

The Effects and Implications of Vaping on the Youth Population

Julia Sisson

A Senior Thesis submitted in partial fulfillment
of the requirements for graduation
in the Honors Program
Liberty University
Spring 2020

Acceptance of Senior Honors Thesis

This Senior Honors Thesis is accepted in partial fulfillment of the requirements for graduation from the Honors Program of Liberty University.

Robyn Anderson, Ph.D.
Thesis Chair

Bethesda O'Connell, Dr.P.H.
Committee Member

Marilyn Gadowski, Ph.D.
Honors Assistant Director

Date

Abstract

Youth today have adopted the “cessation tool” known as the e-cigarette as a form of recreational activity. An examination of the history of tobacco use and prevention enables a fuller understanding of the problem presented by this product. Youth around the country are addicted to the sensation of vaping and are largely unaware of the associated health dangers. To address this growing issue among adolescents, vaping and its impact on the youth population should be carefully examined by health professionals. Although an overall solution has not yet been determined, there are several ways to impede the spread of the vaping epidemic from a public health standpoint.

Keywords: vaping, e-cigarette, epidemic, health, nicotine, danger, JUUL, youth

The Effects and Implications of Vaping on the Youth Population

Over the years, numerous health concerns and epidemics have threatened the quality of life for individuals within the United States of America. Public health efforts have targeted these issues with determination, resilience, and the use of various resources for many years. Some sicknesses have been prevented, and others have still managed to wreak havoc. Throughout these fights, health officials have sought to keep the public safe by steering them away from potentially dangerous sources. These sources have included objects, substances, behaviors, and practices.

Among the most popular sources of concern was the cigarette. The invention of the cigarette caused great alarm due to the negative health consequences associated with its use. Men, women, and adolescents throughout the United States quickly became addicted to the sensation as well as the ingredients. Since then, considerable progress has been made to minimize the desirability and use of cigarettes and other tobacco products. The health community was able to make a positive change through extended effort, and the results are still seen today. Although the cigarette is still in use, the extent of its impact has been significantly reduced due to public health efforts (Centers for Disease, 2000). Even still, smoking “remains one of the leading causes of preventable death in the United States despite heightened awareness of its dangers” (Cross, Linker, & Leslie, 2016, p. 422).

Now, a new threat has arrived. This new threat targets not only adults, but also adolescents and children who are largely unaware of the risks. This threat is termed the e-cigarette, which has rapidly become a craze, particularly among the youth population. It appears that all of the work accomplished by previous cigarette interventions is being unraveled by the phenomenon known as vaping. In addition, the e-cigarette presents a façade of safe smoking and

preys upon adolescents' desires to fit in with the crowd. In order to effectively target this health issue, the e-cigarette must be understood within the context of modern culture and evaluated through conducted research.

The risk of vaping to the American youth population cannot be stressed enough. To date, sixty reported deaths have been associated with the use of vaping technology. In addition, 2,711 vaping-associated lung injuries have occurred within the American population (Centers for Disease, 2020). The American Academy of Pediatrics (AAP, 2017) reports a 1,500% increase in monthly poison center calls received since the release of the e-cigarette. While these statistics stimulate concern, it is important to note just how many adolescents are involved in vaping. In a study conducted by the Centers for Disease Control and Prevention (2019), five million middle and high school students had used an e-cigarette device within the past thirty days. This indicates that at least five million students are at risk of death or lung injury as well as other serious health concerns.

Research is actively being conducted to determine the full extent of the e-cigarette's health impact. Ingredients and components of the e-cigarettes must be studied in-depth to view the product comprehensively. Because the e-cigarette is so new, it is difficult for researchers to identify long-term consequences of use. On the other hand, statistics and studies are finally beginning to show just how harmful short-term vaping can be, especially to youth. It is through these studies and the lenses of science, research, and health that one can understand the vaping epidemic.

In order to fully recognize the problems associated with adolescent e-cigarette use, the issue must first be discussed with context. The history of tobacco products and their correlation

to the invention of the e-cigarette present important details to consider. E-cigarettes can be defined and described from social, behavioral, and scientific aspects. A specific e-cigarette product brand, known as JUUL, relates to the youth population and social norms and deserves considerable attention from public health officials (JUUL, 2020a). By studying and targeting the issue presented by the company, healthcare professionals can glean proper techniques for addressing the vaping epidemic among teenagers.

Tobacco

Effects of Tobacco Use

Tobacco use is associated with effects that weaken the human body and cause susceptibility to diseases such as cancer. According to research, tobacco kills up to half of its users, which equates to eight million or more people every year. Not only does tobacco pose a risk to firsthand users, but it also causes harm to individuals nearby who are often exposed to the fumes. Both firsthand and secondhand smoke are significant causes of disease and concern within the public health realm (World Health Organization, 2019). Consequences of consistent tobacco use include complications like severe respiratory illness. Additionally, it has been repeatedly shown that lung growth and function are impaired in young people by the use of cigarettes and other tobacco products. Lung cancer is also heavily correlated with tobacco use (American Lung Association, 2019b). While these health issues present the greatest concern, it is important to note that these are not the only conditions associated with the use of tobacco products.

History of Tobacco as Public Health Issue

It is undeniable that cigarettes and tobacco products are some of the greatest public health threats ever faced by the United States (World Health Organization, 2019). From the beginning, tobacco products became a nationwide sensation that endangered the health of the overall population. The first popular uses of tobacco within the United States took the form of chewing, pipe smoking, inhalation, and cigar smoking. The invention of the cigarette did not occur until the early nineteenth century. Upon its introduction to society, the product was met with protest and popularity alike. Some population groups gladly received and utilized the cigarette, while others were fearful of associated health consequences (Centers for Disease, 2000). One group that particularly accepted the cigarette was young women. The cigarette became a symbol of women's freedom and independence and was an increasingly common source of recreational activity for young females in the late 1800s (Amos & Haglund, 2000; Centers for Disease, 2000). Smoking a cigarette was not considered a medical problem at this time; instead, it was treated merely as a consumer activity. It was not until 1938 that cigarettes were truly examined. An epidemiological study conducted by Raymond Pearl began to indicate a link between lung cancer and smoking habits. Even still, his concern did not come to light until 1952 when his findings were publicized (Centers for Disease, 2000). Since then, public health officials have greatly reduced the prevalence of the health-threatening product. Today, fourteen out of 100 American adults actively engage in smoking behaviors (Centers for Disease, 2018).

Addiction

According to the American Lung Association (2019b), addiction typically begins during one's childhood or adolescent years. Dependence upon tobacco products is related to the

addictive agent known as nicotine. Nicotine, a highly addictive drug, damages or inhibits the brain development process in children and young adults. According to Hatsukami, Stead, and Gupta (2008), the only difference between nicotine addiction and addiction to other substances is that nicotine does not cause disruptive behavior. When an individual is addicted to tobacco, he or she will often continue to engage in smoking behavior despite awareness of associated harmful effects. The individual will still have “a high motivation to seek the drug” (Hatsukami et al., 2008, para. 6).

Efforts to Eliminate Tobacco Use

Decline in tobacco use in the twentieth century was affected by several factors. First, the Surgeon General’s report in 1964 was instrumental in demonstrating the severity of the health problem. Other factors that contributed to this public health success included bans on tobacco advertising. This included both a direct comprehensive ban and an indirect comprehensive ban. Taxes also contributed to a decrease in the amount of tobacco products purchased and used within the United States. A 10% tax increase was associated with a 4-5% reduction in tobacco consumption. Cigarette taxes today amount to approximately \$1.01 per pack. Finally, pictorial health warnings and mass media campaigns effectively targeted the public to alert them of the health implications of tobacco use (World Health Organization, 2019). These combined factors contributed to a decrease in the rate of cigarette use within the United States.

While cigarettes were of great concern to the public health community for an extended period of time, they no longer pose the threat they once did. In fact, statistics indicate that there is an all-time low in cigarette smoking among American adults today (Centers for Disease, 2018). In 1964, 40% of U.S. adults smoked cigarettes (Frieden, 2014). Today, however,

approximately 18% engage in this behavior. Due to these public health efforts and targeted campaigns, the threat of smoking has been minimized, and the American population currently faces reduced risk for health conditions like that of respiratory illness and cancer (Frieden, 2014).

E-cigarettes

Vaping Defined

As the vaping epidemic continues to spread across the nation, it is necessary to recognize and establish what vaping is. Vaping is the act of using electronic cigarettes (e-cigarettes) for any purpose, whether the individual is participating in the behavior for tobacco cessation or recreation. These e-cigarettes encompass the following products: vapes, e-hookahs, and electronic nicotine delivery systems (Centers for Disease, 2020). All functioning in relatively the same manner, e-cigarettes contain a battery, space for liquid, and heat source (Centers for Disease, 2000). When the device is in use, the liquid is heated by the battery and transformed into an aerosol. One common misconception surrounding vaping is that e-cigarettes merely turn the liquid into a water vapor, which people understand to be relatively unharmed. The substance produced, however, is not a vapor; it is an aerosol that is extremely toxic to inhale (Center on Addiction, 2018). While these products are sold in various shapes and sizes, each type of e-cigarette serves to provide nicotine to its user. Using any form of e-cigarette is typically referred to as “vaping,” even if the specific product in question is not a vape.

Because of the diversity between e-cigarette products, many researchers have begun referring to the devices as first-generation, second-generation, third-generation, or fourth-generation. The complexity of the e-cigarette appears to increase with each generation. For example, the first-generation e-cigarettes look startlingly similar to a regular cigarette and can be

thrown away following use. On the other hand, second-generation e-cigarettes are rechargeable and resemble pens. Third-generation e-cigarettes are refillable and significantly larger than previous generations of the devices (Truth Initiative, 2019). Fourth-generation e-cigarettes are more difficult to describe as they are newer and rapidly changing (Williams & Talbot, 2019).

History of E-cigarettes

Despite the success of public health efforts to decrease the use of tobacco products within the United States, a new threat has appeared. Due to the dilemma presented by cigarettes, experimentation has occurred over the years in an effort to create a less harmful form of tobacco product. This culminated in the official development of the modern e-cigarette by Hon Lik in 2003 (Centers for Disease, 2019). Within seven years of this event (2010), new brands and versions of his e-cigarette flooded the market. By 2013, 13.1 million adolescents were aware of the existence of e-cigarettes (Wang, King, Corey, Arrazola, & Johnson, 2014). The public health community was immediately alarmed for several reasons. First, public health officials were concerned because of the rapid rate at which the e-cigarettes grew popular within the United States. Another source of concern was the excessive number of underage consumers. While many adolescents used cigarettes before the invention of the e-cigarette, the e-cigarette's skyrocketing popularity quickly surpassed the prevalence of cigarette use among youth. For example, the current rate of cigarette use among eighth-graders is approximately 3.6%. Comparatively, the rate of e-cigarette use among this age range is 9.6%, more than double the rate of cigarette use (National Institute, 2016).

E-Cigarettes as Cessation Devices

Originally, e-cigarettes were marketed as tools by which smokers could end their cigarette addiction. Rather than functioning as a pastime or social activity, use of the e-cigarette was described as a method of smoking cessation. Because of this, the public immediately welcomed the e-cigarette and recognized it as a safer product for one's health compared to combustible cigarettes (Bhatnagar, Payne, & Robertson, 2019). E-cigarette companies also marketed their newly-developed devices as reduced-harm products, which contributed to the public's willing acceptance. Despite this, the Food and Drug Administration (FDA) never approved these devices as cessation tools. Research conducted by Wallace and Foronjy (2019) and other scholars found that the e-cigarette is not, in fact, a form of evidence-based cessation. Thus, the e-cigarette was released and marketed on false, unsupported claims. From the beginning, the e-cigarette's rise to fame was questionable.

E-cigarettes as Source of Epidemic

As of 2019, five million middle and high school students within the United States used e-cigarettes. This statistic presents significant alarm because it reveals an increase of nearly three million students in a span of merely two years (Tobacco Free Kids, 2019). In fact, the issue of e-cigarettes accelerated so quickly that the Surgeon General declared vaping, the use of e-cigarettes, an epidemic in 2018. A product that began as a cessation device for adults has been adopted by the youth population and continues to grow increasingly popular. Because of this, the e-cigarette presents one of the greatest health issues currently faced by Americans.

The e-cigarette presents a threat to the youth population for several reasons. First, scholars have found that some teenagers participating in vaping would never have initiated

smoking prior to e-cigarette use (Bunnell et al., 2014). Studies have also indicated that an individual is more likely to choose to smoke cigarettes as a result of using e-cigarettes as an adolescent (Centers for Disease, 2019). Therefore, the e-cigarette is creating a greater issue than the cigarette and is entrapping youth who were not previously engaged in smoking behavior. It has also been determined that the product is unsafe for youth. A possibility exists that the device contains toxic cancer-causing substances such as the chemical known as diacetyl (World Health Organization, 2019). Nicotine, the drug contained in e-cigarettes, has been scientifically proven to impede brain development processes within maturing youth (Centers for Disease, 2019). For example, nicotine impairs memory, attention, and learning by changing the way in which neural synapses are formed (Centers for Disease, 2019; Know the Risks, 2020). Nicotine is also known to alter cell functioning by injuring or killing cells found in the lungs and blood vessels (Truth Initiative, 2019). Thus, instead of diminishing a health concern among Americans, the e-cigarette has created an entirely different problem.

Additional concerns exist regarding the way in which e-cigarette companies target the youth population. One issue presented by the e-cigarette's popularity is the ability of a user to stealthily participate in the behavior while avoiding detection. Many brands of e-cigarettes design their products to resemble objects such as pens or USB-sticks so that users may vape with less chance of being caught. Some vape companies even promote their low-visibility vapors and slight odors as positive characteristics (Ramamurthi, Chau, & Jackler, 2018). Not only this, but e-cigarette companies appeal to youth's desire to fit in by incorporating elements of advertising that directly attract their age group. For example, companies have offered monetary scholarships to students if they agree to write essays on the positive influence of vaping. Additionally, youth

comprise most of the target audience of social media. Companies spend millions of dollars to launch their products on social media, which obviously will capture the attention of any socially-involved teenager (Truth Initiative, 2018a). E-cigarette companies also provide enticing flavors; although this practice has been recently limited, it has not been eliminated (Truth Initiative, 2018c). In 2015, one-third of e-cigarette company marketing posts utilized adjectives such as “cool” to describe the product (Truth Initiative, 2017). Thus, these companies target adolescents and influence them into believing they will be “cool” if they use the product. These elements of marketing work together to attract youth to the highly addictive products. If the epidemic is to be stopped, e-cigarette marketing tactics must be forced to change.

E-cigarette Policy

Prior to April 2016, the FDA enforced no regulations upon the production and sale of e-cigarettes. Consumers were therefore entirely unaware of chemicals and ingredients contained in vape products as well as the level of nicotine exposure. Products could be marketed as nicotine-free even if they were not, and no prevention efforts were in place. This contributed greatly to early addiction rates, especially among the unsuspecting youth population (Lichtenberg, 2017). As of 2018, the FDA required e-cigarettes to be labelled with the following: “WARNING: This product contains nicotine. Nicotine is an addictive chemical,” (Lichtenberg, 2017, para. 14). While this is certainly an improvement in consumer education efforts, this warning does not encompass associated health risks and concerns.

Prior to the vaping epidemic, the minimum age for tobacco purchase was eighteen years old (Lichtenberg, 2017). As of December 20, 2019, retailers who sell tobacco products are not permitted to sell to individuals below the age of twenty-one. However, one study indicated that

stores do not always abide by this new regulation. Specifically, decoys were sent into corporate-owned stores and franchise stores to attempt to purchase e-cigarettes. Franchise stores were more likely to sell the e-cigarette to the underage decoy than corporate stores were. One e-cigarette brand, JUUL, is often found to be the favorite among adolescent users. For this reason, users of this particular product were studied, and results indicated that 74% of adolescent JUUL-users reported obtaining their products from a face-to-face store in the last thirty days (Henriksen, Schleicher, Johnson, & Lee, 2020). This is concerning due to the level of disregard the new law is receiving. Even if stores were to respect this new regulation, underage individuals are capable of easily obtaining vape products through online mediums. Thus, while this new rule may have created some difficulty for adolescents attempting to purchase vapes in person, there is nothing preventing them from lying about their age and purchasing the product online.

At the state level, numerous e-cigarette policies exist. Regulations vary by state and are constantly changing. Examples of state-level policies include taxation of e-cigarette products, clean indoor air policies, and licensing. Taxation of e-cigarettes especially hinders youth because many consumers within this age range do not have a steady source of income. Because of this, taxation is likely the most effective form of state-level intervention. Clean indoor air policies restrict individuals from vaping in establishments such as restaurants, protecting the health of the user and those in close proximity. Additionally, some states require stores to obtain licenses for the retail of vape products. While these efforts may impede youth e-cigarette usage, further improvement of e-cigarette regulation is needed as the epidemic spreads (Public Health Law Center, 2020).

Health Threats of Vaping

Pulmonary Threat

One particular health threat presented by the vaping phenomenon targets the lungs. A study conducted on mice revealed adverse health outcomes associated with all ingredients contained in e-cigarettes. This study was performed in order to study the effects of e-cigarette vapor on the lung compared to those produced by traditional cigarettes. After exposing the mice to both ambient air and air containing e-cigarette vapor for an extended period of time, it was determined that e-cigarette vapors do in fact cause damage to the lung. Outcomes included inflammatory responses and impediment to overall respiratory system function. Additionally, the researchers noted that the flavoring contained in the products seemed to increase the amount of harm observed to the lung tissue (Glynos, Bibli, & Katsaounou, 2018). This is a notable discovery as most youth purchase e-cigarette products due to the appeal of the flavoring (Centers for Disease, 2020).

A similar study examined the effects of aerosolized nicotine on pulmonary function. Low amounts of nicotine inhalation resulted in injury to the lungs of rats. Another determined outcome was pulmonary edema, which is essentially additional fluid in the lungs that hinders one's ability to intake air (Ahmad et al., 2018; Drugs.com, 2018). Observable health characteristics of nicotine inhalation included blocked blood vessels as well as epithelial cell deaths, which are cells that are important for numerous processes within the body (Ahmad et al., 2018). Through this study, it was determined that the body is negatively affected by aerosolized nicotine in multiple aspects.

According to Clapp and Jaspers (2017), the flavoring agents contained in vape products are established as irritants. They cause damage to the airways and inhibit one's ability to properly breathe. Various reports have indicated that these chemicals often cause occupational asthma. Further, the exposure level that e-cigarettes produce exceeds most workplace exposure standards (Clapp & Jaspers, 2017). Thus, it is undeniably dangerous for youth to inhale this aerosol so consistently. While the nicotine in the aerosol works to harm the lungs, chemicals used to make the product appealing are similarly combining efforts to produce irritation and obstruction. Other respiratory symptoms associated with the use of e-cigarettes include shortness of breath, cough, airway edema, and inflammation. At times, various forms of pneumonia have also been linked to e-cigarette use. Overall, numerous components of the e-cigarette cause distress to lung function (Varkey, Joshi, & Bartter, 2020).

Brain Development

As previously mentioned, nicotine harms the brain development process within aging youth. Because an individual's brain is not completely developed until approximately age twenty-five, nicotine presents a threat to youth involved in any form of cigarette consumption. Attention, learning, and memory are just three activities that nicotine can inhibit (Centers for Disease, 2020). This is accomplished through the alteration of synapse formation within the brain. Additional damage may be caused to parts of the brain that control the decision-making process and impulses. Impulse control can be permanently impaired by nicotine use in young adults and teenagers (Know the Risks, 2020). Nicotine presents a health threat to any user, but it particularly affects individuals under twenty-five years of age who are still undergoing brain development.

Trends in Youth Vaping

Ever since its first appearance on the market, vaping has consistently risen in popularity among adolescents within the United States. One significant indicator of this rise is demonstrated by the results of a Monitoring the Future survey that addressed twelfth-graders, tenth-graders, and eighth-graders. Reported rates of vaping use more than doubled within each grade level between the years of 2017 and 2019. The increase in nicotine vaping between the years of 2017 and 2018 is the most significant increase in any substance ever tracked by Monitoring the Future. In 2019, more than one in four twelfth-grade students engaged in vaping within the past thirty days (Miech, Johnston, O'Malley, Bachman, & Patrick, 2019). These statistics confirm the fast and rising rates of this disturbing youth epidemic.

Multiple e-cigarette devices exist that exacerbate the vaping epidemic, but some are more popular with youth than others. JUUL, vape pens, and mods (modified or enhanced vape pens) were discovered to be the most common source of nicotine administration for adolescents (Krishnan-Sarin et al., 2019). Importantly, JUUL was the most frequently used of these three device categories. It is so popular that many adolescents dressed up as the flash-drive lookalike for Halloween (Kavuluru, Han, & Hahn, 2019). In addition, it was discovered that the use of multiple devices was very common within this population. For those who used only one e-cigarette device, however, JUUL was the most commonly reported type. Additionally, the study indicated that adolescents using mods, vape pens, and other devices were likely to initiate use of other tobacco products such as cigarettes, cigars, and chewable tobacco (Krishnan-Sarin et al., 2019). Thus, it is evident from these results that e-cigarettes were never intended to be used as a cessation tool by youth; they merely caused them to initiate the use of other tobacco products.

Youth do not use e-cigarettes for the purpose of quitting smoking but rather as a recreational activity, and prevention efforts must start by targeting the most popular e-cigarette company, JUUL.

JUULing

In order to properly address the vaping epidemic among American youth, one must pay attention to the brand with the most significant popularity and sales rates. This brand is known as JUUL. The company comprises more than 70% of the American e-cigarette market (Tobacco Free Kids, 2019). According to JUUL, their e-cigarette product was developed as a “satisfying alternative to cigarettes” (JUUL, 2020a, para. 1). The mission statement of this company is “to improve the lives of the world’s one billion adult smokers by eliminating cigarettes” (JUUL, 2020b, para. 1). The company has far from accomplished this mission, however. Instead of eliminating cigarettes, JUUL has contributed to a far more significant problem, especially as it pertains to American youth. JUUL, the e-cigarette of choice for adolescents, has encouraged youth to participate in behaviors they would never have performed otherwise.

JUUL attracts youth for multiple reasons. Originally, JUUL sold pods that were flavored in ways that would appeal to adolescents. Flavors included options like mango, crème, cucumber, cool mint, and more. After various research studies revealed these particular flavors enticed youth to engage in e-cigarette use, JUUL was forced to remove the flavors from their stores in late 2019. This was a result of pressure from the FDA (LaVito, 2019). Now, JUUL only offers the flavors of Virginia tobacco, tobacco, and menthol (JUUL, 2020c). Although these flavors are undeniably less likely to attract adolescents, the damage has already occurred. Another reason that youth choose JUUL as the preferred brand of vape is the ease of access the

product provides. Because the device is shaped like a USB drive, students are able to hide or disguise the product from teachers or superiors within seconds. A study conducted of teenage students revealed that the most significant reason for JUUL usage among adolescents was feeling the “buzz” (Kong et al., 2019, para. 3). Other reasons for use included the high concentration of nicotine contained within the pods and that close friends also used the device (Kong et al., 2019). While the issue of flavoring has already been addressed, nicotine levels contained in these products must be limited by the FDA in order to prevent the spread of the vaping epidemic.

Social media plays a drastic role in the popularity of devices such as the JUUL. One fourth of individuals who retweeted content from the official JUUL Twitter account in 2017 were underage (Chu et al., 2018). This exposure to JUUL advertisements and promotions must be reduced. Additionally, social media posts by addicted adolescents about JUUL most often reflect the concept of the device’s easy concealment (Kong et al., 2019). This entices teenagers unassociated with the product to engage in vaping behavior due to peer influence. The combined influence of the company’s social media content as well as peer content appeals to the desire of youth to fit in with the crowd. Thus, JUUL usage by underage individuals is greatly influenced by what this generation is exposed to via social media.

Impact of JUUL on Society

JUUL was first introduced to the e-cigarette market in 2015. During this time, many other vaping product companies were actively competing for sales and popularity. From 2016 to 2017, JUUL sales expanded exponentially. Specifically, the company’s sales increased 641% from 2.2 million devices sold to 16.2 million devices sold (Truth Initiative, 2018b). At this point, JUUL’s control of the e-cigarette market was finalized. As the JUUL rose in popularity, nicotine

addiction levels among underage individuals grew as well. Vaping was established as a societal norm, and JUUL was largely to blame for this fact. Today, public health officials fight a raging epidemic that is compromising the health of future generations.

In recent months, the popular e-cigarette company has undergone a significant amount of scrutiny. In September 2019, federal authorities began investigating JUUL at a deeper level. Although the reason for these investigations is not entirely known, marketing to minors is believed to be the main consideration (Kelly, 2019). Amidst the uncertainty of the company's future, many leading JUUL figures stepped down from their positions (The Fly, 2019). Still, the vaping epidemic continues as more teenagers accept e-cigarettes as a recreational activity. JUUL has changed the societal norm regarding tobacco products, and society at large gladly welcomes their product.

JUUL also welcomes the idea of concealment. Because the device is designed to look like a USB flash-drive, teachers and parents alike have trouble recognizing the object as a vape. This design allows students and youth to engage in vaping without receiving recognition or attention for the behavior from their superiors. Since the use of tobacco products under the age of twenty-one is prohibited, JUUL encourages adolescents in society to break standards and remain secretive. Importantly, in a study that investigated the word "JUUL" on Twitter, the mention of the device was often associated with concealed locations within schools (Kavuluru et al., 2019).

Impact of JUUL on Individual

A significant number of JUUL users never would have initiated smoking. According to research performed by Johns Hopkins Medicine, approximately two million young adults that use e-cigarettes have never before purchased any other form of nicotine product (Blaha, 2020).

Thus, JUUL and similar products encourage individuals to engage in new, unhealthy behaviors. Use of the JUUL increases likelihood of nicotine addiction. One pod of JUUL contains 0.7 mL of liquid with 5% nicotine concentration, which is the same as smoking one pack of cigarettes. Despite the significant amount of nicotine, 37% of adolescents are unaware that the product contains nicotine (Gibson-Young & Martinasek, 2018). Promotion of the JUUL motivates adolescents to vape in order to gain the admiration and affirmation of their peers. Essentially, these youth are functioning as human test subjects. Because the products have not been available for an extended period of time, research on the health consequences of use is currently being conducted with teen users. From animal studies, results have shown that nicotine causes brain impairment, including “neuron loss, acetylcholine receptor upregulation, diminished acetylcholinergic tone, dysregulated catecholaminergic tone, and altered intracellular signaling pathways” (Liao, Chen, Lee, Lu, & Chen, 2012, p. 157). Long-term harm associated with the use of JUUL products is very possible, and time will reveal these health consequences. Not only does JUUL impact individuals socially, but it is detrimental to their physical health as well.

Societal Perception of JUULing

Societal Norm

Because JUUL grows increasingly popular by the day, a lack of societal backlash exists. While individuals involved with healthcare and public health officials fight to keep youth safe, society allows youth to participate in this behavior. Many people view vaping as a safe practice compared to that of utilizing regular cigarettes. While it may be true that e-cigarettes have as yet not been found to cause the same health effects as cigarettes, e-cigarettes still pose threats. They also contain nicotine, which is dangerous whether it is obtained through a cigarette or an e-

cigarette. Youth are often allowed to purchase e-cigarettes at local gas stations and retail stores despite the age restriction on tobacco products. JUULing is viewed as a behavior that makes youth “cool,” and adolescents come together to use or share their vapes. Unless society demands change and further education efforts, it will be difficult for healthcare professionals to end the epidemic.

Social Media Presence

JUUL possesses a pervasive social media presence. It is on Twitter, Facebook, Reddit, YouTube, and beyond. Teen vape users utilize social media to promote their use of the product, thereby encouraging their peers to participate in the behavior as well. It is not, however, just the consumers who use social media to promote JUUL. The company, JUUL, utilizes social media as well. Their social media presence is strong and has been known to depict their product in a way that specifically appeals to the youth population. This includes the portrayal of trendy people, places, and activities where JUUL is being used.

Considerable change has occurred within JUUL’s marketing strategies since the product’s original release. When the e-cigarette was first placed on the market, launch parties organized by JUUL undeniably targeted an underage population. They portrayed themes of enjoyment, social interaction, style, and identity (among others) that may appeal to youth struggling to find a sense of belonging. In addition, content has since been removed from the company’s social media websites, such as Facebook and Instagram, that were confirmed as youth-oriented. Another method of recruiting youth to the vaping phenomenon was employed by JUUL in the form of social media influencers (Jackler et al., 2019). Social media influencers are figures on platforms such as Instagram and Twitter that possess a large following and are able to

influence numerous people. This type of marketing was certainly geared towards adolescents and has since been altered. While JUUL now specifically states that their product is for adults, it is difficult to overlook how long it took for them to address their role in the epidemic (JUUL, 2020a). Unfortunately, it is too late to undo the influence gained by JUUL during this period of marketing. Addiction to nicotine is difficult to break and will not be terminated by the removal of specific flavor options or marketing ploys.

Public Health and Vaping

Many methods of targeting the youth vaping epidemic have been suggested since the introduction of the product. One method included requiring health warning labels on all vaping products in the United States so as to educate the public on associated risks. This, however, would not likely produce a significant difference. In England, health warning labels are required on all e-cigarette products. In other countries, such as the U.S., the manufacturer is allowed to decide whether or not a health warning will be placed on the product packaging. In one study, labels failed to influence consumer reactions because they were overlooked by consumers from countries where labels are mandated as well as by consumers from countries where they are not (McDermott et al., 2019). The youth population in particular would be very unlikely to stop and read the mandated label before choosing to vape. Therefore, requiring labels would create little to no change and fail to educate the public on the overarching risks of adolescent vaping habits.

One method that may be effective in addressing the vaping epidemic involves healthcare providers participating in open conversation with their patients. Every clinician in the U.S. would be required to ask their patients about vaping use, and—upon receiving a positive answer—would proceed to gather information about their vaping habits. This would provide the context

needed in order for public health efforts to more successfully target the issue. Additionally, the healthcare provider could then connect the patient with resources and educational materials to motivate them to quit vaping. If disinterested, the individual would not be forced to interact with any of the resources. Although the number of people affected by this precaution would likely be limited, it would allow researchers to obtain more effective and far-reaching methods (Baldassarri, Fiellin, & Friedman, 2019).

The second tactic that may create change from a public health standpoint is one that has already been briefly discussed in the instance of the decoy e-cigarette consumers. It involves the use of assurances of voluntary compliance. These assurances function as agreements between the government and shops which sell vapes and other tobacco products. While corporate stores sign assurances of voluntary compliance (AVCs), franchise stores do not. Data collected through a decoy study revealed that corporate stores were less likely to agree to sell products to underage individuals. It was observed that certain corporate stores would still allow adolescents to purchase e-cigarettes, but the rates were not as high as in franchise stores (Henriksen et al., 2020). Thus, it may be gathered from this research that it will be effective to establish assurances of voluntary compliance with stores so that youth will have decreased access to vapes. It has been shown that stores cooperating with AVCs are less likely to provide tobacco products to youth. Additionally, existing AVCs should be monitored more closely so that each retailer is abiding by the rules to which they have agreed. While this may not prevent youth from turning to online sources to obtain their products, at least it will impede in-person sales.

The third and final tactic is one that has already been incorporated to an extent. School-based education offers a potential method for reducing the youth vaping rate. Schools are not

required to execute the programs, however. The decision to enroll students in vaping education programs belongs to the school administrators. When a vaping education program is established within a school, students are supplied with access to materials that provide information and statistics regarding the risks of vaping. One example of an established school-based program is VapeEducate, which is an online program that can be purchased by a school administrator or teacher. The teacher or administrator would then assign the educational program at their own discretion and rate (VapeEducate, 2019). Another example of this type of educational program is INDEPTH, a program offered by the American Lung Association. This program aims to intervene with students who are vaping rather than prevent initiation of the behavior. The material is intended for students who have already decided to vape and have been caught vaping on school property. INDEPTH is a substitute for suspension and citation; students can choose to participate in the program rather than receive other forms of discipline. As a result of the INDEPTH program, 60% of participating students stated that they were willing to quit using tobacco products (American Lung Association, 2019a). Another example of school-based vaping education is The Vape-Free School Project, which is still being developed. It has been tested in two Rhode Island high schools. Developers reported a 56% increase in unfavorable opinions of vaping as a result of the trial. While these programs may create a slight improvement now, progress would be more significant if a nationwide mandate of school-based vaping education was enacted. Thus, uniformity across schools must be established in order to educate the American youth population successfully (Leyva et al., 2017).

Gaps in the Literature

Since the invention of the e-cigarette, significant knowledge has been accumulated regarding the effect of the device on the user's health. There is, however, further information to gather through research. While the short-term consequences of vaping and addiction have been observed in adolescents, long-term consequences have not yet been studied. In many regards, the e-cigarette has been termed less harmful than conventional cigarettes. For example, fewer toxic chemicals are associated with e-cigarettes (Blaha, n.d.). Because of this, many people are led to believe that the risks presented by e-cigarettes are low or nonexistent. The safety of cigarettes compared to e-cigarettes, however, is taken into consideration after many years of observing cigarette use and health outcomes. That insight has not yet been provided regarding the e-cigarette due to the newness of the product. In upcoming years, healthcare professionals will be able to collect the information necessary to demonstrate the dangers of long-term vaping.

Additionally, literature does not yet reveal how public health can conclusively target the vaping epidemic. While raising the minimum age of tobacco product purchase created a substantial change, the change was not sizeable enough to hinder the spread of the epidemic. Adolescents still gain access to the products. Other precautions like eliminating appealing JUUL flavors have also been effective, yet addiction within the adolescent population is still increasingly common. While many suggestions and considerations have been added regarding the topic, a lack of uniformity exists. As there is no definitive solution to the vaping epidemic, the approach is ultimately inconsistent among public health professionals. A lack of compliance to regulations also exists as observed from the results of the decoy study (Henriksen et al., 2020). The literature on vaping does not yet provide the necessary information to effectively control the

vaping phenomenon that has overtaken the nation. Until there is research and literature to identify proper methods of approaching this issue, no singular factor will conclusively end the epidemic.

Conclusion

In conclusion, the vaping epidemic is a problem that stems back to the very first instance of tobacco use within the United States. While health officials worked tirelessly to reduce the rate of cigarette use, companies worked equally as hard to produce a product that could be considered reduced-harm. The companies' efforts culminated in a product that did not reduce harm but spread it further, capturing the attention of youth who were previously uninvolved in smoking. These youth are now at risk due to numerous physiological outcomes of using e-cigarettes and the possibility of lifelong addiction. Companies target adolescents with their product features and advertisements, and it works. If this vaping epidemic is to be stopped, public health officials will need to compile resources and utilize preventative measures that target every aspect of vaping. The companies who produce e-cigarettes need to be held more accountable, the stores which sell vaping products to youth need to be monitored, and youth need education regarding the health concerns. Vaping poses a terrifying threat, and future generations will continue to be at risk if the success of companies like JUUL is not terminated.

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