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Electronic cigarette use during middle school and high school has become an alarming public health concern. Educating youth about the risks of using e-cigarettes through a prevention program can be instrumental in curbing the growing numbers. Our Extension team implemented a prevention program, Escape Vapes, which adapted three Stanford University Tobacco Toolkit units. This study is an evaluation of the program that 1,347 youth in grades 5 through 12 completed. Results from the online retrospective post-pretest indicate that participation in the program significantly increased knowledge about e-cigarettes. Overall, the results indicate that Escape Vapes is an effective prevention program for increasing youths' knowledge.

Keywords: vaping, electronic cigarettes, prevention, youth, nicotine

Background

National data indicate a rise in electronic cigarette (e-cigarette) use among youth, particularly those who have never smoked (Barnett et al., 2015; Krishnasamy et al., 2020). Currently, e-cigarettes are the most used nicotine product among adolescents in the United States (Gentzke et al., 2019). In 2019, more than 5.2 million young people in the US reported using vaping devices, including 27.5% of high school students and 10.5% of middle school students (Cullen et al., 2019). As an organization, Cooperative Extension is charged with disseminating educational programs that enhance the health and well-being of youth, families, and communities (Rodgers & Braun, 2015). Extension units that serve youth are poised to play an important role in curbing the growth of e-cigarette use by informing youth of the risks.

Electronic Cigarettes Defined

E-cigarettes deliver nicotine without tobacco smoke by heating a solution of flavoring, additives, nicotine, and propylene glycol or vegetable glycerin into an aerosol to vape (Barnett et al., 2015). These devices can produce smoke that can either be undetectable or smell like sweet flavors that do not resemble traditional cigarette smoke. Many e-cigarette devices also do not visibly resemble traditional cigarettes but resemble USB flash drives and other small electronic handheld devices. Overall, studies indicate that the variety of sweet flavors and misunderstandings about nicotine content contribute to youth vaping initiation (Cullen et al., 2018; Morean et al., 2018; Oliver et al., 2019).

The variety of flavor options is a continued draw for young users (Harrell et al., 2017). Therefore, the U.S. Food and Drug Administration (FDA) has used its authority to regulate available flavors for popular devices like JUUL (U.S. Food and Drug Administration, 2020); however, all flavors are not off the market. There is also growing evidence that many of the flavors used in e-cigarettes are toxic and impact the respiratory system (Gentzke et al., 2019). Benzaldehyde is an example of a toxic ingredient in 108 out of 145 “natural” fruit flavors. Benzaldehyde irritates respiratory airways and can cause e-cigarette or vaping use-associated lung injury (EVALI; Dai & Hao, 2016).

While flavors draw youth in, nicotine creates the addictive habit. Nicotine is highly addictive, and youth are often uninformed about the nicotine levels in e-cigarettes. Studies demonstrate that the adolescent brain is highly susceptible to the effects of nicotine addiction (Leslie, 2020). The power of addictiveness is demonstrated in a study by DiFranza and colleagues (2007), who followed sixth graders for four years to study nicotine addiction. This study highlighted that nicotine withdrawal symptoms and failed attempts to quit happen despite youth starting with infrequent and low levels of nicotine use. DiFranza et al. (2007) also found that the most susceptible youth in the sixth grade (10%) lost their autonomy to stop smoking within two days of nicotine use, and 25% lost their autonomy within 30 days of inhaling their first e-cigarette.

Youth Knowledge of Electronic Cigarettes

Many youth who use the wide selection of flavors are unaware of their nicotine exposure and have decreased risk perception (Boccio et al., 2020). Bernat et al. (2018) found that less than half of the youth in their study reported that e-cigarettes are harmful to their health. Other studies indicate that youth perceive e-cigarettes and other vaping products to be safer than conventional cigarettes, despite data suggesting these products are harmful because of nicotine and other chemicals in the flavors (McConnell et al., 2017; Tierney et al., 2016). Therefore, prevention programs must focus on educating and shifting knowledge, beliefs, and risk perceptions to reduce the initiation of these devices. In response to this growing educational need, our Extension team implemented a school-based prevention program, *Escape Vapes*. Our guiding evaluation question is, “To what extent did participants have knowledge gains concerning nicotine and e-cigarette risk after participating in the program?”

Program Description

Escape Vapes is a vaping prevention program that utilizes lessons and activities from the *Stanford University Tobacco Prevention Toolkit* (The Toolkit; Stanford Medicine, n.d.). The Toolkit is an evidence-informed, theory-based resource designed to prevent the use of nicotine and tobacco products during adolescence. The program is comprised of a PowerPoint presentation with embedded Kahoot! quizzes and discussion questions to engage youth. Our team of seven regional agents implemented three units from the Stanford prevention toolkit module focused on electronic cigarettes:

- **Unit 6: What are JUULs and other pod-based systems?** Unit 6 explains how JUULs work, their nicotine content, as well as the health risks and impacts associated with using these products. Since JUUL and other pod-based systems are the most popular, we begin with this unit first.
- **Unit 3: What is so bad about E-cigarettes/Vape pens?** Unit 3 explains the harmful effects of nicotine and e-juice flavors on the body and brain.
- **Unit 4: Why do e-cigarettes and vape pens matter to young people?** Unit 4 explains the marketing strategies that seek to manipulate them into smoking and helps them understand how to counter the appeal of vaping. Our team added a refusal skill activity from The Toolkit to the end of this module.

Agents make connections with school counselors, administrators, and teachers to gain access to middle and high school classrooms. The program is often implemented in elective classes that last 50 minutes. During the 50 minutes, the educator teaches a lesson over three consecutive weeks. Overall, *Escape Vapes* aims to help students understand electronic cigarettes/pods/vape pens and the health and addiction risks of using these devices.

Methods

During 2019 and 2020, 1,347 youth from 13 counties participated in our online retrospective post-pre survey. We used Qualtrics XM™ to design a survey that measured youth knowledge gains related to key learning components of *Escape Vapes*. The survey was distributed by link or QR code on the last day to evaluate the program. Youth could complete the survey using a smartphone, desktop computer, or Chromebook. Youth participants concurrently self-reported their knowledge of each question before and after participating in the program using a single-assessment retrospective post-pre survey. Previous research supports using a retrospective post-pre survey because it provides efficient data collection and meaningful empirical documentation of program change (Nolte et al., 2012).

Measures

The *Escape Vapes* Survey includes 22 items that include demographics, e-cigarette use, and knowledge of e-cigarettes, especially JUULpods, because they are the most popular for adolescents (See Table 2). Youth respond twice for each question, first noting their knowledge level before the program and then identifying their current knowledge after participating in the program. These items are rated using a 4-point Likert scale that was reverse coded to indicate 1 (*none*) to 4 (*a lot*). The eight items on the *Escape Vapes* Survey have pre-program reliability of 0.86 and post-program reliability of 0.88. We also measured the rate of e-cigarette use by reporting the number of days youth vaped in the last 30 days (0 days, 1-5 days, 6-11 days, 12-19 days, and 20-30 days).

Data Analysis

De-identified data were analyzed using the 26th version of the Statistical Package for the Social Sciences (SPSS). This study aims to examine change in youths' knowledge after participating in the *Escape Vapes* Prevention Program. Given the ordinal nature of the data, we conducted a Shapiro-Wilk test to test the normality of the seven knowledge gain items. Significant Shapiro-Wilks test on each item indicated that a non-parametric analysis would be most appropriate for the data, $W(1,347) = 0.46-0.88, p < 0.001$. Therefore, we conducted a Wilcoxon Signed Rank test to assess the change in youths' e-cigarette knowledge before and after the *Escape Vapes* Program.

Results

Table 1 describes the demographic characteristics of the youth participating in the *Escape Vapes* Program. The sample was racially diverse, and one-half of the youth who participated in the study were in the 7th or 8th grade.

Table 1. Sociodemographic Characteristics of Participants

Sample Characteristics	<i>n</i>	%
Grade Level		
5 th -6 th grade	346	25.7
7 th -8 th grade	720	53.5
9 th -10 th grade	188	14
11 th -12 th grade	93	6.9
Gender		
Male	666	49.4
Female	615	46.7
Race		
White	668	49.6
African American/Black	451	33.5
More than one race	115	8.5
Latino/Hispanic	57	4.2
American Indian/Alaska Native	33	3.4
Asian	13	1.0
Native Hawaiian/Pacific Islander	4	0.3
E-cigarette Use in Past 30 days		
0 days	1,214	90.1
1-5 days	57	4.2
6-11 days	25	1.9
12-20 days	24	1.8
20-30 days	27	2.0

Note: $N = 1,347$

The Wilcoxon Signed Ranks test indicated a statistically significant mean difference, pre to post, across survey items. Table 2 shows statistically significant knowledge gains for youth across all seven items. Youth reported the greatest knowledge gains for “Knowledge of what’s in a JUULpod” ($Z = -22.06, p < .001, r = -0.43$) and “Knowledge that one JUULpod has as much nicotine as one pack of cigarettes” ($Z = -17.99, p < .001, r = -0.35$). Youth reported a slight increase in their “Confidence to avoid nicotine products” ($Z = -9.76, p < .001, r = -0.19$).

Furthermore, most youth self-report no e-cigarette use in the last 30 days (90%). Only 2% report e-cigarette usage every day, and 4.2% report using e-cigarettes 1 to 5 days in the last 30 days. Post-program, 61.94% of youth perceived e-cigarettes as more addictive than traditional cigarettes and only 5.56% perceived that they were less addictive.

Table 2. Mean and Standard Deviation of Pre- and Post-Program E-cigarette Knowledge Scores

Item	N	Pre-test	Post-test	r	Z	p
		Mdn	Mdn			
Understanding how nicotine affects my brain.	1,347	3	4	-0.38	-19.96	< .001
Knowledge that E-cigarettes can contain nicotine.	1,347	4	4	-0.22	-11.16	< .001
Knowledge that one JUULpod has as much nicotine as one pack of cigarettes.	1,347	3	4	-0.35	-17.99	< .001
Knowledge of the long-term effects of vaping and JUULing.	1,347	3	4	-0.33	-17.05	< .001
Knowledge of what’s in a JUULpod.	1,347	3	4	-0.43	-22.06	< .001
How e-cig, electronic cigarette, JUULpod manufacturers target young people.	1,347	3	4	-0.30	-15.49	< .001
Confidence to avoid nicotine products.	1,347	4	4	-0.19	-9.76	< .001

Figures 1a -1h. Frequencies of Pre- and Post-Program E-cigarette Knowledge Scores



Note: N = 1,347, * p ≤ .0005

Discussion

The results indicate that *Escape Vapes* is an effective prevention program for increasing knowledge about the risk of e-cigarette use. Recent studies indicate a widespread misperception about nicotine and e-cigarettes during adolescence (Bernat et al., 2018; Boccio et al., 2020; Pepper et al., 2018). Therefore, increasing knowledge is a meaningful outcome for preventing electronic cigarette use.

Perception of harm is also a factor in whether youth initiate e-cigarette use. This study indicates that youth's perception of harm increased concerning JUUL usage, with youth perceiving e-cigarettes as more addictive than traditional cigarettes post-program. Increasing youth's perception of harm is an important outcome for youth participants. In studies on perception of harm, youth who are susceptible or have already used e-cigarettes are less likely to report possible harm than committed non-users (Amrock et al., 2015; Bernat et al., 2018; Hammig et al., 2017). Therefore, if youth perceive e-cigarette use as harmful, they may be less likely to initiate use.

Prevention efforts are essential because nicotine addiction has short and long-term consequences. It not only poses current and future health risks, but recent studies indicate that vaping is associated with future combustible cigarette smoking for youth (Levy et al., 2019). Among youth and young adults, there is moderate evidence that e-cigarette use increases the frequency and intensity of subsequent combustible tobacco cigarette smoking, as well as alcohol abuse in adulthood (Leslie, 2020). Therefore, preventing youth from using e-cigarettes in adolescence may prevent future substance use in adulthood.

There are several limitations to this study. First, knowledge gains do not always translate into youth resisting nicotine. A longitudinal approach could measure whether the program impacted youth smoking initiation. Although knowledge gains do not always translate into behavioral changes, this evaluation is important to understanding prevention efforts and their effects. A second limitation is that we only measured knowledge gains using a one-item measure. Future studies should develop constructs for better outcome measures.

More program evaluations will remedy some of the limitations in this study. For example, we did not implement a randomized control trial and therefore did not have a control group for our study. Therefore, we cannot determine causality. Furthermore, since we did our post-test right after the program, we cannot assess how long the youth retained this information. Despite not having a control group, assessing knowledge gains is still valuable. Programs focusing on vaping prevention are still new, so preliminary information is informative for future studies.

Based on the results of this study, we recommend that youth educators who engage in vaping prevention focus on helping youth increase their knowledge of the risk of e-cigarettes and increase their perception of harm. Youth who are knowledgeable about the risk of electronic

cigarettes may be more likely to make better health decisions. Furthermore, using an evidence-informed program is important to program success. The Stanford University Tobacco Toolkit is a free resource that can be used and tailored to the context. While this resource is excellent, other programs should be evaluated to understand new ways we may impact adolescent health behaviors.

References

- Amrock, S. M., Zakhar, J., Zhou, S., & Weitzman, M. (2015). Perception of e-cigarette harm and its correlation with use among US adolescents. *Nicotine & Tobacco Research, 17*(3), 330–336. <https://doi.org/10.1093/ntr/ntu156>
- Barnett, T. E., Soule, E. K., Forrest, J. R., Porter, L., & Tomar, S. L. (2015). Adolescent electronic cigarette use. *American Journal of Preventive Medicine, 49*(2), 199–206. <https://doi.org/10.1016/j.amepre.2015.02.013>
- Bernat, D., Gasquet, N., Wilson, K. O. D., Porter, L., & Choi, K. (2018). Electronic cigarette harm and benefit perceptions and use among youth. *American Journal of Preventive Medicine, 55*(3), 361–367. <https://doi.org/10.1016/j.amepre.2018.04.043>
- Boccio, C. M., Jackson, D. B., & Leal, W. E. (2020). Nicotine and marijuana attitudes among flavor-only vaping youth: New evidence from Monitoring the Future. *Addictive Behaviors, 102*, Article 106186. <https://doi.org/10.1016/j.addbeh.2019.106186>
- Cullen, K. A., Ambrose, B. K., Gentzke, A. S., Apelberg, B. J., Jamal, A., & King, B. A. (2018). Notes from the field: Use of electronic cigarettes and any tobacco product among middle and high school students—United States, 2011–2018. *Morbidity and Mortality Weekly Report, 67*(45), 1276–1277. <http://doi.org/10.15585/mmwr.mm6745a5>
- Cullen, K. A., Gentzke, A. S., Sawdey, M. D., Chang, J. T., Anic, G. M., Wang, T. W., Creamer, M. R., Jamal, A., Ambrose, B. K., & King, B. A. (2019). E-cigarette use among youth in the United States, 2019. *JAMA, 322*(21), 2095–2103. <https://doi.org/10.1001/jama.2019.18387>
- Dai, H., & Hao, J. (2016). Flavored electronic cigarette use and smoking among youth. *American Academy of Pediatrics, 138*(6), Article e20162513. <https://doi.org/10.1542/peds.2016-2513>
- DiFranza, J. R., Savageau, J. A., Fletcher, K., O’Loughlin, J., Pbert, L., Ockene, J. K., McNeill, A. D., Hazelton, J., Friedman, K., Dussault, G., Wood, C., & Wellman, R. J. (2007). Symptoms of tobacco dependence after brief intermittent use: The Development and Assessment of Nicotine Dependence in Youth–2 study. *Archives of Pediatrics & Adolescent Medicine, 161*(7), 704–710. <https://doi.org/10.1001/archpedi.161.7.704>
- Gentzke, A. S., Creamer, M., Cullen, K. A., Ambrose, B. K., Willis, G., Jamal, A., & King, B. A. (2019). Vital signs: Tobacco product use among middle and high school students—United States, 2011–2018. *Morbidity and Mortality Weekly Report, 68*(6), 157–164. <http://doi.org/10.15585/mmwr.mm6806e1>

- Hammig, B., Daniel-Dobbs, P., & Blunt-Vinti, H. (2017). Electronic cigarette initiation among minority youth in the United States. *The American Journal of Drug and Alcohol Abuse*, 43(3), 306–310. <https://doi.org/10.1080/00952990.2016.1203926>
- Harrell, M. B., Weaver, S. R., Loukas, A., Creamer, M., Marti, C. N., Jackson, C. D., Heath, J. W., Nayak, P., Perry, C. L., & Eriksen, M. P. (2017). Flavored e-cigarette use: Characterizing youth, young adult, and adult users. *Preventive Medicine Reports*, 5, 33–40. <https://doi.org/10.1016/j.pmedr.2016.11.001>
- Krishnasamy, V. P., Hallowell, B. D., Ko, J. Y., Board, A., Hartnett, K. P., Salvatore, P. P., Danielson, M., Kite-Powell, A., Twentyman, E., Kim, L., Cyrus, A., Wallace, M., Melstrom, P., Haag, B., King, B. A., Briss, P., Jones, C. M., Pollack, L. A., Ellington, S., & Lung Injury Response Epidemiology/Surveillance Task Force. (2020). Update: Characteristics of a nationwide outbreak of e-cigarette, or vaping, product use-associated lung injury - United States, August 2019-January 2020. *Morbidity & Mortality Weekly Report*, 69(3), 90–94. <http://doi.org/10.15585/mmwr.mm6903e2>
- Leslie, F. M. (2020). Unique, long-term effects of nicotine on adolescent brain. *Pharmacology Biochemistry and Behavior*, 197, Article 173010. <https://doi.org/10.1016/j.pbb.2020.173010>
- Levy, D. T., Warner, K. E., Cummings, K. M., Hammond, D., Kuo, C., Fong, G. T., Thrasher, J. F., Goniewicz, M. L., & Borland, R. (2019). Examining the relationship of vaping to smoking initiation among US youth and young adults: A reality check. *Tobacco Control*, 28(6), 629–635. <http://doi.org/10.1136/tobaccocontrol-2018-054446>
- McConnell, R., Barrington-Trimis, J. L., Wang, K., Urman, R., Hong, H., Unger, J., Samet, J., Leventhal, A., & Berhane, K. (2017). Electronic cigarette use and respiratory symptoms in adolescents. *American Journal of Respiratory and Critical Care Medicine*, 195(8), 1043–1049. <https://doi.org/10.1164/rccm.201604-0804OC>
- Morean, M. E., Butler, E. R., Bold, K. W., Kong, G., Camenga, D. R., Cavallo, D. A., Simon, P., O'Malley, S. S., & Krishnan-Sarin, S. (2018). Preferring more e-cigarette flavors is associated with e-cigarette use frequency among adolescents but not adults. *PLoS ONE*, 13(1), Article e0189015. <https://doi.org/10.1371/journal.pone.0189015>
- Nolte, S., Elsworth, G. R., Sinclair, A. J., & Osborne, R. H. (2012). The inclusion of ‘then-test’ questions in post-test questionnaires alters post-test responses: A randomized study of bias in health program evaluation. *Quality of Life Research*, 21(3), 487–494. <https://doi.org/10.1007/s11136-011-9952-1>
- Oliver, A. P., King, K. A., & Vidourek, R. A. (2019). JUUL use among adolescents: A call to action. *American Journal of Health Studies*, 34(4), 196–205. <https://doi.org/10.47779/ajhs.2019.48>
- Pepper, J. K., Farrelly, M. C., & Watson, K. A. (2018). Adolescents’ understanding and use of nicotine in e-cigarettes. *Addictive Behaviors*, 82, 109–113. <https://doi.org/10.1016/j.addbeh.2018.02.015>

- Rodgers, M., & Braun, B. (2015). Strategic directions for Extension health and wellness programs. *Journal of Extension*, 53(3), Article 11.
<https://tigerprints.clemson.edu/joe/vol53/iss3/11/>
- Stanford Medicine. (n.d.). *The tobacco prevention toolkit*.
<https://med.stanford.edu/tobaccopreventiontoolkit/about.html>
- Tierney, P. A., Karpinski, C. D., Brown, J. E., Luo, W., & Pankow, J. F. (2016). Flavour chemicals in electronic cigarette fluids. *Tobacco Control*, 25(e1), e10-e15.
<http://doi.org/10.1136/tobaccocontrol-2014-052175>
- U.S. Food and Drug Administration. (2020, January 2). *FDA finalized enforcement policy on unauthorized flavored cartridge-based e-cigarettes that appeal to children, including fruit and mint* [Press release]. <https://www.fda.gov/news-events/press-announcements/fda-finalizes-enforcement-policy-unauthorized-flavored-cartridge-based-e-cigarettes-appeal-children>

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