5-2020

How Vaping Is Impacting One Rural High School and What Can Be Done

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25 April 2020

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Abstract

How vaping is impacting one rural high school and what can be done. There has been an increase in the number of teens vaping. In order to understand this epidemic among teens and vaping, this research answers the following questions: What is vaping and why is it a problem? What are the health risks of vaping? Why is vaping among teens a concern? How is vaping impacting teens in local high school? In a review of literature on vaping, the research shows the negative impact on health and the increasing popularity of vaping especially among youth. This action research project reports on a collaboration between CSUMB Liberal Studies students and a local high school to learn what students know about vaping. Our findings indicate a need for more instruction on the health risks of vaping.

Introduction and Background

I am the parent of a high school student. One evening, as I was folding clothes, I found a vaping pen in my 16-year-old daughter's pants. I questioned her about the pen, and she stated it wasn't hers. My parenting sense suggested to me that she may have tried it. I went over with her my knowledge and health risk of the pens as a deterrent. I also shared with her my own use and struggle with tobacco. My daughter insisted that she didn't do it and hadn't tried it, regardless if she did or if she didn't the monkey was now in my house and who knows who else's house, he's in. This is what sparked my curiosity and concerns of vaping among teens and what the health risk. I hope to delve into and uncover what is vaping and why is it a problem.

According to Patrick, Miech, Carlier, O'Malley, Johnston & Schulenberg (2016), vaping gained traction in popularity amidst adolescent and young adults due to the introduction of electronic cigarettes in the last decade. The widespread use of vaping among adolescents has increased significantly over the past five years. As stated by Patrick, Miech, Carlier, O'Malley, Johnston & Schulenberg (2016), the number of adolescents and youths indulged in vaping has grown from one and a half percent since 2011 to sixteen percent in 2016. The growth is more prevalent among youths and adolescents. The number of high school students indulging in vaping in the United States has overtaken the use of tobacco cigarettes. The growth is attributed to heavy investment in advertising investments in the United States. The advertising investment budget in vaping plummeted to one hundred dollars in 2014 from six million dollars in 2011.

A review of literature about electronic cigarettes indicates that eight million youths and adolescents were exposed to vaping advertisements in 2014. The growing advertisement and awareness among teens are the leading reason for the growing use of vaping by youths and adolescents. Besides, the number of students using electronic cigarettes increased by eleven

percent in the previous thirty days in 2016. A survey conducted by Patrick, Miech, Carlier, O'Malley, Johnston & Schulenberg (2016) indicated that vaping teens and adolescents are more vulnerable to consequently start and continue to more incessant and heavy smoking. E-cigarettes were initiated into the market in 2006 as a lower-risk alternative for tobacco smoking adults and to aid in smoking cessation.

During the introduction of electronic cigarettes, they were not regulated by the Food and Drug Administration since they were not considered and categorized and as tobacco substances. In 2014, the Food and Drug Administration researched to assess the impact of e-cigarettes on helping teens to cede smoking. The research shows that the number of tobacco smoking youth reduced significantly and leveled off. However, the increasing number of adolescents and young adults indulging in vaping emerged as a point of concern. The research shows an increasing number of middle and high school students expose adolescents and teens to the dangers of nicotine Patrick, Miech, Carlier, O'Malley, Johnston & Schulenberg (2016).

Literature Review

What is vaping?

In the 50s, the risk of smoking was identified, following extensive campaigns to prevent smoking. The new health risk to have replaced smoking appears to be vaping and our teens and youth are primary targets for this health risk.

Why is this important?

Vaping among youths is hazardous and quite addictive. Despite the reduction of the prevalence of tobacco smoking by adolescents and teens, the administration of nicotine has emerged in a totally new way through vaping (Selekman, 2019; Knopf, 2018). Vaping has negative implications on the health of teens and adolescents. Selekman (2019) indicates that the use of electronic cigarettes has significantly increased among school-going teens in the last ten years. E-cigarette or electronic nicotine delivery system is defined by the National Institute of Drug Abuse (2018) as a device operated using a battery to inhale an aerosol that contains nicotine, flavorings, and other different chemicals.

According to Selekman (2019), the available vaping brands are over four hundred. The most prominent flavor is the Juuls. E-cigarettes can come in various designs and shapes like pipes and cigars. Selekman (2019) suggests that the increasing popularity of electronic cigarettes has successfully averted fifty years of declining use of tobacco among youths. The initial intentions of electronic cigarettes were to act as a smoking cessation aid to be used by adults with long term cigarette smoking addiction. Nonetheless, the use of electronic cigarettes is now more common among adolescents and youth adults than among non-youth adults. Also, Selekman (2019) indicated that vaping products had metamorphosed the outlook of nicotine

application among youths. This has largely been contributed by technology advancement, appealing designs, and coupled with spirited marketing and social media sensitization.

E-cigarettes have developed to be the main source of nicotine vulnerability among youth in a span of only three years. According to Knopf (2018), there is an urgent need for a combative sensitization and education to address the negative effects of electronic cigarettes among youths through well-structured health policy. Currently, one problem is that there is a research discrepancy on vaping, that conflicts with other research on the negative impacts of e-cigarettes. The contradictory research states that the use of e-cigarettes has useful outcomes as it reduces the use of tobacco products. While on the other hand, there is evidence that it is more addictive. The need for the establishment of stern regulations and government scrutiny of the e-cigarette industry is suggested by Selekman (2019). The suggestion aims at using the regulations to curb and regulate the use of e-cigarettes to reverse the use of it among youth adults. The increasing use of e-cigarettes among young adults calls for prompt enactment of policy and an urgent public education campaign to overturn the trend and protect young adults from the dangers of vaping.

According to Selekman (2019) and McGee and Goldschmidt (2019), the application of e-cigarettes among young adults has resulted in a public health outcry in the United States. This is due to the likelihood of creating a generation that is addicted to nicotine. The concern has been raised on the ground that nicotine in e-cigarettes is highly addictive in various forms, including vaping. In response to the harmful effects of e-cigarettes, McGee, and Goldschmidt (2019) gave an account of the adverse effects of vaping on health that is more severe than those caused by products emanating from tobacco.

Moreover, McGee and Goldschmidt (2019) gave a recount of nicotine's pathophysiology and its diffusion within the human body. The availability of oxygen to tissues is affected by the distribution of nicotine in the body secondary to the hormones that are made by adrenal glands. Nicotine triggers an increase in the rate of the heart and blood pressure leading to vasoconstriction of vessels and arteries and leads to failure of the small arteries to perform its functions effectively. The related effects result in atherosclerosis acceleration, as stated by McGee & Goldschmidt (2019). Additionally, when the brain is undergoing development during adolescence and young adulthood, nicotine can give rise to addiction. Addiction can lead to adverse effects like cognitive and behavioral impairments, inattention, and loss of memory. Therefore, this narrative upholds McGee, and Goldschmidt's (2019) different opinion against dissension that vaping has negative impacts on the human body, in place of good effects.

E-cigarette additives and aerosols have been indicated to have harmful impacts on the human body. According to McGee and Goldschmidt (2019), short-time exposure to propylene glycol aerosol e-cigarette consumption is asserted to have adverse and irritating effects on the respiratory system and eye. The authors also indicate that carcinogens like formaldehyde and acetaldehyde produced when high-powdered cigarettes are heated in high temperature to nicotine liquid cause cancer. Douglass (2017) asserted that metals were discovered in some aerosols of electronic cigarettes. The metals detected include lead, silver, cadmium, copper, and nickel, which is said to be the product of the heating coil. Toxic chemicals emitted from exposure to aerosols from second-hand e-cigarettes are harmful to the human body, as asserted by McGee and Goldschmidt (2019). Notwithstanding, the adverse effects of harmful substances produced from heated and aerosolized e-cigarette liquid ingredients that include toxicants, solvents, and flavorings have not been thoroughly studied. Various researchers have eluded that the use of

both vaping devices and cigarettes exposes the user to additional health concerns. This assertion is relevant because it tries to match up between the impacts of e-cigarette in a young adult and the likelihood to use other tobacco products in different forms.

Mendes (2019) deliberated on a published study that established that the fluid contained in electronic cigarette increases in toxicity during vaping. Mendes (2019) argument is of important consideration as the previous investigations of the e-cigarette's safety have failed to give accounts of the impacts of the process of vaping and accounted for only the unvaporized fluid. Mendes made a comparison between cytotoxic effects of unpaved electronic cigarette liquid to those of vapor condensate of electronic cigarettes. The researcher treated the alveolar macrophages were exposed to both e-cigarette vapor condensate and unvapored e-cigarette liquid. Mendes (2019) established e-cigarette vapor condensate to be cytotoxic at lower concentrations and resulted in more deaths of the cells than unvapored e-cigarette liquid.

Overproduction of excessive reactive oxygen species was found to inhibit phagocytosis and results in impaired bacterial clearance Mendes (2019). The impairment of bacterial clearance coupled with inflammatory chemokines and cytokines may result in inflammation of alveolar macrophages when induced by the vapor. Despite the need for further research, Mendes (2019) indicated that e-cigarette vapor condensate is notably more toxic to lung immune cells than the non-vaped unpaved e-cigarette liquid that is normally being researched on. Furthermore, the author cautions against a popular belief that e-cigarettes are safe. In opposition, the survey carried out on smokers in 2016 suggested that e-cigarettes were less harmful as compared to a conventional cigarette.

Vaping can also have a damaging impact on the pulmonary as it has a negative effect on the epithelial-rich oral cavity. Sherry, Blackstad, and Wheatley (2017) affirmed that oral epithelial cells are shed fast and undergo a rapid regeneration to maintain the normal cellular equilibrium. In a study conducted by Sherry et al. (2017), a study conducted in 2015 established that vapor with or without nicotine proved to be cytotoxic to the lines of the cells and induce breaks in DNA strands. Individuals who engaged in vaping experience multiple times in a day exposed their already damaged epithelial cells to these harmful substances resulting in oral ulcerations and cancer and abnormal mutations. In addition, due to vaping, it becomes harder for the human body to kill and prevent harmful microorganisms leading to a compromise in the immune system and, eventually, illness. A study conducted in 2011 by Sherry et al. (2017) found out that six percent of the reported irritation of the mouth, dry mouth, and sore throat were reported by eight percent of the sample population while eight percent reported coughing after eight weeks.

The variation of nicotine content in e-cigarette cartridges can result in immediate adverse effects. The normal content of nicotine ranges from 3 mg to 24 mg. Nevertheless, content can vary to as high as 100 mg per cartridge. The increased level of nicotine can result in an increase in the risk of nicotine toxicity. Researchers have demonstrated that various palatal injuries, nasal and oral damage to be the most common respiratory tract burns. The health complications that have been documented in the past include increased heart rate and pressure, ulcerative colitis, inflammation of the airways, impaired bacterial phagocytosis, and impaired immunological response.

According to Chen (2017), when e-cigarettes were first introduced in the market in 2007, some of the discreet devices were designed to resemble regular cigarettes while others were

designed to look like cigars, pipes, and USB flash drives. To account for various designs for electronic cigarette designs, various researchers have categorized e-cigarettes as first, second, and third-generation e-cigarette devices. Chen (2017) suggests that first-generation e-cigarettes resemble conventional cigarettes and is disposable. The author describes second-generation e-cigarettes as large, a pen-shaped device that is rechargeable. Additionally, Chen (2017) referred to a third-generation e-cigarette as a device that does not have a resemblance to conventional combustible cigarettes and normally has large and customized batteries. Parts of the third-generation e-cigarettes are replaceable and refillable, and it is the main reason why they are sometimes called "mods."

One of the most popular JUUL among the youths entered the market in 2015, as indicated by Chen (2017), and established itself as the leading e-cigarette product constituting three-quarters of the cigarette marketplace. According to the researcher, other products resembling JUUL, including Vuse Alto, Suorin Drop, and myblu preceded the high technology design and high nicotine administration using nicotine salt electronic liquid formulations. As affirmed by the author, these devices are not only referred to as JUUL because of its universality of the brand but also as pod mods since the e-liquid is sold in self contain and replaceable pods. The growing popularity of JUUL among youths is attributed to the copycat of devices that are explicitly compatible with it. According to Chen (2017), the compatible device includes Eonsmoke and vapor4life. The author suggests that these devices are equally high in nicotine in sleek, discreet tools that either utilize the application of JUUL pods that can be designed in JUUL devices.

According to a research conducted by Cullen, Gentzke, Sawdey, Chang, Anic, Wang & King, (2019) to estimate the preference of e-cigarette among the United States high and middle school students, there are popular flavors like Cinnamon, vanilla, creamy, menthol and

strawberry and banana. The authors affirm that certain e-cigarette flavors are riskier than others because of the chemicals used to make them and their reactions when exposed to heating and inhalation. In accordance with Cullen, Gentzke, Sawdey, Chang, Anic, Wang & King, (2019), cinnamon-flavored e-cigarettes smell and taste like a delicious snack. The authors indicated that the chemicals used to create cinnamon flavor e-cigarettes are the most harmful in the body since they damage the white cells. As stated by Cullen, Gentzke, Sawdey, Chang, Anic, Wang & King, (2019), Cinnamon is the most toxic vaping flavor as it can alter and inhibit the ability of the lungs to dispose of mucus. Although chemicals that taste and smell like Cinnamon have the approval of the FDA as food additives, researches have confirmed that the chemicals have harmful effects when heated and exhaled.

According to Ghosh, Coakley, Mascenik, Rowell, Davis, Rogers & Livraghi-Butrico, (2018), vanilla flavor tops the toxic list of e-cigarette chemicals. The research conducted by the authors indicates that the chemicals are harmful to the body since it leads to the death of the body cells. The research study conducted by Ghosh, Coakley, Mascenik, Rowell, Davis, Rogers & Livraghi-Butrico, (2018) confirms that the vanilla flavors impairs the normal function of blood vessels which results in the damage of the heart among youths. The burning of vanilla, cinnamon, cloves, strawberry, and banana flavors produces high levels of inflammatory chemicals that reduce the levels of nitric oxides in the body. The harm of vanilla has raised concerns in public health among the youth population in the United States.

According to Ghosh, Coakley, Mascenik, Rowell, Davis, Rogers & Livraghi-Butrico, (2018), diacetyl in buttered popcorn is the chemical that is used to create scents, and it is very harmful when inhaled. The conducted research indicated that diacetyl in buttered popcorn is responsible for irreversible lung diseases like bronchiolitis obliterans among youths and teens.

According to Abbasi (2020), all the e-cigarette flavors, including banana and strawberry flavor, were found to contain a high level of harmful substances that affect the cells of the heart. Dimethylpyrazine and isoamyl acetate chemicals are used to create strawberry and banana flavors, respectively. The researchers tested and confirmed the short- and long-term effects of these flavors on endothelial cells. The flavors with the most adverse effects were found to be that of strawberry since it resulted in the deaths of the cells. The research recommends avoidance of these flavors till more and detailed information about their uses is obtained.

A tadpole study conducted by Kennedy, Kandalam, Olivares-Navarrete & Dickinson, (2017), shows the effects of creamy flavors and mint flavors on human embryos by assessing its impacts on tadpoles. According to the research, the exposure of tadpoles to these flavors led to the development of clefts. However, there is not enough information regarding the safety and the impacts of vaping on humans. The research indicates that there is a sharp difference between eating up the flavors as approved as food additives by the FDA and heating them and inhaling them. Studies conducted by Kennedy, Kandalam, Olivares-Navarrete & Dickinson (2017) found out that prolonged exposure to vaping flavors like menthol is more toxic because it can kill bronchial cells.

In conclusion, various researches have indicated the surge in the use of electronic cigarettes among youths in the United States. The surge is attributed to the easy availability and aggressive advertisement of e-cigarette products. Substances contained in e-cigarettes have harmful effects and are the leading cause of pulmonary and lung diseases among the users. The carcinogenic compounds and hard metals produced by the heating elements of e-cigarettes are the leading cause of deaths caused by cancer among the users. The growing use of vaping among the youths should be controlled and reduced to contain its harmful consequences. Policy-

based intervention is needed to regulate the harmful flavors and restrict the spirited advertisement of e-cigarette products because these have higher levels of nicotine.

Methods

Given my concern as a parent, I united with the vice-principal of a local high school to investigate the prevalence of vaping. My methods consisted of: (1) Interview of the vice-principal, and (2) Development of a survey following extensive research on vaping. I created a survey to shine a light on what teens knew and didn't know about the health risk of vaping and e-cigarettes.

Participants

The study of this research on vaping in a rural high school resulted from 155 students. The students were between the ages of 15 and 18 years old that are currently in the 9^{th}, 10^{th}, 11^{th} and 12^{th} grades. There were 47.7% males, and 48.4% females and a very small population of students who identified themselves as other or uncertain. At that high school in 2020 there was a student population of 1,437. The student demographics can be seen in (figure 1)

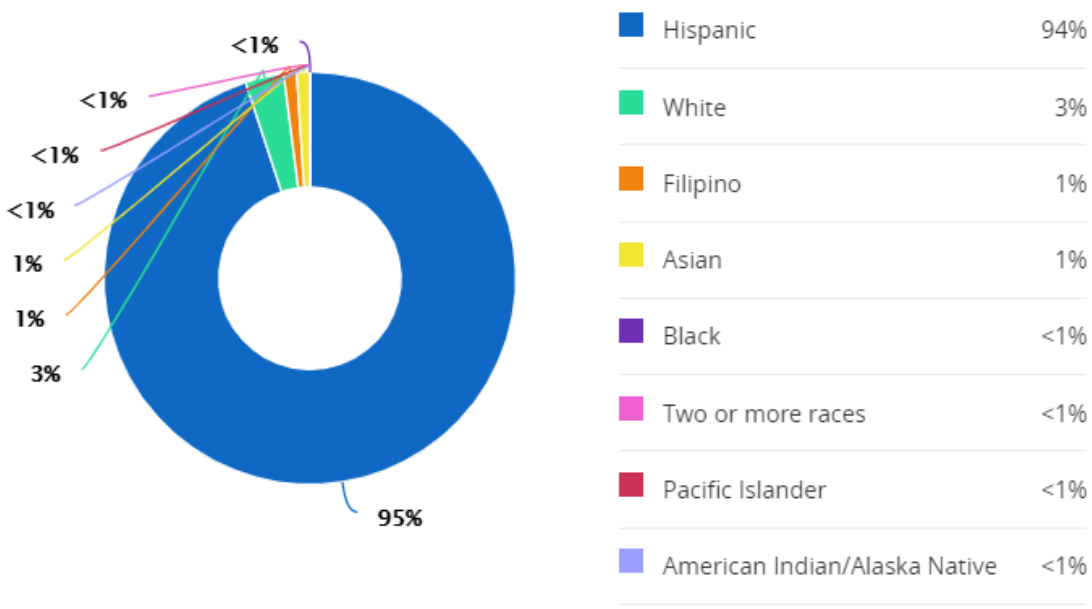


Figure 1: Student Demographics of Soledad High School in Soledad, CA provided by GreatSchool.org, 2020

Design

With permission from the Principal and Vice-Principal I was able to survey, anonymously, 200 students in which 155 students were involved to complete this study. The surveys were distributed to 5 classes on a typical school day. The survey was comprised of 17 questions of true or false and short answers to determine what high school students know about the health risk involved with vaping and e-cigarettes.

The benefits of surveys, which were chosen because they are flexible in administering, inexpensive, extensive because you can analyze a large population, like classes, and it ensures a more accurate result of data so that a better result of a better conclusion can be determined. I used graphs to show my findings.

Discussion

In order to address the research questions in this study, I conducted an interview with the vice-principal Mr. X, who has been the vice-principal at this rural high school for seven years. I asked Mr. X what kind of smoking devices he confiscates the most and he replied 98% of the time is vaping pens, vaping chargers, and hollowed out plastic pens. Vaping devices come in many forms, see (figure 2). Interestingly enough, he only confiscated 1 traditional cigarette and a joint in the last two years. Mr. X has observed that when California legalized marijuana two years ago, vaping spiked. Another interesting finding is that smoking prevention is part of the California Public School Policy, but only for 9th graders and the same for vaping and e-cigarette use. When Mr. X was asked what the biggest challenge is regarding e-cigarette use and he said it's legal for adults and, as a result, vaping appears to be the "new alcohol" for teenagers. It's easy for students to obtain materials for e-cigarettes, because students can get it from their older family members, friends and sometimes they can buy it themselves. This high school has worked with an organization called SunStreet to help with prevention approaches. If a curriculum were developed, Mr. X would like to see schoolwide education involving parents.

Figure 2: The PuffIt Vaporizer link from VapingDaily.com; Vaping Hoodie, from oregonlive.com; TicTac-Toke link from tobaccocontrol.bmj.com; Flash Drive Sized Vape from Just Fog Minifit Review; Apple-like watch from latimes.com

This is a video that aired on NBC News health segment. This episode of Students Are Hiding Vaping Devices in Plain Sight was aired October 10, 2019. The video was to bring to light the increase of vaping use along with the increase of lung disease reported by the CDC.

Globally we are fighting the COVID-19 and we are aware that a person with underlying conditions is at greater risk of contracting the virus then others. In recent news from ABC network and its affiliate partner WTA21, on April 23, 2020 aired “Smoking, vaping found to increase risk of coronavirus”. Smokers are particularly more vulnerable because smoking causes inflammation of the lungs and inflames which is where the virus lingers and attacks. Smoking has been found to more than double the odds in progression of the virus (Nguyen, 2020).

Findings

An anonymous survey was given to students between the ages of 15 and 18 years old at the same high school of Mr. X. There were 155 surveys completed on the knowledge of what students knew and didn't know about the health risk of vaping and e-cigarettes. The findings are illustrated in Figures 4-7.

Figure 4: Response to T/F statement: E-cigarettes are not harmful to health.

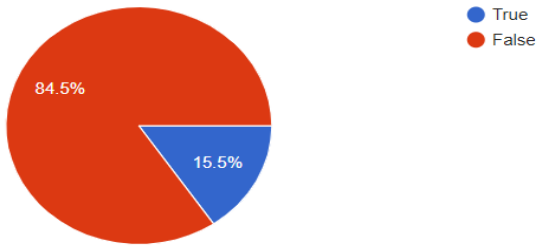


Figure 5: Re

sponse to T/F statement: E-cigarettes contribute to environmental pollution.

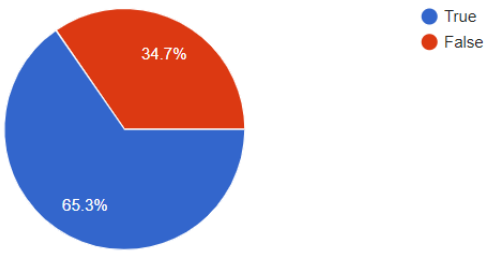


Figure 6: Response to T/F statement: The smoke from e-cigarettes is not harmful to the smoker or bystander's health.

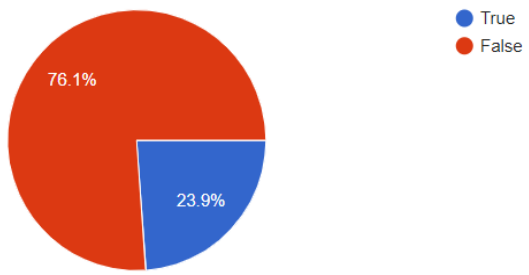
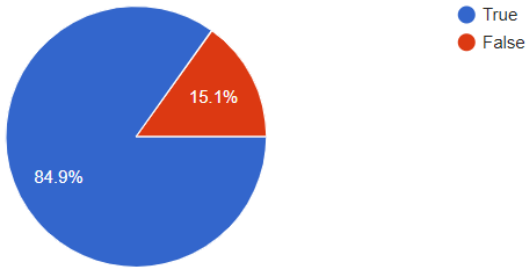


Figure 7: Response to T/F statement: E-cigarettes are easy to hide from parents and teachers.



Recommendations

Given the findings of the study, my recommendations are to bring in more health-related material to increase the high school teen's awareness on the dangers of vaping. I plan to contact the Food and Drug Administration (FDA) for Teen E-Cigarette Prevention Materials. In 2018 there was a collaboration between FDA and Scholastic, Ashley Roberts, Chief of Strategic Communications, Office of Health Communication and Education, FDA's Center for Tobacco Products teamed up with Scholastic to assist teachers with the ever-growing problem of students vaping (FDA, 2020). Through books and educational materials, Scholastic is uniquely

positioned to develop and disseminate resources featuring FDA's e-cigarette prevention messages into classrooms.

Another recommendation would be to create drop boxes around the school to drop vaping devices in, with in mind "Don't Ask, Don't Tell" policy. There can be discreet boxes around the school campus where students can drop their vaping pens or cigarettes in with no questions asked, modeled after the gun amnesty program in 1996. This would be helpful because some students may be ashamed to admit to smoking or afraid of some type of punishment for vaping.

Another suggestion may be to allow students, during quarterly assemblies on the health risk of vaping, to discretely, but in an open, comfortable, and safe atmosphere to walk-in and discuss quitting options with a health professional. I believe this program could be successful and should start off as a quarterly assembly. Sometimes schools have tv monitors up displaying team scores or after school bake sales, but maybe quarterly during the assembly videos of vaping dangers could be shown.

Limitations

Bringing in more health-related material to increase the high-schools teens' awareness of the dangers of vaping would not be highly effective. It will, however, be too late for some students to learn about the dangers of vaping in high school. Parents should have started talking about the dangers of vaping much sooner and at home.

Although creating drop boxes around the school campus to drop vaping devices could be helpful, it would be promoting the continued use of vaping devices. An alternative and more

effective method should be applied. This is because students can steal the drop boxes and the vaping devices from others.

Videos showing the dangers of vaping are recommended, but sometimes they may tend to show how trendy and cool vaping looks. This makes the videos ineffective as students may focus on the "benefits" part of the video and ignore the “dangerous” side.

Conclusion

Reflection

I found this research topic to be important and relevant to today’s teens and health risk. This has been enlightening and informative. I started off trying to scare my daughter on the risk of vaping or e-cigarettes and I opened a host of other findings to expand my knowledge and share with her which I have. I am a former smoker of 12 years and am discouraging my daughter from going down that road.

Learning Outcomes

Parents can take this research paper and have more confidence in their knowledge of this subject on teens and vaping and the health risk involved. I believe this research project analyzes the data to show the health risk in vaping and what students know and don’t know of the risk. This research project contains recommendations that can be implemented into a high school curriculum with the help of administrators, health professionals and parents.

The Major Learning Outcomes that this project satisfies are MLO 1: Developing Educator and MLO 2: Diversity and Multicultural Scholar. This research project satisfied MLO 1: Developing Educator by increasing my academic consciousness and enabling me to

recommend it to parents, school administration, and students to use methods such as vaping videos as a way of education on vaping pens and e-cigarettes. MLO 2: Diversity and Multicultural Scholar, was also fulfilled. It is that vaping among teens has been spreading rapidly due to the availability of electronic cigarettes. This is dangerous to their health. As schools have students from diverse backgrounds who have different cultures, this project can be used to educate them on vaping and its dangerous effects on their health and education. Vaping among teens is not a personal, but rather a community problem. Therefore, this project can be used to educate all members of the community on the issue and how to control it. Moreover, the project answers several questions that different people may have concerning vaping.

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Appendix A

LS 400, Capstone Survey Question

What is your age?

a. 15 b. 16 c. 17 d. 18

What gender do you identify as?

a. Male b. Female c. Other d. Uncertain

Do you know anyone who uses e-cigarettes or vapes?

a. Yes b. No

Have you ever used e-cigarettes or vaped?

a. Yes b. No c. I would never use it d. I have thought about it

True or False: Identify the health risks associated with e-cigarettes and vaping

True or False

6. E-cigarettes contain more nicotine than tobacco cigarettes.

True or False

7. E-cigarettes are more addictive than tobacco cigarettes.

True or False

8. E-cigarettes are useful in smoking cessation (They help people to STOP smoking).

True or False

9. E-cigarettes are not harmful to health.

True or False

10. E-cigarette companies care about the health of children.

True or False

11. E-cigarettes are only harmful when other drugs are added.

True or False

12. E-cigarette companies use fruit-flavors (like mango, cherry, etc.) to attract young people to buy their products.

True or False

13. E-cigarettes contribute to environmental pollution.

True or False

14. The smoke from e-cigarettes is not harmful to the smoker or bystander's health.

True or False

15. E-cigarettes are more expensive to use than tobacco cigarettes.

True or False

16. E-cigarettes are easy to hide from parents and teachers.

True or False

17. E-cigarettes are more harmful to teens than adults.

True or False