcohol in past 30 days; control group (63%) and intervention group (73%) quitting efforts; intention to try tobacco products in next year decline ($p < 0.05$)</p> <p>DV4: Smoking initiation: family/friends/significant other, smoking behaviors (+/-), parental smoking (+), parental communication (+/-)</p>	<p>limiting comparative analysis of outcomes</p> <p>Conclusion: Effective interventions utilizing interpersonal communication, support strategies, and tailored education conducted in HC settings</p> <p>Feasibility/Application to practice: Generalizable and interventions can be applied to pediatric population in PCS</p>
<p>Morean et al., (2019)</p>	<p>Not stated, inferred</p>	<p>Type: Quantitative</p>	<p>N = 1009</p>	<p>IV: EDS measurement</p>	<p>Quantitative: Bentlers CFI ></p>	<p>Descriptive statistics,</p>	<p>4-item CFA: RMSEA = 0.044,</p>	<p>LOE: IV</p>

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<p>Psychometric evaluation of the E-cigarette Dependence Scale</p> <p>Country: US</p> <p>Funding: NIDA, FDACTP, NIH, FDA CECTR</p> <p>Bias: Anonymity</p>	<p>incentive-sensitization theory</p>	<p>Cross-sectional mixed method</p>	<p>Demographics: 50.2% male, 77.1% White, mean age 35.81 years, 66.4% daily EC users, 72.6% smokers</p> <p>Setting: Recruited via Qualtrics Online Sample; email survey</p> <p>Inclusion: Weekly EC use at least once in past week, American adult</p> <p>Attrition: Not disclosed</p>	<p>DV: EC nicotine dependence</p>	<p>0.90, RMSEA < 0.08, SRMR < 0.08</p> <p>Qualitative: Online EC survey, Likert scale</p>	<p>Bentler’s CFI, RMSEA, SRMR, Cronbach’s alpha, bivariate correlations, independent samples <i>t</i>-tests</p>	<p>CFI = 0.997, SRMR = 0.010; internal consistency: alpha = 0.86,</p>	<p>Strengths: EDS psychometrically sound for EC dependence, 4-item EDS advantage over longer measuring tools</p> <p>Weaknesses: Potential skewed results (online, self-reported, anonymous), lack of sample diversity</p> <p>Feasibility/Application to practice: Could be reproduced in adolescent population</p>
<p>Rohde et al., (2018) The role of knowledge and risk beliefs in adolescent e-cigarette use: A pilot study</p>	<p>KAB Theory</p>	<p>Type: Quantitative Cross-sectional survey</p>	<p>N = 69</p> <p>Demographics: 48% male, 81% White, 41% 12th grade, 16.33 mean age, 30%</p>	<p>IV: Knowledge and risk beliefs of EC use</p> <p>DV: Adolescent EC use</p> <p>Definitions: EC liquid contains</p>	<p>Online EC survey, Likert-scale</p>	<p>Chi-square test, multivariable logistic regression, bivariate analyses, logistic regression</p>	<p>Findings: ECEU less likely to worry about HR of EC (<i>p</i> = 0.049) and believe EC leads to addiction (<i>p</i> < 0.001)</p>	<p>LOE: IV</p> <p>Strengths: Identify need for awareness of addiction and EC use through media campaigns and HC messages</p>

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<p>Country: US</p> <p>Funding: NCI, FDACTP</p> <p>Bias: None identified</p>			<p>have used EC (not current)</p> <p>Setting: National sample</p> <p>Inclusion: Age 14-18 years with smartphone, send/receive texts</p> <p>Attrition: 22%</p>	<p>addictive chemical nicotine, can prime addiction to other harmful drugs</p>		<p>analysis, SPSS version 23</p>	<p>Belief EC leads to addiction less likely to use ($p < 0.05$)</p>	<p>Weaknesses: Sample not nationally representative, modest sample size (decreased statistical power)</p> <p>Feasibility/Application to practice: May be easily reproducible within additional population samples</p>
<p>Selph et al., (2020)</p> <p>Primary-care relevant interventions for tobacco and nicotine use prevention and cessation in children and adolescents: Updated evidence report and systematic review for the US Preventative</p>	<p>None stated, inferred TTM</p>	<p>Type: Quantitative meta-analysis</p>	<p>N = 24 studies; 44,521 participants</p> <p>Databases searched: CCRCT, CDSR, MEDLINE, PsycINFO, EMBASE</p> <p>Inclusion: RCT and NRCI studies of children and adolescents evaluating prevention or</p>	<p>IV: Primary care interventions</p> <p>DV1: Initiation of tobacco products</p> <p>DV2: Smoking cessation in tobacco products users</p> <p>DV3: Smoking status at FU</p> <p>DV4: Smoking cessation with bupropion</p>	<p>CI: 95%, p value < 0.05, relative risk</p>	<p>Random-effects model (Strata version 14.2), I² statistic, coefficient 0.01, meta-regression</p>	<p>DV1: Nonsmokers decreased likelihood of initiation (13 studies); 7.4% vs 9.2%; relative risk, 0.82 (95% CI, 0.73-0.92)</p> <p>DV2: Smokers in smoking cessation: no significant benefit (9 studies): 80.7% vs 84.1%</p>	<p>LOE: I</p> <p>Strengths: Recognizes potential benefit of BI in reduction of SI in nonsmoking children and adolescents</p> <p>Weaknesses: 4 studies rated good quality, the rest fair-quality; methodology: unclear allocation concealment methods, lack of clarity regarding baseline group similarities, high attrition, many studies only examined cigarette smoking, studies published</p>

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<p>Services Task Force</p> <p>Country: US</p> <p>Funding: AHRQ, USPSTF</p> <p>Bias: Individual studies may have risk for bias, not individually discussed; two investigators individually assessed study quality/bias</p>			<p>cessation of any tobacco product, reported health outcomes, effects on tobacco use, frequency of other substance abuse, minimum 6-month follow-up, English written articles</p> <p>Exclusion: Poor quality studies</p> <p>Attrition: Individual study attrition rates not discussed</p>	<p>DV5: Smoking cessation with nicotine replacement therapy</p>			<p>DV3: continued smoking at FU; relative risk, 0.97 (95% CI 0.93-1.01)</p> <p>DV4: Bupropion cessation no significant benefit (2 studies); 17% (300 mg) and 6% (150 mg) vs 10% (placebo), 24% (150 mg) vs 28% (placebo)</p> <p>DV5: Nicotine replacement therapy no significant benefit (1 study); 8.1% vs 8.2%</p>	<p>> 10 years ago, BI heterogenous, inconsistent definitions (baseline smoking status, initiation, abstinence), few numbers of studies available</p> <p>Feasibility/Application to practice: Generalizable to apply BI to children and adolescents in the PCS</p>
<p>Stalgaitis et al., (2020) Who uses tobacco products? Using peer crowd segmentation to identify youth at risk</p>	<p>None stated, inferred SLT</p>	<p>Method: Quantitative Cross-sectional survey</p>	<p>N = 1,167</p> <p>Demographics: Age 12-17 years old (M = 14.79), non-cigarette established users 56.1% female, 59.1% Hispanic</p>	<p>IV: Peer crowd identification</p> <p>DV: Tobacco product use</p> <p>Definitions: Peer crowds: macro-level teen subcultures with</p>	<p>In-person screening survey, self-reported demographic, peer crowd, tobacco use and openness to use</p>	<p>Chi-Square test with follow up z-tests with Bonferroni corrections or ANOVA with Bonferroni corrections and</p>	<p>Findings: Risk differed by peer crowd; highest use rates Hip Hop peer crowd (12.8% (cigarettes) to 33.4% (e-cigarettes)</p>	<p>LOE: IV</p> <p>Strengths: Examines use of variety of tobacco products, sample large and geographically/demographically diverse; data collection during increased incidence of youth e-cigarette use</p>

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<p>for cigarettes, cigar products, hookah, and e-cigarettes</p> <p>Country: U.S.</p> <p>Funding: U.S. FDA</p> <p>Bias: Volunteer bias</p>			<p>Setting: Four middle schools and five high schools in CA, CO, NY, GA, and FL</p> <p>Inclusion: Middle school and high school students</p> <p>Attrition: Not disclosed</p>	<p>shared values, beliefs, interests, and norms, transcend geography and race/ethnicity (alternative, country, hip hop, mainstream, popular)</p>		<p>multivariate logistic regression</p>	<p>Differences in tobacco use between peer crowds: $p < 0.05$</p>	<p>Weaknesses: Convenience sample; lower representation in Alternative and Country peer crowds may lead to drawing conclusions about particular crowds; excluded smokeless tobacco use</p> <p>Feasibility/Application to practice: Could be easily reproduced if have appropriate sample population diversity</p>
<p>Yang et al., (2019) Effects of a nicotine fact sheet on perceived risk of nicotine and e-cigarettes and intentions to seek information about and use e-cigarettes</p> <p>Country: US</p>	<p>Theories: TR and HBM</p>	<p>Method: Quantitative RCT</p>	<p>N = 756</p> <p>Demographics: 100% current adult smokers or recent former smokers: 54.2% female 70.5% White 63.4% daily smokers 47% EC use</p> <p>Setting: Online study, participants recruited by</p>	<p>IV: Nicotine educational fact sheet</p> <p>DV: Smoker’s perceived harm of nicotine/e-cigarettes and behavior intentions to seek further information</p> <p>Definitions: Nicotine: A chemical found naturally in</p>	<p>Likert scale, pretest/posttest</p>	<p>Log-Poisson regression with robust error and linear regression</p>	<p>Nicotine harm: 95% CI = 1.51, 2.82, $p = 0.001$</p> <p>Intention to seek e-cigarette information: 95% CI = 0.15, 0.74, $p = 0.003$</p>	<p>LOE: II</p> <p>Strengths: Examines how use of educational tool may influence perception harm from nicotine products and inquiry for smoking cessation resources</p> <p>Weaknesses: Adult only sample; population demographic homogeneity (limits generalizability)</p> <p>Feasibility/Application to practice: Could easily be</p>

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<p>Funding: NIDA and NCI (NIH/FDA’s CTP)</p> <p>Bias: Preconceived beliefs regarding nicotine may bias findings</p>			<p>commercial research company</p> <p>Inclusion: Current adult smokers or recent former smoker (quit past 2 years)</p> <p>Attrition: Not disclosed</p>	<p>tobacco; main addictive ingredient in tobacco products</p> <p>E-cigarette: Electric nicotine containing devices</p>				<p>reproduced (pediatric population)</p>
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Table A3
Synthesis Table

Study	Bascombe et al., 2016	DiFranza et al., 2002	Duncan et al., 2018	Gorzowski et al., 2016	Hwang et al., 2020	Morean et al., 2019	Peterson et al., 2018	Rohde et al., 2018	Selph et al., 2020	Stalgaitis et al., 2020	Yang et al., 2019
Design/LOE	Qual, VI	Longitudinal, IV	SR, I	Qual, VI	Qual, VI	CS, IV	Qual, VI	CS, IV	MA, I	CS, IV	RCT, II
Sample											
N subjects	20	679	51233	37	91	1009	25	69	44521	1167	756
N studies			16						24		
Country	US	US	US	US	US	US	US	US	US	US	US
Demographics											
Mean age (years)	45.45	13				35.81		16.33		14.79	
Age range			7-18		18-46				12-18		
% female	65			76		49.8	48	52		56.1	54.2
% Caucasian	60					77.1	80	81		6.2	70.5
EC current/potential users		X	X			X		X	X	X	X
HCP	X			X	X		X		X		
Mean # years practicing				12			8.2				
Setting											
Home			X			X		X			X
Practice	X		X	X	X		X		X		
School		X	X							X	
Other			X								
Measurement Tools											
Survey		X				X		X		X	X
Interviews	X				X		X				
Focus group				X							
Screening tool		X				X					
Various			X						X		
Framework	KAB, HBT, CM	AT, IST, NRT, SMT	TTM	KAB, HBT, CM	KAB, HBT, CM	IST	KAB, HBT, CM	KAB	TTM	SLT	TRA and HBM
IV											
Adolescent educational tool											X

Key: **AT** Autonomy Theory **CM** Cognitive Model **CS** Cross-sectional **DV** Dependent variable **EC** Electronic cigarettes **HBM** Health Belief Model **IST** Incentive Sensitization Theory **IV** Independent variable **KAB:** Knowledge, attitudes, and behaviors **MA** Meta-analysis **N** Number **NRT** Negative Reinforcement Theory **Qual** Qualitative **SLT** Social Learning Theory **SMT** Self-medication Theory **SR** Systemic review **TR** Theory of Reason **TTM** Transtheoretical Model

Adolescent peer crowd									X	
Adolescent EC knowledge/attitudes								X		
Screening tool		X				X				
Prevention intervention			X						X	
Social/environmental influences			X							
DV										
Cessation attempt		X	X						X	
EC use/frequency		X						X	X	X
Nicotine dependence identification		X				X				
Adolescent likeliness to use EC			X							X
Outcomes										
Screening identifies EC use/dependence		X	X			X			X	
Education reduces EC use									X	X
EC use dependent on social/environmental influences			X							
Adolescent knowledge/beliefs/peer groups influence EC use								X		X
Primary care intervention influences adolescent EC use									X	
Themes										
Inadequate resources	X			X			X			
Lack of provider EC knowledge	X			X	X		X			
Lack of provider confidence				X						
Lack of EC screening					X					
Lack of time							X			

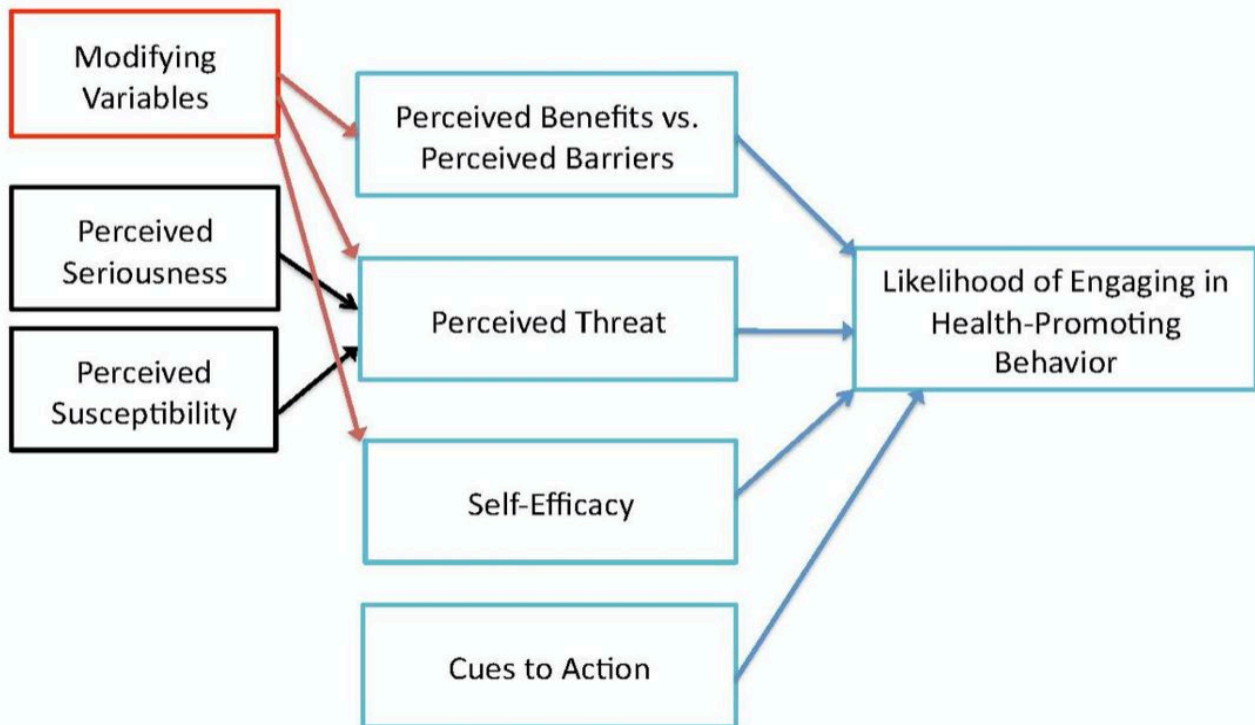
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Appendix B

Models and Frameworks

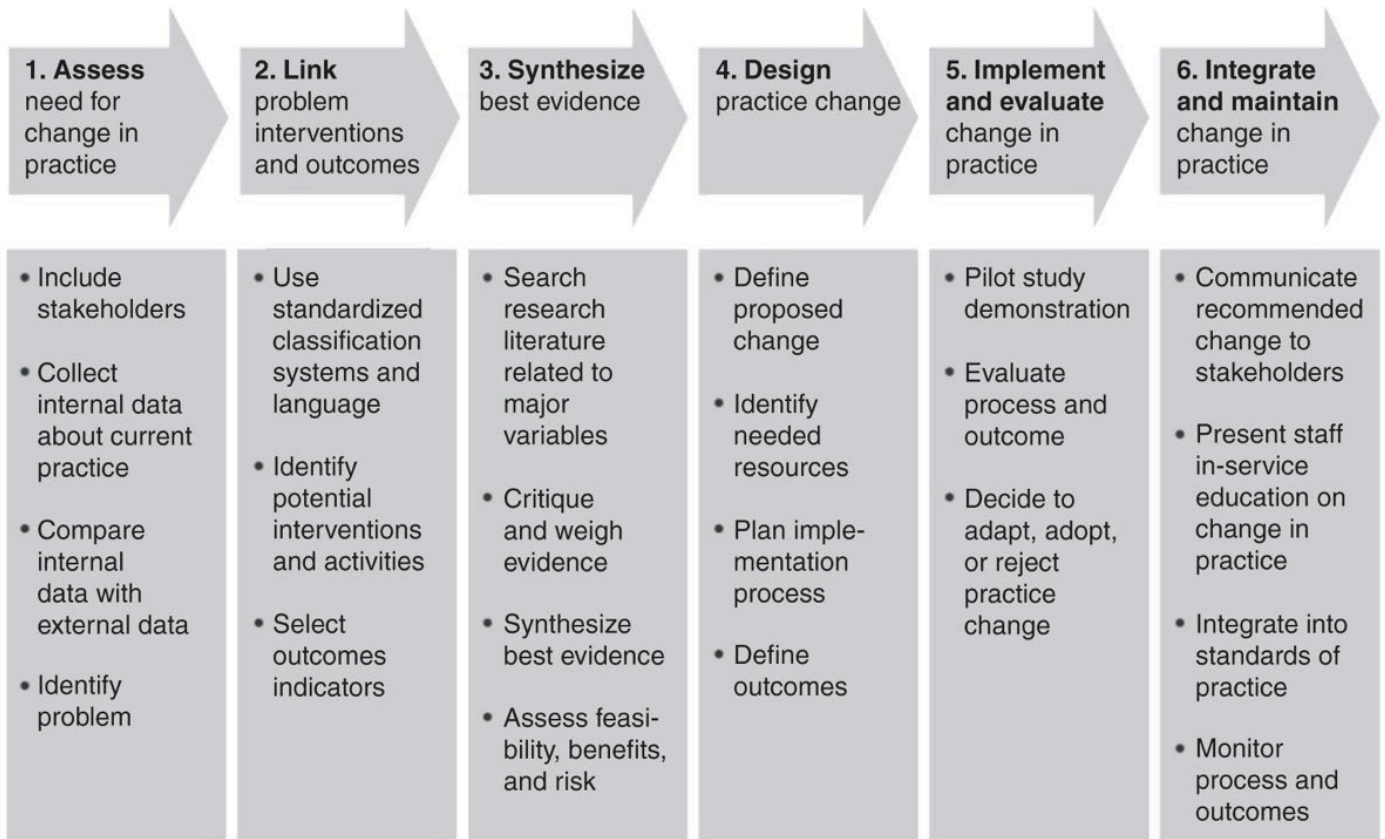
Figure B1
Health Belief Model

The Health Belief Model



Rosenstock et al. (1988)

Figure B2
Rosswurm & Larrabee Model



Rosswurm & Larrabee (1999)

Appendix C

Budget

Phase	Activities	Cost	Subtotal	Total
Preparation	Creation of pre and two post-education surveys via Survey Monkey: Standard Monthly Plan at student discount pricing rate	\$70/month		
			\$70	
Delivery				
	No anticipated costs for intervention delivery	N/a		
Evaluation				
	Intellectus SPSS software for data analysis: Student discount monthly rate	\$59/month		
			\$59	
				\$129