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ABSTRACT

YOUTH VAPING: AN ANALYSIS OF AN EPIDEMIC

By

TINA GARDNER KILPATRICK

MAY 15, 2020

Youth use of e-cigarettes has reached epidemic proportions. In 2019, 5.4 million youth and young adults were current e-cigarette users. This represents 27.5% of high school youth and 10.5% of middle school youth reporting current e-cigarette use. Comparatively, only 3.2% of US adults were current e-cigarette users in 2018.

Many factors have contributed to the rise in prevalence of youth vaping, including: marketing tactics employed by e-cigarette companies; e-cigarette product design; and the generational values of youth and young adults themselves. In this paper, these specific factors are addressed and their influence on the youth vaping epidemic is explored. The Social Cognitive Theory is used as a theoretical framework to elaborate on the relationship between youth tobacco use and social constructs. Current data are presented on e-cigarette use and used to inform recommendations to combat rising youth and young adult prevalence rates.

Findings suggest that national tobacco prevention and education campaigns are successful in changing tobacco use attitudes and behavior among youth and young adults. Campaigns should address deceitful tobacco company marketing tactics that have misguided the public as well as the technological appeal of e-cigarettes. Additionally, policies that address flavors and restrict use of e-cigarettes in schools and other locations are also discussed.

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Author's Statement Page

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____Tina G. Kilpatrick_____

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TABLE OF CONTENTS

Youth Vaping: An Analysis of an Epidemic.....	6
Background.....	7
Theoretical Background.....	18
Literature Review.....	18
The Role of Marketing.....	21
The Role of E-cigarette Product Design.....	26
The Role of Generation Z.....	30
Recommendations.....	36
Conclusion.....	39
References.....	41

Youth Vaping: An Analysis of an Epidemic

‘Vape.’ In the 1980s, this was a phrase used to describe weapon use—limited primarily to science fiction writing. By the year 2014 however, ‘vape’ was named Oxford Dictionary’s word of the year. Currently use of the word ‘vape’ now means “to inhale and exhale the vapor produced by an electronic cigarette or similar device” (Oxford Press, 2019). What happened in the span of about 30 years? Vaping. Specifically, a rise in youth use of vaping. In the United States, youth are more likely than adults to use e-cigarettes (Centers for Disease Control and Prevention [CDC], 2020a). In 2019, over 5.4 million middle and high school students reported currently using e-cigarettes (Cullen et al., 2019). These data reflect an increase of about 1.8 million youth over a one-year period. In more specific terms, e-cigarette use was high among both high school and middle school students, with 27.5% and 10.5% reporting current use, respectively. Among these high-school users, ‘JUUL’—an e-cigarette brand that popularized vaping—was preferred by 59.1% of those surveyed (Cullen et al., 2019). Comparatively, in 2018 only 3.2% of United States (U.S.) adults were current e-cigarette users (CDC, 2020b).

The stark contrast in prevalence rates of youth and adult e-cigarette use points to a need for an in-depth analysis of the problem. The vaping industry denies influence in the rise of youth vaping rates, claiming that e-cigarettes were not intended to be used by youth, but rather by adults as a form of smoking cessation. However, data show that 40% of current e-cigarette users aged 18-24 years had never been regular cigarette smokers (CDC, 2016a). As youth use of traditional cigarettes has reached record low numbers, there is reason to believe that the industry has used e-cigarettes to capture a subset of the population that would have otherwise been missed. Recently, federal entities have echoed their concern over youth e-cigarette use. On September 11, 2018, the Food and Drug Administration (FDA) Commissioner Scott Gottlieb declared youth vaping an

epidemic (Food and Drug Administration [FDA], 2018). Gottlieb stated concerns over vaping, arguing that intervention was needed to prevent youth from using e-cigarettes without detracting from harm-reduction that adults may receive by vaping versus smoking traditional cigarettes. In December of the same year, Health and Human Services (HHS) Secretary Alex Azar was quoted as saying, “in the data sets we use, we have never seen use of any substance by America’s young people rise as rapidly as e-cigarette use is rising” (Health and Human Services [HHS], 2018).

Currently, youth and young adults can be described as Generation Z: a generation born in the year 1997 and later. Generation Z represents a generation unlike any other before it, as it is the first group of individuals to be born entirely in the digital age. This characteristic plays an important role in the identity of Gen Zers, and in turn has had an impact on rates of youth use of e-cigarettes. This paper will explore the role that Generation Z, marketing, and product design has played on the youth vaping epidemic. Although this issue is complex, this paper intends to analyze the factors that have contributed to the rise in youth use of e-cigarettes. To what extent did e-cigarette product design, brand marketing tactics, and the users themselves impact the rising prevalence of vaping among youth in the US? The following discussion attempts to answer this question with evidence from the literature and publicly available data.

Background

There are many different types of e-cigarette products on the market. E-cigarettes can vary in shape, size, and name. Most include the same three elements: a battery, a heating element, and a place to hold liquid. The liquid found in e-cigarettes is primarily composed of propylene glycol and vegetable glycerin as solvents and typically contains nicotine, although some liquids can contain marijuana and other drugs (CDC, 2020a). E-cigarette liquid can also contain flavoring additives and other chemicals—all of which are released in the aerosol that e-cigarettes produce.

Although some may believe that e-cigarette aerosol is harmless, it does in fact contain harmful chemicals—similar to secondhand smoke from cigarettes. Additionally, these chemicals and flavorings can be inhaled by bystanders when an e-cigarette user exhales (CDC, 2020a).

The section below will go into more detail regarding the various types of e-cigarettes, the market growth of popular brands, and the harms and effects of using e-cigarettes. Additionally, populations that are at risk will be analyzed and the state, federal, and cultural landscapes surrounding e-cigarettes will be assessed.

Types of E-cigarettes. As mentioned, e-cigarettes are identified by a variety of names. Throughout this paper, the product will be referred to as an e-cigarette, but in actual use the product has a few different terms. Slang terms include “e-cigs,” “vapes,” or “mods.” Additional names for e-cigarette products include “e-hookahs,” “vape pens,” “tank systems,” and “electronic nicotine delivery systems” (CDC, 2020a). Not only do e-cigarettes vary in name, but they also vary in shape and style. Some e-cigarettes have been designed to look like other products altogether: i.e., a USB flash drive, a pen, a cigarette, cigar, pipe, or a number of other everyday items, whereas some e-cigarette devices do not resemble any other products at all. The larger products with tank systems—often the ones nicknamed as “mods”—typically reflect this design style (CDC, 2020a).

Market Growth. E-cigarettes have seen a staggering growth since being introduced on the market. As HHS Secretary Alex Azar stated, the quick rise in youth use of e-cigarettes is unlike any other substance seen before. In the first quarter of 2011, e-cigarette retail sales were about US\$19 million. By the last quarter of 2017, e-cigarette retail sales were reported as US\$409 million (Huang et al., 2018). That is a growth rate of over 21 times in six years. If we look at these six years more closely, we will see that four distinct growth periods exist. Starting in 2012, we begin to see a general growth of e-cigarette product popularity. As more people began using e-cigarettes,

more e-cigarette brands were introduced to the market. In 2013, two product leaders emerged in the market: Blu and Njoy. By the third quarter of 2014, there existed just one leader: Vuse brand e-cigarettes. Finally, in the second quarter of 2017, we saw JUUL begin to dominate the market (Huang et al., 2018). To put this into perspective, the JUUL retail share amounted to \$150 million in US retail sales in the last quarter of 2017 (Huang et al., 2018). By 2018, annual retail sales were more than US\$650 million (Herzog & Kanada, 2018). Later that same year, Altria, the maker of Marlboro brand cigarettes, purchased a 35% stake in JUUL Labs for \$12.8 billion (JUUL, 2018). This purchase valued the company at \$38 billion. This information is important for many reasons. JUUL is now owned by a major tobacco company, one with a history of deceiving the public. In fact, Altria was one of several tobacco companies ordered by a U.S. District Court to run a set of five ‘corrective statements’ across national news media in 2018 to inform the public of their deceptive actions. These corrective statements addressed the adverse health effects of smoking and secondhand smoke as well as the manipulation of product design to deliver a more potent product (Campaign for Tobacco-Free Kids, 2020a). However, Altria’s purchase of JUUL did not slow their growth. In fact, most recent data show that JUUL is still the most popular brand, representing a 73.4% share of the e-cigarette marketplace in July 2019 (Truth Initiative, 2019). As will be explored in upcoming sections of this paper, JUUL is primarily used by youth and young adults and is a key player in the rise of youth use of e-cigarettes.

Harms and Effects of Vaping. As mentioned previously, e-cigarettes typically contain nicotine, which is an addictive chemical, in their e-liquid (CDC, 2016b). Nicotine is harmful to youth and young adult brain development, as most brains continue developing until about the age of 25. As the brain develops, synapses are built between brain cells. Strong connections typically occur when a new memory is created or a new skill is learned, and young people can build these

synapses faster than adults (CDC, 2020c). But when nicotine is introduced, the formation of synapses is altered. Not only is the developing brain more vulnerable to the effects of nicotine, but when compared to adults, teens may also be more sensitive to nicotine and may feel more dependent on the substance sooner (CDC, 2016b). Consequences of nicotine use before age 25 can include mood disorders, reduced impulse control, and deficits in attention and cognition. Additionally, the use of nicotine in adolescence may increase the risk for future addiction to other drugs (CDC, 2016b). In terms of nicotine content in e-cigarettes, it varies from product to product. JUUL claims that their e-cigarettes contain a nicotine content that is similar to traditional cigarettes. Further, JUUL can deliver nicotine up to 2.7 times faster than other e-cigarette products (Truth Initiative, 2019).

Nicotine is also released in the aerosol that e-cigarettes produce. Many youth believe that e-cigarette aerosol is harmless “water vapor,” when in fact aerosol can contain harmful and potentially harmful substances. These substances vary, but can include ultrafine particles, flavorings, volatile organic compounds, cancer-causing chemicals, and heavy metals such as nickel, tin, and lead (CDC, 2020c). Ultrafine particles can be inhaled deep into the lungs, while flavorings can include substances like diacetyl, a chemical linked to a serious lung disease called ‘popcorn lung’. These substances expose both the e-cigarette user as well as the bystander (CDC, 2020c).

Most recently, there have been recorded instances of harm classified as e-cigarette, or vaping, product use-associated lung injury—known as EVALI. Most recent data show that 66% of the 2,668 hospitalized EVALI cases were male, and the median age of patients was 24 years old (CDC, 2020d). While concerning, research into causes, symptoms, and risk factors surrounding EVALI cases are still being explored by health officials. Currently, national and state data from patient reports and product sample testing show tetrahydrocannabinol (THC)-containing e-

cigarette, or vaping, products are linked to most cases (CDC, 2020d). Additionally, the presence of Vitamin E acetate in e-liquid has been strongly linked to the outbreak as well. While THC and Vitamin E acetate in e-cigarettes have played a major role in the EVALI outbreak, it should be noted that, at the time of writing this paper, health officials have not officially ruled out other chemicals and their potential roles.

Since the first EVALI cases were reported, health officials around the country observed a sharp rise in cases of EVALI in August 2019, a peak in September 2019, and a gradual, but persistent decline since then (CDC, 2020d). On October 4, 2019, the FDA released a statement warning consumers to stop using THC vaping products amid ongoing investigation into lung illnesses (FDA, 2019). Time and research are needed to understand the full effects of the outbreak. Additionally, future data will reflect whether the EVALI outbreak impacted youth and young adult vaping rates in 2019. And while this paper attempts to analyze the youth vaping epidemic as it relates to ‘traditional’ e-cigarettes—that is, those used to deliver nicotine—it should be noted that THC and other substances can be delivered through e-cigarette product use. While important, this paper specifically explores the impact of nicotine only e-cigarettes and vaping products on youth and young adults.

Current use of e-cigarettes is also related to risk of future harm for youth and young adults. In fact, young people who use e-cigarettes may be more likely to smoke cigarettes (CDC, 2020c), and there is some evidence to support that e-cigarette use increases the frequency and amount of cigarette smoking in the future (National Academy of Medicine, 2018). The health effects of cigarette use are well-studied and widely known to be detrimental. Cigarette use is the leading cause of preventable death in the United States and is responsible for more deaths every year than human immunodeficiency virus (HIV), illegal drug use, alcohol use, motor vehicle injuries, and

firearm-related incidents combined (CDC, 2018). Cigarette smoking can lead to heart disease, stroke, and lung cancer. Currently, the prevalence of middle school students reporting current use of cigarettes is 2.3%—a decrease from 4.3% in 2011. The prevalence of high school students reporting current use of cigarettes is 5.8%—a decrease from 15.8% in 2011 (CDC, 2019). Fortunately, efforts of local, state, and national health agencies have made significant progress on youth and young adult cigarette smoking rates and the current prevalence rates reflect this progress. Unfortunately, their efforts could be reversed by the youth vaping epidemic.

E-cigarette products currently on the market share many commonalities when it comes to their basic technology. However, there is not necessarily a ‘typical’ e-cigarette and evidence shows a large amount of variability within the product category (Truth Initiative, 2019). Different products can include different ingredients, different hardware and deliver very different amounts of nicotine. Not only that, but the levels of potentially toxic chemicals vary as well. There is no standard level of cadmium, lead, nickel, tin or copper, which may make it difficult to understand overall public health impact. Further, recommendations about the product category are difficult to issue due to product variability (Truth Initiative, 2019).

At-Risk Populations. As you might expect in a youth vaping epidemic, youth and young adults have been primarily affected by the invention of the e-cigarette. In 2019, 27.5% of high school students reported current e-cigarette use and 10.5% of middle school students reported current e-cigarette use. This represents about 5.4 million youth and young adults (Cullen et al., 2019). In comparison to adults, the data show that youth and young adults are vaping at much higher rates. Those aged 45 and older are significantly less likely to have ever tried an e-cigarette compared to young adults (Truth Initiative, 2019). 2018 data show current adult use of e-cigarettes at 4.2% among adults aged 25-44, and 2.1% among adults aged 45-64 (CDC, 2016a).

When looking at risk factors across sociocultural and regulatory contexts, being male, using illegal drugs, and having a family member who uses e-cigarettes and cigarettes are likely to be important determinants (Zavala-Arciniega et al., 2019). Additionally, one study has shown that independent correlates of e-cigarette awareness and trial included established risk factors for smoking—like race and ethnicity, age, and socioeconomic status—as well as use of more media technologies and greater Internet tobacco advertising exposure (Thrasher et al., 2016). A study conducted by Rodriguez-Bolaños et al. displayed that only having friends who smoked cigarettes at baseline was a significant predictor of current exclusive e-cigarette use at follow-up for males (2019). Further, baseline current drinking, having a job, higher technophilia (feelings of pleasure related to technology use), and higher positive smoking expectancies were shown to be associated with current e-cigarette use among females (Rodriguez-Bolaños et al., 2019).

State and Federal Policy Landscape. The first e-cigarettes were introduced to the US market in 2007 and continued to grow in popularity since their introduction. In 2014, e-cigarettes surpassed cigarettes as the most commonly used tobacco product among youth (A Report of the Surgeon General, 2016). In May 2016, the FDA took notice of the amount of various e-cigarette products on the market and chose to extend their tobacco regulatory authorities to other products meeting the definition of a tobacco product (Backinger et al., 2016). This extension in their regulatory authority, known as the Deeming Rule, included the previously unregulated electronic nicotine delivery systems (ENDS) and other e-cigarettes on the market, as well as cigars, pipes, and hookahs. The Deeming Rule extended FDA’s authority so that manufacturers of these tobacco products must also submit a list of ingredients and health documents for review (Truth Initiative, 2016). The regulatory extension by the FDA was the launching pad for many anti-tobacco policies moving forward. As the FDA began claiming authority over e-cigarette products and their potential

health impacts on the public, many local and state health departments were able to continue addressing e-cigarette use within their communities by relying on direction from the federal government.

Prior to the Deeming Rule, some states pursued other measures to reduce tobacco use within their population. Raising the minimum legal purchase age (MLPA) for purchasing tobacco to 21, known as ‘Tobacco 21’, is a policy that could effectively help to decrease youth use of tobacco. National data show that about 95% of adult smokers begin smoking before they turn 21, and four out of five adult smokers become daily smokers before they turn 21 as well (Campaign for Tobacco-Free Kids, 2020b). An Institute of Medicine report shows that increasing the tobacco age will significantly reduce the number of adolescents and young adults who start smoking, reduce deaths related to smoking, and immediately improve the health of those who will be deterred from smoking (2015). Before December 2019, a total of 19 states passed laws requiring an MLPA of 21: Arkansas, California, Connecticut, Delaware, Hawaii, Illinois, Maine, Maryland, Massachusetts, New Jersey, New York, Ohio, Oregon, Pennsylvania, Texas, Utah, Vermont, Virginia and Washington. At least 530 localities, including Washington, D.C., also have MLPAs of 21. Then, in December 2019, Congress passed a federal Tobacco 21 law that raised the MLPA for purchasing tobacco to 21 across the US. By having a comprehensive law to protect youth and young adults from purchasing tobacco, progress is likely to be made on lowering the prevalence of youth tobacco use. The likelihood that a high school student would be able to legally purchase tobacco products for other students and underage friends is reduced—blocking a critical tobacco access avenue for underage youth (Campaign for Tobacco-Free Kids, 2020b). In 2019, 72.2% of youth e-cigarette users reported getting their e-cigarettes from friends and other social sources

(Bach, 2019). And among JUUL users in particular, aged 12-17, half had gotten JUUL from a social source (Truth Initiative, 2018).

Earlier this year the FDA passed a policy on flavored e-cigarettes. On January 2, 2020, the FDA issued a policy that places a priority on enforcing specific unauthorized flavored e-cigarette products on the market. Flavors play an important role in youth use of tobacco products: 97% of current youth e-cigarette users have used a flavored e-cigarette in the past month and 70% cite flavors as a reason for their use (Truth Initiative, 2019). In an attempt to reduce the appeal that e-cigarettes have among youth, fruit and mint flavors found in cartridge-based e-cigarette products are no longer allowed to be sold on the market unless authorized by the FDA under the new product pathway (FDA, 2020a). And while this policy does address an important component of the youth vaping epidemic, critical gaps exist in policy coverage and enforcement. The policy does not address tobacco or menthol flavored e-cigarettes, nor does it include tank-based or disposable e-cigarette products. This is important as disposable e-cigarettes are sold in a variety of flavors and refillable devices—like tank-based systems—are the most popular brands among high school students after JUUL (Campaign for Tobacco-Free Kids, 2020c).

Cultural Landscape. The cultural landscape in the U.S. has played an important role in the youth vaping epidemic. There is a history of traditional cigarette manufacturers with large lobbying efforts that argue for and against laws that impact their business. In the 1990s, the tobacco lobby engaged in efforts to neutralize clean indoor air legislation, minimize tax increases, and preserve the industry's freedom to advertise and sell tobacco. Their political efforts were comprehensive and aggressive in nature, targeting state legislatures through lobbying, media, public relations, front groups, industry allies, and contributions to legislators (Givel & Glantz, 2001). Legislators in particular received the largest amounts of campaign contributions and gifts

from lobbyists. In fact, significant associations were observed between pro-tobacco industry bill votes and gifts received from tobacco lobbyists (Matheny et al., 2015). But that's not all—tobacco-area legislators, agricultural interest groups and commissioners of agriculture represent other facets of the tobacco industry's varied and effective approach to wield power (Fallin & Glantz, 2015). Further, pre-emption—a law that restricts local entities from enacting laws stricter than state-level policy—was also a focus of the tobacco lobby during this time. Lobbyists were successful in enacting pre-emption of stricter local tobacco control laws in a number of states and prevented the passage of many state tobacco control policies as well (Givel & Glantz, 2001).

The tobacco industry has historically conducted their business with no regard to the health of their product's users. Thousands of internal documents have been released that reveal industry knowledge of adverse health effects, nicotine addiction, marketing to youth, unsafe cigarette design, health effects of secondhand smoke, and more (World Health Organization (WHO), n.d.). Tobacco companies have also carried out a variety of product promotions, packaging, and sponsorships that they have argued are solely to gain market share from their competitors, but evidence shows that industry marketing tactics have played a major role in influencing youth use of tobacco (CDC, 2012). And while cigarette smoking rates continue to decline for both adolescents and adults, the industry must pursue other avenues to turn a profit. In December 2018, Altria, the maker of Marlboro brand cigarettes, purchased a 35% stake in JUUL Labs for \$12.8 billion (JUUL, 2018). This purchase valued the company at \$38 billion. Less than a year later, the CEO of JUUL stepped down and was replaced by an Altria executive (Kaplan et al., 2019). Tobacco industry interference is one of the main obstacles for advancing tobacco control policies (Reynales-Shigematsu et al., 2019), and the industry continues to demonstrate that it cannot be trusted.

Outside of the impact of big tobacco companies, public health organizations have faced opposition from small business owners and adults who support e-cigarettes as a cessation device. Small vape shops and the vape industry in general have spent time fighting against tobacco control efforts to reduce e-cigarette use. Proponents of harm reduction have argued that e-cigarettes help current smokers quit smoking traditional cigarettes and pose little risk to increasing youth smoking rates (Warner, 2018). This concept has been acknowledged by the FDA, the CDC, and other organizations, but as of yet e-cigarettes are not an approved method to help people quit smoking (FDA, 2019). And while harm reduction may be true for adults, the same is not true for youth. Among current e-cigarette users aged 45 years and older, most were either current or former regular cigarette smokers (CDC, 2016a). In contrast, 40% of current e-cigarette users aged 18-24 years had never been regular cigarette smokers. Organizations cannot ignore that e-cigarettes put youth at risk for a nicotine addiction they may have otherwise never been exposed to. The role of flavored e-cigarettes still plays a role here as well. While some groups have argued in favor of keeping flavored e-cigarette products on the market as a cessation aid, there is inconclusive evidence that they can assist in quitting smoking (Zare et al., 2018).

Furthermore, there is evidence that many current e-cigarette users still engage in traditional cigarette smoking, a phenomenon known as ‘dual use’. In 2016, 54.6% of current adult e-cigarette users also smoked cigarettes and 55.9% of youth and young adult e-cigarette users started using another tobacco product in addition to e-cigarettes (Truth Initiative, 2019). There is also data to support that e-cigarettes may worsen the problem of dual use. E-cigarette use was found to be associated with more frequent cigarette smoking and intensive cigarette use among young adults aged 18-35, and young adults who started using e-cigarettes in the previous year had increased

odds of daily cigarette use, as well as higher likelihood of being diagnosed with a tobacco use disorder (Truth Initiative, 2019).

Theoretical Background

The Social Cognitive Theory has been explored as a basis for understanding youth behavior related to e-cigarette trial and use. The Social Cognitive Theory (SCT) supports the idea that diversity in social practices produces substantial differences in individuals regarding both cultivated and underdeveloped capabilities (Bandura, 1989). The SCT is comprised of five key constructs: knowledge, perceived self-efficacy, outcome expectations, goal formation, and socio-structural factors. The SCT also posits that a ‘reciprocal causation’ exists between the individual, the environment, and the behavior. In this reciprocal causation, individual, environmental, and behavioral factors all play a role in influencing one another. All factors are operating as interacting determinants that influence each other bidirectionally (Bandura, 1989). It is not just the environment that acts on the person, or the person on the behavior, but rather the person impacts their environment, and behavior impacts the person, or their outcome expectations. SCT is often applied to behaviors that are complex and require considerable behavioral capacity. Regarding tobacco product use, we know this characteristic of complexity to be true. It takes significant behavioral capabilities to quit nicotine once addicted, and it is not solely the influence of the individual that can play a role in successfully quitting. Tobacco product use, specifically e-cigarette use, is a complex issue with multiple levels of influence. As will be reviewed in upcoming sections, marketing and product design interact directly with personal beliefs to influence behavior.

Literature Review: Social Cognitive Theory and Tobacco Use Among Youth

While there is limited data available on any theoretically based youth vaping prevention or reduction programs, there is some recent research that uses the Social Cognitive Theory to

better understand youth vaping. The three studies below all explore how the Social Cognitive Theory supports understanding of youth use of tobacco products.

Brandon et al., 2004. Researchers explored cognitive and social learning models as they related to drug dependence—specifically the use of tobacco dependence in adolescents. The focus of the study was to provide clarity into measures of tobacco dependence during adolescence by conducting a broad, multi-dimensional conceptualization of dependence and utilizing a range of theoretical explanations to address the issue. Albert Bandura’s model of self-efficacy within the Social Cognitive Theory was examined in detail throughout the paper.

According to theory, self-efficacy plays a critical role in determining personal control over your feelings, your thoughts, your behaviors, and the environment you live in. With what is understood about smoking and tobacco use in general, we can see that self-efficacy plays an important role in dependence. Definitions of nicotine dependence refer to previous loss of control over smoking and/or a difficulty to refrain from smoking. Researchers argue that if self-efficacy is indeed a causal determinant of loss of control, then they can propose that self-efficacy may be a core component of tobacco dependence itself. When exploring tobacco dependence among adolescents specifically, the study found that measures of self-efficacy for a variety of behavioral targets, including abstinence, coping, and control, predicted the onset of smoking. Not only that, but the progression from experimental use to regular use could be explained through self-efficacy as well. The researchers identify abstinence self-efficacy (ASE) as a likely candidate for assessment, as it may capture both the ability to refuse cigarette offers and the ability to use coping strategies to manage adverse situations.

Although this particular study was written before the introduction of e-cigarettes to the market, findings from the study can be used to guide general understanding of the issue of tobacco

use among youth and young adults. Further, findings also point to implications for intervention, suggesting that programs should focus on increasing self-efficacy capacity among youth and young adults in order to reduce tobacco product initiation and continued use.

Kelder et al., 2020. A health education program named “CATCH My Breath” was recently launched in middle schools in central Texas in an attempt to prevent youth use of e-cigarettes. Researchers conducted a study among 12 schools in Texas to analyze the effectiveness of the prevention program during the 2016-2017 school year. Six schools served as the control group and did not receive the intervention, and six schools served as the intervention group. The CATCH My Breath program is based in the SCT and consists of 4 interactive in-class modules.

Researchers found that increases in ever e-cigarette use prevalence were significantly lower among intervention schools compared to control schools over a 16-month period. In addition, schools receiving the intervention displayed significantly greater improvements in e-cigarette knowledge and perceived positive outcomes than the control group. Overall, implementing the CATCH My Breath program had a positive impact on middle school youth rates of ever e-cigarette use. Findings suggest that constructs of the SCT may aid in intervention development of e-cigarette prevention programs and this program should be replicated in larger settings moving forward.

Creamer et al, 2018. In 2018, researchers examined whether the outcome expectations of adolescent never users of tobacco products predicted tobacco product use or susceptibility to tobacco product use over a six-month period. In another study conducted in Texas, researchers collected data from a cohort of urban middle and high school students from 2014 to 2015.

Researchers found that a specific outcome expectation was related to ever use of and susceptibility to tobacco products, including e-cigarettes. Namely, outcome expectations related to stress relief were noted as an important predictor. On the other hand, outcome expectations such

as relaxation, concentration, slimness and additional expectations were not associated with ever use of susceptibility. Findings point to the need for interventions to offer alternative solutions to stress relief for at-risk youth.

Overall, the constructs of SCT can be used to understand e-cigarette use among youth and young adults. Use of tobacco is a complex behavior, influenced by nicotine addiction, peer use and social norms, and product and company perceptions. These interactions are in line with factors that have been identified in this paper and will be explored in more detail below.

The Role of Marketing

Marketing plays an important role in every business. Marketing is used to target potential customers about a business' product or service and persuade target markets to use that specific product or service—often over another business' product or service offering. Tobacco companies are very familiar with using marketing tactics to successfully gain new business, and e-cigarette advertisements are no different. This section will explore the role that marketing has played in the youth vaping epidemic, including the impact of social media practices, Point of Sale activities, and the response of tobacco control organizations.

Social Media. Since its inception, social media has grown into a behemoth of a social networking platform. People from all over the world can connect with each other, share news stories, and learn new information through sites like Facebook, Instagram, Twitter, and others. Social media is also an avenue with which one can observe and learn social norms. Individuals can see what their peers are doing in real time, and as we know from the social cognitive theory, the environment can have a positive or negative impact on an individual's behavior. E-cigarette companies used social media to their advantage through aggressive advertising and marketing campaigns targeted toward youth. Multiple studies have examined the relationship between social

media, e-cigarette ads, and e-cigarette use among youth. A 2019 study found that mere exposure to online e-cigarette ads was an important predictor of e-cigarette use (Barrientos-Gutierrez et al.). The same study also noted that technophilia and e-cigarette trial and use were associated with frequency of exposure to online e-cigarette ads. The e-cigarette advertisements themselves may implicitly promote e-cigarettes as a reduced harm cigarette alternative (Pokhrel et al., 2016), although data show that harm reduction may not be an effective argument as many users continue to engage in dual use of e-cigarettes and smoking, negating any potential reduction in harm (Truth Initiative, 2019). Further, any e-cigarette marketing that displayed enhanced social life or self-image may encourage non-smoking young adults to try e-cigarettes (Pokhrel et al., 2016). An analysis of e-cigarette marketing was conducted and found that many websites included youthful appeals. Of the e-cigarette websites examined, 73% of websites included images or claims of modernity, 44% showed increased social status, 32% showed enhanced social activity, 31% showed romance, and 22% showed celebrity use (Grana & Ling, 2015). Additionally, mere exposure to e-cigarettes through users on social media sites—outside of paid ads and brand promotion—also have been shown to impact rates of youth e-cigarette use. When users see peers on social media sites vaping, two positive outcome expectancies are triggered: positive “smoking” experience and positive sensory experience. These positive outcome expectancies found in social media e-cigarette exposure were found to be indirectly associated with current e-cigarette use (Pokhrel et al., 2018).

Although JUUL denies ever marketing its product to youth or young adults, there is evidence to refute these claims. When the company first launched in 2015, JUUL’s original marketing campaign featured YouTube videos, advertising in a young adult magazine, billboards in prominent, high-traffic areas, and launch parties. The company used young people dancing and

using JUUL as a way to promote their product and designed their advertisements to be colorful and eye-catching with youth-focused images (Bach, 2019). JUULs marketing tactics were arguably youth-focused from the start. Social media platforms are dominated by the young adult demographic, with 88% of 18- to 29-year-olds indicating that they used any form of social media, the highest percentage out of any other demographic group (Fry & Parker, 2018). JUUL devoted more of its marketing budget to social media content on channels like Instagram and Twitter, and less to traditional media channels, like TV and radio, representing a different budget breakdown than other competing brands at the time (Huang et al., 2018). And JUULs budget allocation seemed to work to capture its target market: in 2018, eight out of ten of JUULs Twitter followers were between the ages of 13 to 20 (Kim et al., 2019). In fact, there is evidence to support that JUUL pioneered social media as the first major e-cigarette brand to heavily rely on social marketing and promotion of its products (Bach, 2019). A comparison can certainly be made between JUUL and other e-cigarette companies advertising now, and cigarette advertising of the past. Many themes seen in cigarette ads of the past—like sex, independence, and rebellion—can also be seen in e-cigarette ads now (CDC, 2017).

Point of Sale. Outside of the use of social media to target youth and young adults, e-cigarettes are also advertised at the point of sale (POS). POS advertising refers to a variety of marketing practices, including interior and exterior signs at retail stores, shelving displays, and coupons or other consumer price discounts (Bach, 2020). The tobacco industry exercises a lot of influence through POS ads. The industry spends \$9.1 billion in the US every year in marketing, and \$8.7 billion (96%) of that is spent solely at the point of sale (U.S. Federal Trade Commission, 2019). Tobacco companies use POS e-cigarette advertising to target specific demographics as well. POS e-cigarette advertising was greater in stores existing in neighborhoods that had higher per

capita income, higher percentage of non-Hispanic whites, and higher percentage of individuals with a high school education when compared with the neighborhoods of stores that did not have POS e-cigarette advertising (Wan et al., 2017). This is no coincidence. The tobacco industry is intentionally targeting demographics that are more likely to use and purchase e-cigarettes. And youth are no exception. In fact, more than half of all high school students and middle school students reported seeing e-cigarette ads in retail stores (CDC, 2017). Exposure to this type of advertising is associated with e-cigarette use and susceptibility of use. In one study, students' ability to recall signs of e-cigarette marketing predicted ever e-cigarette use and also increased susceptibility to use e-cigarettes in the future (Pasch et al., 2018).

Tobacco Control Response to Marketing. In an attempt to combat the youth vaping epidemic, various governmental and non-profit organizations underwent efforts to execute campaigns that highlighted the truth about vaping and discredit any untrue e-cigarette industry claims.

From a federal level, the FDA released an extension of their successful 'The Real Cost' campaign. The Real Cost had been initially created and used to educate at-risk teens about the harmful effects of cigarette smoking. But in 2018, as a response to the rising rates of youth e-cigarette use, the campaign was extended to include education on e-cigarettes. The new series of messages aims to reach youth aged 12-17 who had ever used e-cigarettes or are open to trying them (FDA, 2020b). Just like previous cigarette smoking messages, the campaign focused on the costs of using these products, like the risk of addiction and other health consequences. The Real Cost is delivered across multiple media channels, including TV, web, online video, social media, and high schools nationwide. In order to target high schools, The Real Cost developed posters for the campaign specifically for placement in school bathrooms.

The non-profit organization, Truth, also developed campaigns targeted toward youth who use e-cigarettes. The Truth #FinishIt campaign was started in 2014 and aimed to encourage youth and young adults to be the generation that ends tobacco use. Like the FDA's The Real Cost, #FinishIt was also later expanded to include an anti-vaping component as part of its messaging. In addition, Truth also developed a mobile text messaging campaign called 'This Is Quitting' that aims to help young people quit vaping through text. The first-of-its-kind program incorporates messages from other young people who have attempted to quit, or successfully quit, e-cigarettes (Truth Initiative, 2020). The program does not shy away from showing what quitting really looks like and incorporates both good and bad messages related to quitting e-cigarettes. The purpose of the campaign is to provide motivation, inspiration and support for young people through their quitting journey with evidence-based tips and strategies for quitting nicotine. This Is Quitting was created for youth and young adults, aged 13-24, and is tailored to give appropriate recommendations based on what age they are within this category.

While additional research is needed to evaluate the effectiveness of the three campaigns mentioned above, there is some preliminary evidence available that supports the campaigns have been, or will be, successful. The FDA's The Real Cost campaign has not yet published evaluations for its e-cigarette component, but data shows that awareness for The Real Cost in general is high. Three years after the cigarette and smokeless tobacco components were launched, 58.5% of middle and high school students reported unaided awareness (Delahanty et al., 2020). For Truth's #FinishIt campaign, findings suggest that engaging youth and young adults in a cause-based social movement, like #FinishIt, can be a powerful tool in driving positive health behavior change (Hair et al., 2018). Values important to this age group, like independence and connectedness, are particularly effective as part of the messaging strategy. One study showed a significant dose-

response relationship between awareness of one phase of the campaign and campaign-targeted attitudes and intentions not to smoke among youth and young adults (Vallone et al., 2018). While the evidence included here is not specific to the anti-vaping component of #FinishIt, results from its original components point to success in its extension as well. Lastly, due to the recent launch of the mobile texting program, there is no preliminary evidence that addresses Truth's This Is Quitting campaign and its impact on the youth vaping epidemic. At the time of writing, evaluation is still needed to determine its effectiveness.

The Role of E-cigarette Product Design

E-cigarettes are sold in many shapes and sizes and can deliver different levels of nicotine. E-cigarettes can be refillable or disposable, cartridge-based or tank-based. They vary in name and design, with some e-cigarettes designed to look like cigarettes, some designed to look like USB flash drives or other household items, and some designed to resemble nothing familiar at all (CDC, 2020a). E-cigarettes can also be flavored with fruit, candy, mint, menthol, or tobacco flavors. In this section, we will discuss how e-cigarette product design has played a role in the youth vaping epidemic.

Flavors. Flavors continue to play an important role in youth initiation of e-cigarettes. Their role in the youth vaping epidemic cannot be understated. Flavors are well-documented to be a reason that youth begin using e-cigarettes in the first place. Once using, youth can become addicted to the nicotine in e-cigarettes. Adolescents were more likely to initiate vaping through flavored e-cigarettes and considered flavor the most important factor when trying e-cigarettes (Zare et al., 2018). In another study, youth e-cigarette users cited flavors as the second-most reason they began using the product, right behind use of e-cigarettes by a family member or friend (Truth Initiative, 2019). And many current e-cigarette users appear to enjoy vaping flavors, too. There is evidence

to support that not only do flavors encourage youth to try vaping, but flavors may keep youth and young adults using e-cigarettes as well. In fact, 97% of current youth users of e-cigarettes have used a flavored e-cigarette in the past month and 70% cited flavors as a reason for their use (Truth Initiative, 2019). Overall, young adults prefer sweet, menthol, and cherry flavors (Zare et al., 2018). Importantly, 98.7% of flavored products sold at the point of sale—in convenience, dollar, drug and grocery stores—contain nicotine (Truth Initiative, 2019).

In April 2019, in response to federal restrictions on the sale of flavored e-cigarettes in physical locations, JUUL removed some of its flavors from retail stores. However, mint and menthol flavors remained available for sale and have continued to increase in popularity (Truth Initiative, 2019). Use of menthol- or mint-flavored e-cigarettes rose from 16% in 2016 to 57.3% in 2019 among high school users, suggesting that a shift in availability of flavors may partially explain the increase (Cullen et al., 2019). As mentioned earlier in the paper, the FDA has since released a stricter enforcement policy related to flavored e-cigarettes, restricting the sale of flavors in cartridge-based e-cigarettes. FDA's policy does not include tobacco and menthol flavors, nor does it address non-cartridge-based e-cigarettes, like tank systems or disposable e-cigarettes. Time is needed to evaluate whether this policy will be effective in reducing youth rates of e-cigarette use.

Design Appeal. E-cigarettes have been designed cleverly, capitalizing on a unique design and featuring a new, modern way to deliver nicotine. Their design should not be overlooked as merely surface-level though—the look and feel of e-cigarettes has played a major role in the youth vaping epidemic. Specifically, the design of the JUUL. JUUL is the most popular e-cigarette, emerging on the market in 2015 (Truth Initiative, 2019). JUUL's e-cigarette design features a high-tech look: with slim, modern features and an all-black exterior. One could argue that the appealing

aesthetic of the JUUL contributed to its popularity among youth. The success of JUUL even inspired other companies to mimic their design, and additional “copycat” products emerged on the market soon after. Suorin Drop, myblu, and Vuse Alto all follow JUULs blueprint of high-tech design and high nicotine delivery (Truth Initiative, 2019). Vuse Alto is an e-cigarette designed by R.J. Reynolds—the makers of Newport and Camel Cigarettes. myblu is an e-cigarette designed by Imperial Brands—the makers of Winston and Kool cigarettes. JUUL has been so successful that other companies have been able to capitalize on their success, creating products to be used with the e-cigarette. There are companies that produce decals that stick to and wrap around the JUUL device, allowing users to customize their e-cigarette (Bach, 2019). In addition to the USB flash drive design, some e-cigarettes have been designed to look like other household objects, like pens, remote controls, car fobs, smart phones, sweatshirt drawstrings and even asthma inhalers (Ramamurthi et al., 2018). Some e-cigarettes have been designed to look like regular cigarettes, potentially appealing to current cigarette smokers and attempting to capture this market of nicotine users. Some larger devices, known as tank systems, or “mods”, do not look like any other products at all and are unique in their design.

Design appeal is an important part of any consumers’ choice of a product. Before a product is used and tested for quality, consumers typically shop with their eyes. E-cigarettes, like JUUL, that have placed their product’s design at the forefront of their planning have done so intentionally. By attracting users to a product that simply looks ‘cool’ before ever being used, brands have created the foundation for a viral trend to take off. As important as the role of billions of dollars funneled into product marketing has played on the youth vaping epidemic, the importance of the product itself should not be understated either. Although nicotine may be what keeps youth using e-cigarettes, product design has played a critical role in youth initiation of the product as well.

Discreteness. A more specific facet of product design, the role that product discreteness has had on the youth vaping epidemic is also explored here. As described above, JUULs product design is modern and high-tech, and resembles a USB flash drive—a small, rectangular item. Because the product resembles a commonly used school item, a window of opportunity existed for the product to be used on school property without suspicion. Anecdotal evidence supports this idea as well, as students across the country have been known to use school bathrooms to discreetly use their vapes. When conducting an internet search, one study illustrated the popularity of this phenomenon by uncovering popular searches that existed such as ‘JUUL at school’, ‘JUUL in class’, ‘hiding JUUL in school’, and ‘JUUL in school bathroom’ (Ramamurthi et al., 2018). Local news reports and school officials as well have confirmed this is happening in schools. Not only does the product design support use by youth in unconventional areas, but so does the aerosol that the e-cigarette produces. The aerosol that is given off from some e-cigarettes is fairly small in size, being labeled as plumes with ‘low visibility’ (Ramamurthi et al., 2018). Some e-juices specifically promote this design factor, lending itself to its discreteness. Other e-cigarettes market having a subtle odor that helps to avoid detection. In addition, techniques have been uncovered that one can use to hide the exhaled vapor plumes: like swallowing the vapor or blowing it into one’s clothing or a backpack (Ramamurthi et al., 2018). The promotion of this specific design factor among various e-liquids and products supports the idea that e-cigarette brands understand the need for a discrete product. Additionally, JUUL uses salt nicotine as a mode of delivering substantial nicotine to the user in a soothing, non-irritating way. Salt nicotine can also deliver nicotine more easily than free-base nicotine, which is typically used in most tobacco products (CDC, 2020a). New tobacco users may find it easier to use this type of product, contributing to its appeal.

The vaping industry has demonstrated ingenuity in devising discrete, attractive vapor products and has focused on de-emphasizing vapor plumes and their aroma. JUUL alone accounts for 70.5% of vaping devices with stealthy characteristics on the market (Ramamurthi et al., 2018). Whether discreteness lends itself solely to youth use is debatable, but surely is a highly useful design factor that can encourage youth use of the product.

The Role of Generation Z

Historians use generations as a way to group various people together based on when they were born. Generations are a great way to understand changing social norms and can even be used to predict future trends, as data are collected and cultural identities are studied. In the 20th century, there are six generations that have been defined and studied: the Greatest Generation, born in 1924 or earlier; the Silent Generation, born 1925-1945; Baby Boomers, born 1946-1964; Generation X, born 1965-1980; Millennials, born 1981-1996; and finally, Generation Z, born 1997 and later. While the specific dates defined here may vary among researchers, the general norms that have been studied stand true. These generations differ vastly in demographics, education, values and ideals. Generation Z is estimated to encompass more than 2 billion young people (Miller & Lu, 2018). Specific to Generation Z, or Gen Z, this cohort is the most racially and ethnic diverse among all previously recorded generations. Gen Z is recording high levels of high school completion and college enrollment rates, and preliminary data suggest that Gen Z is likely to be the most well-educated generation yet. Gen Z median household income stands at roughly \$63,700, exceeding earlier generations when they were young. Only 13% of Gen Zers are living in rural areas—the majority of Gen Z individuals live in metropolitan areas and the Western region of the US (Fry & Parker, 2018). When examining their consumer habits, it is worth noting that this generation is the first group of people to be born entirely within the digital age (Cheung et al., 2017). This should

not be understated, as this has likely had a tremendous impact on this generation's relationship with technology and therefore their relationship with vaping. Gen Zers have never experienced a time without internet, without phone applications, or without constant communication to an extended network of their peers (Cheung et al., 2017). This generation is entirely self-reliant in the digital world, and has learned to socialize, learn and have fun inside the boundaries (or non-boundaries) of this age. Borders that used to exist between their internet lives and their physical lives can become unrecognizable among this generation (Cheung et al., 2017). This distinct set of characteristics that define Generation Z has helped set the stage for the youth vaping epidemic.

Relationship with Technology. As mentioned above, Generation Z is the only generation to have grown up completely inside of the digital age. Gen Z has a relationship with technology unlike any other generation before it, and this plays an important role in their health behavior as it relates to e-cigarette use. A phenomenon, called technophilia, has been found to exist among individuals using technology and can help explain the digital relationship in greater detail. Technophilia is defined as the positive orientation towards new technology, drawing specific attention to the emotional feelings of pleasure that accompany the use and adoption of a new technological item (Barrientos-Gutierrez et al., 2019). Technophilia can help explain why one might feel happiness or joy after having purchased a new phone or using a new video gaming system. This term is helpful in understanding youth use patterns related to e-cigarettes as well. A study by Barrientos-Gutierrez et al. found that identifying with technophilia was positively associated both with trial of e-cigarettes and report of e-cigarettes as the first tobacco product ever tried (2019). Researchers found a novel association between higher technophilia and greater frequency of e-cigarette use. That being said, higher levels of technophilia were not necessarily associated with current e-cigarette use—only e-cigarette trial. This is an important distinction to

make, as technophilia could be seen as an important factor in helping explain why youth may pick up an e-cigarette for the first time—in addition to flavored e-cigarettes and product design. When explaining the continued use of e-cigarettes, other factors besides technophilia exist, including peer use, greater wealth, online marketing exposures, sensation seeking, and use of other substances (Barrientos-Gutierrez et al., 2019). The addictiveness of the product and its ease of use are also important to understand why youth continue to use e-cigarettes as well. Among exclusive e-cigarette triers, significantly higher technophilia was measured, as was having bedroom internet access, and being exposed to internet tobacco advertising when compared to conventional cigarette triers and never triers (Thrasher et al., 2016). Dual triers of e-cigarettes and cigarettes were found to have significantly stronger conventional cigarette risk factors, including a parent or sibling who smokes, a close friend who smokes, whether they have tried alcohol or drugs, and positive expectancies associated with conventional cigarettes (Thrasher et al., 2016). This difference may be helpful in understanding where youth users of e-cigarettes differ in risks of nicotine initiation from traditional youth cigarette smokers, and how each group can be effectively targeted from a public health perspective.

As briefly mentioned earlier, the digital age has created a landscape of technology use that has blurred the lines between offline and online environments. Generation Z can be considered congruent with the growth of technology, both as much a part of it as an influence on it. E-cigarettes fit nicely into this technology space. E-cigarettes—like other technological inventions such as the phone, digital watches, and wireless headphones—can become one with an individual’s daily lifestyle. In one study, a youth interviewee referred to e-cigarettes as one of ‘several toys for smoking’ (McDonald & Ling, 2015). The interviewee categorized e-cigarettes as part of their technological collection, akin to their mobile phone, Mp3 player, and flash drive. This

categorization can be assumed to exist among other youth as well. Not only is the e-cigarette design viewed as ‘sleek’ and ‘cool’, but the technological aspects of the e-cigarette align with Generation Z’s own definition of their lifestyle. Technological aspects of the e-cigarette design have also been shown to be appealing to youth. Being able to plug in and charge an e-cigarette was a factor that young adults perceived to be similar to other novel devices they are familiar with using (McDonald & Ling, 2015). By aligning design features with other familiar devices, e-cigarette companies have capitalized on the intersection of a new technological device that pushes boundaries of new devices without breaking them. It is this intersection of characteristics that makes e-cigarettes unique and appealing to otherwise low-risk groups of youth and young adults (i.e., those who do not share the same risk factors for conventional cigarette use, like family or friends who smoke and trial of alcohol or drugs). And previous studies confirm this: evidence shows that e-cigarettes may appeal to relatively low-risk adolescents who would otherwise be unlikely to use conventional cigarettes (Barrientos-Gutierrez et al., 2019).

Relationship with Brands. Outside of any technological aspect of e-cigarette product design, the relationship that e-cigarette companies have cultivated with their consumers may have influenced youth use of e-cigarettes as well. Consumer relationships with brands is an important factor in use of any product, and manufacturers can choose to cultivate a relationship with their consumers that may in turn play a role in consumer purchasing decisions. Relationships can be so strong that consumers may forgo purchase of a comparable competitor product solely based on the reason that the consumer has a better brand relationship with one over the other. In fact, one consumer behavior study found that half of study respondents chose a product or service based on the brand alone (Chovanova et al., 2015). Brands are able to capitalize on the digital age as well. Social media has become a space for brands to form one-on-one relationships with their consumers,

an opportunity that has never existed before. Because there is opportunity for brands to engage with consumers directly, brand relationships can hold a strong influence on consumer purchasing decisions. For example, when comparing two popular soft drinks, Coca-Cola and Pepsi, market growth and consumer trends have played an important role for both brands. Coca-Cola is valued at \$204.87 billion versus PepsiCo, which is valued at \$159 billion. (Georges, 2019). Comparatively, Coca-Cola has 107.62 million fans on Facebook while Pepsi has 37.86 million. Strength of their social media channels can outline consumer preferences in brands and translate to real dollars in the market.

The purpose of this example is to illustrate that brand relationship and identity, both online and offline, are important factors in consumer decision-making. Brand loyalty and brand engagement can be used to understand how JUUL rose so quickly in popularity. Brand loyalty can be defined as a consumer who makes repeat purchases of a product (Cheung et al., 2017). Brand enthusiasm involves an active engagement between the brand and consumers and allows an organization to understand consumer preferences and behaviors (Cheung et al., 2017). Brand enthusiasm creates an opportunity to gain insight about consumer attitudes toward the brand as well as understand consumer level of trust. Researchers have shown that in order to successfully build relationships with Generation Z, brands need to gain trust and be transparent. Allowing consumers to feel in control of their purchasing decisions is also important (Cheung et al., 2017). In one study, 60% of Gen Zers noted that it was important for brands to value their opinions, 55% wanted to have control over what information to share, and 54% wanted to have control over how brands contacted them (Cheung et al., 2017). This aligns well with how e-cigarette companies have targeted their consumers online, through youth-focused advertisements and a large and ‘transparent’ social media presence. Communication with Gen Z is also important, and brands

should understand that Gen Z expects two-way engagement. Generation Z expects a product or service to deliver what is expected of it, and if this is not the case then this generation will take their business and their influence elsewhere (Cheung et al., 2017). Gen Zers tend to value brands that are ‘cool’ and ‘fun’ as well as those that are ecofriendly and socially responsible (Cheung et al., 2017). Gen Zers are significantly more likely to believe that brands understand them as individuals and are more prone to choose brands that have been endorsed by celebrities and athletes (Cheung et al., 2017).

E-cigarette companies have in fact not been transparent with their consumers. One study found that nicotine content levels were inaccurate on 51% of e-cigarette liquid nicotine labels (Buettner-Schmidt et al., 2016), illustrating how some e-cigarette brands have not been forthcoming in the nicotine content of their products, potentially misleading youth and preventing informed decision making. Both brand loyalty and brand engagement have played a role in JUUL’s popularity. JUUL’s activity on social media and strong user following display that brand enthusiasm exists between youth, young adults, and JUUL. Eight out of ten of JUUL’s Twitter followers were between the ages of 13 to 20 (Kim et al., 2019), and JUUL is thought to have been a pioneer in the social media space as the first major e-cigarette brand to heavily rely on social marketing and promotion of its products (Bach, 2019). This data may reflect that JUUL understood the importance of youth engagement with their product online and built up their brand through social channels intentionally. Youth users of e-cigarettes also seem to display brand loyalty when analyzing JUUL’s market share. JUUL alone accounted for 73.4% of the market share in July 2019 (Truth Initiative, 2019). In addition, JUUL’s initial marketing campaign included tactics that directly aligned with brand characteristics noted as being important to Generation Z. JUUL’s first campaigns featured YouTube videos, advertising in a young adult magazine, billboards in

prominent, high-traffic areas, and launch parties. The company used young people dancing and designed their advertisements to be colorful and eye-catching with youth-focused images (Bach, 2019). It is the intersection of Generation Z's relationship with brands and activities by e-cigarette companies themselves that have played a role in the youth vaping epidemic.

Recommendations

When aggregating all of the evidence on the youth vaping epidemic, recommendations have been made that may be helpful in combatting growing trends. Some of the recommendations below are based on findings in the literature, whereas others are recommendations that have been surmised from a review of current data and information on the subject.

Ultimately, specific characteristics of Generation Z have played a large role in the youth vaping epidemic. This is not to say that youth are to blame for their own addiction to e-cigarettes—far from it. Rather, that e-cigarette companies have identified their key audience and targeted them well. Generation Z appreciates authentic brands who cultivate real conversations through a social experience and place value in personal relationships with technology. **Moving forward, future public health interventions could consider highlighting the dishonesty of tobacco/vaping companies as a tactic to discourage use** (Cheung et al., 2017). By displaying that youth and young adults have in fact been deceived by companies they may have considered to be trustworthy, public health programmers have an opportunity to break the influence these brands have on youth and align with specific values of Gen Z. **Furthermore, the federal government should consider placing stringent restrictions on the online presence and use of social media by tobacco and vape companies.** We know that youth and young adults are primary users of social media and therefore may be most susceptible to brand pages and their social advertisements and posts. **Additionally, it may be possible to target the technological aspect of e-cigarettes and their**

appeal to youth. Health education campaigns that simplify the components of what actually make up an e-cigarette may help break down traditional views held by youth and address feelings of technophilia. At the end of the day, a JUUL is nothing more than a cleverly designed item used to deliver nicotine. By addressing the visual and technologically appealing aspects of e-cigarettes, health education campaigns may be able to change user perceptions of the product and reduce youth use.

While the above addresses a specific component of a public health campaign, **national education campaigns focused on anti-tobacco messaging in general are also a key policy intervention** (Hair et al., 2018). Anti-tobacco campaigns have been in place for years and should continue to be financially supported as a way to educate youth and young adults on the dangers of e-cigarettes and other tobacco products. In fact, anti-tobacco public education campaigns that are aimed at youth and young adults have been found to be a key population-level intervention (Vallone et al., 2018). In an expanding market and cluttered media environment, tobacco use patterns are shifting, and new products are emerging. Evidence-based public health campaigns can play a critical role in encouraging the next generation to reject tobacco. Mass media campaigns can be a key component to changing tobacco use attitudes and behavior, particularly among the target demographic—youth and young adults (Vallone et al., 2018). More specifically, study results have also suggested that campaigns that can target differences among the individual users themselves may be useful. **As we learned, risk factors for e-cigarette use differ by sex, and interventions could consider specifically targeting males as a way to reduce prevalence of youth use** (Roriguez-Bolaños et al., 2019). Based on findings from the literature, interventions would also do well by targeting constructs of self-efficacy among youth and young adults in order

to reduce tobacco product initiation and continued use. By increasing self-efficacy, youth and young adults may feel stronger control over their role in a potential dependence to tobacco products.

As discussed, flavors have also played a large role in youth initiation. Subsequently, restrictions from a state and federal level that include flavors could be impactful in reducing youth use. Flavor restrictions have been a consideration for some time, as evidence behind their role in youth use of tobacco continues to grow. Restricting all flavors in e-cigarettes—including mint and menthol—could have an impact on decreasing the number of youth and young adults who choose to engage in e-cigarette use for the first time. As of right now, the FDA's ban on flavored e-cigarettes is limited to specific flavors and only captures cartridge-based products. **The federal government should consider a ban that addresses all types of flavors on the market as well as all types of e-cigarette products, including tank-based and disposable e-cigarettes.** It is also worth noting that other types of policy interventions that have not been discussed in this paper exist and may also be effective in reducing youth use of tobacco products. For example, **public health planners and policy makers can consider increasing taxes on nicotine products and developing school policies that restrict use of tobacco products on school property.** Price increases, like increasing taxes attributed to nicotine products, is an excellent avenue to pursue with e-cigarettes. Studies show that increasing taxes on cigarettes has been effective at reducing smoking rates, with the strongest effect observed among young adults aged 18-24 (Sharbaugh et al., 2018). Perhaps the same can be said for e-cigarettes as well. Passing legislation that restricts use of any tobacco product, not just cigarettes, inside businesses and schools could also be an effective way to address where users are able to engage in vaping. School policies like this may work to reduce youth who choose to vape on school property, like bathrooms or hallways.

Finally, more research is needed to understand the theoretical background of e-cigarette use and the specific risk and protective factors for e-cigarette use among youth. In this paper the use of the Social Cognitive Theory was explored as a way to explain youth e-cigarette and tobacco product use. While there is research on this subject, findings are limited. Promising measures do exist though, and the literature suggests that large-scale programs that address youth use of e-cigarettes through constructs of the SCT—like knowledge, perceived self-efficacy and outcome expectations—may offer successful intervention and prevention tactics. Additional research is needed to present a comprehensive picture of what behavioral factors influence youth use of e-cigarettes, and how these factors can be effectively targeted.

Conclusion

The youth vaping epidemic is a complex issue. There are many factors that have contributed to rising youth rates of e-cigarette use, including marketing tactics, e-cigarette product design, and the generation of young adult users themselves. It is difficult to say if one factor in particular has played a dominant role in the youth vaping epidemic, but research supports the idea that a combination of these factors have contributed to the epidemic in significant ways. Findings suggest that national tobacco prevention and education campaigns are successful in changing tobacco use attitudes and behavior among youth and young adults and care should be taken to support their funding and sustainability. It is likely that prevention campaigns that undermine the influence of tobacco and e-cigarette companies by highlighting their dishonest business and marketing tactics will do well in positively influencing youth and young adult perceptions of e-cigarette products. Additionally, policies that address flavors and restrict use of e-cigarettes in schools and other locations could be a useful upstream approach to influence population-level health among youth and young adults.

It is clear that the high rates of youth use of e-cigarettes have been impacted by multiple levels of influence. In order to reverse the staggering youth rates of e-cigarettes, care should be taken to address the marketing of e-cigarettes, the e-cigarette product design itself, and how these factors interact with the generational identity of youth and young adults.

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