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## **Associations Between Devices, Flavors, Ease of Acquisition, and Use of E-Cigarettes Among American Youth**

Sasha Anderson  
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# Walden University

College of Health Sciences and Public Policy

This is to certify that the doctoral study by

Sasha Anderson

has been found to be complete and satisfactory in all respects,  
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the review committee have been made.

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Walden University  
2025

Abstract

Associations Between Devices, Flavors, Ease of Acquisition, and Use of E-Cigarettes

Among American Youth

by

Sasha Anderson

MPH, Walden University, 2013

BTech, College of Agriculture, Science & Education, 2009

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

Walden University

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## Abstract

Initiation of use of e-cigarettes is attributed to many factors and must be understood to curtail health-related problems such as cardiovascular and pulmonary diseases that are associated with use of tobacco products. This study used the Social Cognitive Theory to analyze how curiosity and peer influence could be possible predictors of e-cigarette use among youth in the United States. Predictors of flavor preference and acquisition were also examined. Data were acquired from the Centers for Disease Control and Prevention's 2018 National Youth Tobacco Survey (N = 20,189). Statistical tests to determine existing relations and associations were binary and multinomial logistic regression. The binary logistic regression revealed there was an association between level of curiosity and peer influence and use of e-cigarettes among American youths ( $p < .001$ ). Curiosity and peer influence varied by race. Age was also a strong and significant predictor of use of e-cigarettes, as odds of use increased by 35.1% as age increased. Younger age groups were more inclined to use fruit ( $p < .001$ ) and menthol-flavored ( $p = .027$ ) e-cigarettes. Females were more inclined to use candy-flavored e-cigarettes than male ( $p = .006$ ). White respondents were more likely to obtain their e-cigarettes from some other source other than a family member ( $p = .002$ ), friend ( $p = .020$ ), or vape shop ( $p = .261$ ) when compared to other races. The results of this study provided evidence regarding associations between demographic factors and flavor and place of acquisition as well as the role of curiosity and peer influence as predictors for use of e-cigarettes. This evidence can be used to strengthen anti-e-cigarette efforts, resulting in positive social change through reductions in the use of e-cigarettes among American youth.

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## Dedication

This work is dedicated to my beloved family, who supported me throughout my period of study. My mother, Paulette, my siblings, Ave and Eltonette, my darling son Daniel, my partner Kevel, and my dad, Elton (Tanny), who passed away twelve years ago.

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## Section 1: Foundation of the Study and Literature Review

As the United States struggles to reach Healthy People 2030 goals, a new public health problem has emerged. Tobacco use has increased, leading to concerns involving age (Tribble & Stewart, 2023). Adolescents use e-cigarettes and vaping products not just because they are easily concealed but also because they can be used without issues with odor produced by other tobacco products (Tribble & Stewart, 2023). There is a need to reduce vaping among adolescents, but there is still a challenge involving how to deter use of such devices. There is a need for care and planning for safeguarding adolescents from the harm e-cigarettes cause.

Combustible cigarettes have been replaced with e-cigarettes. E-cigarettes, which were promoted as the new replacement for combustible cigarettes, are being used by younger individuals (Sapru et al., 2020). This includes children and adolescents (Khambayat et al., 2023). Use of e-cigarettes by this population is a public health concern, and the effects of vaping are not known, further complicating the matter. It is important to understand behaviors of this group to understand the magnitude of public health risks.

Potential risks are many. Contents of these devices, include electronic liquid (e-liquid), pose many threats. Liquid is heated in the device and produces a vapor which is inhaled, in most instances, through the mouth. This vapor, also referred to as aerosols, goes to the lungs. Use of tobacco products containing nicotine contributes to cancer rates, compromised quality of life, and leading to heart and lung disease (Jones & Salzman, 2020). Long-term effects of use of e-cigarettes are not fully understood, but there are

potential risks associated with its use. Many health organizations, including the Centers for Disease Control and Prevention (CDC) have declared use of e-cigarettes by adolescents to be an epidemic.

Design and level of attractiveness and flavors tobacco companies incorporate into their marketing strategies have worked in their favor by ensuring they appeal to children (Gentzke et al., 2022). This is due to the design of these e-cigarette devices and their compactness (Phan et al., 2020). They are easy to carry and can be easily masked, making it difficult to be detected by those who do not know about these devices (Sapru et al., 2020). It is, challenging to protect adolescents from advertisements and vaping shops.

To gain deeper insights regarding the problem, I sought to address the background of the problem. I highlighted the purpose of the study and research questions to determine if there were existing correlations between variables. Also, the theoretical framework was examined, followed by a detailed review of existing literature. For the purpose of this study, key terms and words were defined. I highlighted assumptions, scope, and limitations. This is followed by an examination of the significance of the study, and a summary and conclusion.

### **Background**

According to Barnes and Ali (2021), e-cigarettes and vaping are associated with lung injury in the United States. The problem is further complicated by lack of knowledge about products that are used in e-cigarettes and effects these chemicals may have on the body . More evidence continues to be discovered regarding different impacts of e-cigarettes and long-term consequences of their use are becoming more recognizable.

There are few educational interventions to address the issue of vaping among adolescents. There is a need to address dangers of these products on health. Companies marketing e-cigarettes do so with the intention of reaching younger populations (Barnes & Ali, 2021). Currently, federal policies prohibit sale of tobacco products, but use of e-cigarettes continues to increase, which has made it a public health concern (Donaldson et al., 2023).

Use of tobacco has proven to be dangerous to the health of humans (Feeny et al., 2022). Loss of life and disability are possible outcomes of smoking (Asim et al., 2023). The full extent of dangers involving e-cigarettes is not known, and they should not be promoted as safer than cigarettes (Feeny et al., 2022). This highlights the need to address use of electronic nicotine delivery systems (ENDS) through collaborative efforts that incorporate stakeholders such as politicians, youth leaders, community advocates, tobacco-control groups, and public health entities.

The specific research problem was it was not known whether there were associations between curiosity about e-cigarettes, appealing flavors, ease of acquisition of e-cigarettes and refills, and use of e-cigarettes among American youth as it relates to age, gender, and race. Although researchers have investigated use of e-cigarettes by this population, no research has examined this topic.

### **Problem Statement**

The situation or issue that prompted me to search literature is the United States has recorded an increase in the number of adolescents who vape in addition to attempts to renormalize smoking by tobacco companies. Data from national surveys continue to

reveal a drastic increase in the use of e-cigarettes among adolescents. This has led to a public health crisis within the United States. Between 2017 and 2019, the number of e-cigarette users more than doubled (Printz, 2020). The age group of those using e-cigarettes is becoming lower. On average, 25% of 12<sup>th</sup> graders, 20% of 10<sup>th</sup> graders, and 9% of 8<sup>th</sup> graders used nicotine vaping products (Printz, 2020). A 10% increase was recorded between 2017 and 2018, which accounted for over 1.3 million teenagers (Jones & Salzman, 2020). The issue is there is a driving force leading to the increase in numbers. Adolescents are motivated to participate, but their motivations are unknown. The nature of attraction to vaping products is unclear, and if the vaping epidemic is to be addressed, there must first be insights regarding causes of motivations to use e-cigarettes.

### **Purpose of the Study**

The purpose of this quantitative study was to understand reasons why peer influence, appealing flavors, ease of use, and curiosity impacted or influenced adolescent decisions to use e-cigarettes. I addressed whether there were particular age groups that was more likely to use e-cigarettes as well as differences in terms of gender or race. Variables of interest in this study are curiosity about e-cigarette devices, type of flavors, ease of acquisition of e-cigarettes and refills (independent variables), use of e-cigarettes (dependent variable), and age, sex, and race (controlling variables).

### **Research Questions and Hypotheses**

RQ1: Is there a relationship between peer influence, curiosity about e-cigarette devices, and use of e-cigarettes among American youth when controlling for age, sex, and race?

H<sub>0</sub>1: There is no relationship between peer influence, curiosity about e-cigarette devices, and use of e-cigarettes among American youth when controlling for age, sex, and race.

H<sub>a</sub>1: There is a relationship between peer influence, curiosity about e-cigarette devices, and use of e-cigarettes among American youth when controlling for age, sex, and race.

RQ2: Is there a relationship between appealing flavors, ease of acquisition of e-cigarettes, and use of e-cigarettes among American youth when controlling for age, sex and race?

H<sub>0</sub>2: There is no relationship between appealing flavors, ease of acquisition of e-cigarettes, and use of e-cigarettes among the American youth when controlling for age, sex and race.

H<sub>a</sub>2: There is a relationship between appealing flavors, ease of acquisition of e-cigarettes, and use of e-cigarettes among the American youth when controlling for age, sex and race.

### **Theoretical and Conceptual Framework**

This research is grounded in the social cognitive theory (SCT). The SCT involves addressing social influence and impacts of social reinforcement (Glanz et al., 2015). This theory is important to this study to address maintenance of behaviors and not just initiating behavior changes. Using the SCT, the focus is on the individual (population), the environment in which they exist, and the behavior (Glanz et al., 2015). This

facilitated participants anticipating consequences of their behaviors and expected outcomes .

I used the SCT to make necessary connections and assess associations between variables and observed behavioral patterns.

### **Nature of Study**

Data research and content analysis were used to address research questions in this quantitative study. I focused on secondary data. Data that were relevant to this public health problem were previously collected. Data were collected via surveys and completion of questionnaires.

I assessed the extent to which there were associations between e-cigarette devices, flavors, ease of acquisition, and use of e-cigarettes among American youth. I used two research questions. Independent variables were curiosity about e-cigarette devices, appealing flavors, and ease of acquisition of e-cigarettes and refills. The dependent variable was use of e-cigarettes, and covariates were age, sex, and race.

Data obtained for these variables came from survey questions. To determine if there were associations between independent variables and the dependent variable, correlation and regression analysis was used. A correlation test involves showing whether there are relationships between variables and the degree to which such relationships exist. To assess strengths of relationships between variables, the regression test was used.

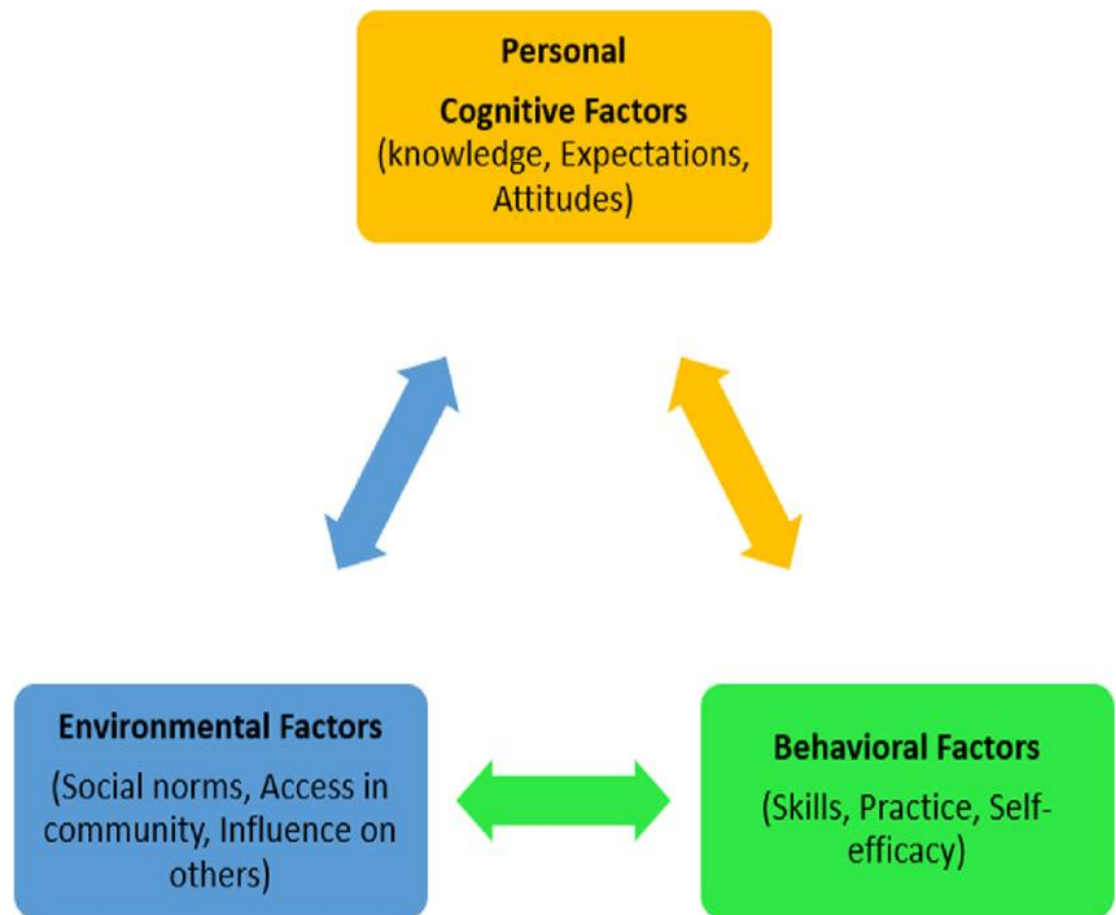
For this research, data were accessed from the CDC NYTS.

### **Literature Search Strategy**

To gain clear insights regarding existing literature, a search strategy was necessary. The literature search strategy was developed based on research questions. The search engines EBSCOHost, PubMed, and Google Scholar were used. I used the following search terms: *e-cigarettes, electronic cigarettes, vapor cigarettes, vapes, nicotine delivery system, nicotine delivery device, JUUL, access or acquisition, ease of acquisition, curiosity or curiosity, the reason for vaping, and flavor, adolescents, teenagers, children, and American youth, public health, community health, population health, epidemiology, quantitative, experimental, clinical trial, randomized control trial, validity, intervention, t-test, and ANOVA*. I searched for peer-reviewed scholarly journals that were published between 2019 and 2024. In addition, websites of the CDC and World Health Organization (WHO) were searched for information on use of e-cigarettes by children and adolescents.

### **Figure 1**

*Social Cognitive Theory*



*Note.* From Rachid et al., (2020). Review and insight on the behavioral aspects of cybersecurity. ([https://www.researchgate.net/figure/Social-Cognition-Theory-basic-diagram\\_fig3\\_340807167](https://www.researchgate.net/figure/Social-Cognition-Theory-basic-diagram_fig3_340807167)) In the public domain.

### **Literature Review Related to Key Variables and/or Concepts**

One of the leading causes of preventable disease, disability, and death in the United States of America is the use of commercial tobacco (Gentzke et al., 2022). The use of tobacco products typically begins during the adolescence period. The tobacco market has seen a great evolution in the products being sold to the general population (Gentzke et al., 2022). The prevalence of youth tobacco use, which may ultimately lead

to later addiction to the products, is of concern since the end products or by-products of its use and diseases associated with its use are preventable. Studies revealed that approximately 9 in 10 adults who used tobacco products started before the age of 18 years (Gentzke et al., 2022). Today, tobacco products have evolved through many generations to the now popular electronic cigarettes (e-cigarettes), also called electronic nicotine delivery systems (ENDS). As much as the products have evolved, so too have the market demands and a change in the population that is most likely to use these products. The now-trending e-cigarettes have become the most popular tobacco product, with their use increasing significantly among the youth. As youth use these products containing nicotine, it raises many alarms within the public health system about the safety and well-being of youth and how well protected they are against the now popular e-cigarettes. The high levels of nicotine can lead to sustained tobacco use as nicotine is highly addictive (Sapru et al., 2020). Nicotine is known to have significant consequences on the human body and a greater impact on adolescents. One such effect is its impact on brain development and function (Nguyen & Mital, 2022). E-cigarette use is also strongly associated with the use of other tobacco products (Graham-DeMello et al., 2023).

To understand the problem that children and adolescents are being faced with it becomes important to not only get an insight into the factors that contribute to their use of e-cigarettes but also understand what these factors are (Pettigrew et al., 2023). With the number of youth e-cigarette users increasing, there is the notion that there is a targeted appeal towards this population. The design, marketing, and availability of the product may be a possible avenue for the level of curiosity that may arise among children and

adolescents, which may ultimately result in their use of the product. Curiosity is likely to be an onset to experimentation with e-cigarettes by children and adolescents, which may result in the initiation of the use of these products (Khouja et al., 2020).

While there is intensified and aggressive marketing of e-cigarettes by tobacco companies, the potential harm is not examined, and children and adolescents are sold on low perceived harm of products. With relatively low perceived harm or the mindset that e-cigarettes are not as harmful as combustible cigarettes, a deeper level of curiosity may be aroused within this population (Gilmore et al., 2023). There are many factors that may spur curiosity about e-cigarettes among children and adolescents, and this must be explored and examined. The level of naiveness that exists among children and adolescents regarding this modern tobacco product is allowing them to participate in the use of these products and putting their lives at risk (Villanti et al., 2020). The prevalence of the use of e-cigarettes and their potential danger is a public health issue that needs to be addressed. Seeing that the dangers associated with the use of these products are preventable, it becomes necessary to curtail their use aggressively among this at-risk population. To decrease the morbidity and mortality rate, which may affect individuals later on in their lives, measures must be put in place that aim at preventing the use of tobacco products during childhood or adolescence period (Gentzke et al., 2022).

In this review of literature, a deeper understanding of what exists as it relates to the use of e-cigarettes is examined. This review serves to give a deep insight into the birth and evolution of e-cigarettes, their level of availability and accessibility, and the impact of the marketing strategies by tobacco companies, which may contribute to the

level of curiosity aroused, ultimately leading to the use of and patterns of use of these products seen among the American youth.

## **History**

The nature of e-cigarettes began in China. The invention came as a result of a Chinese pharmacist by the name of Hon Lik, who was working with a company called Dragon Holding (Sapru et al., 2020). Lik sought to design the famous e-cigarettes because of the death of his father. Lik's father was considered a heavy smoker and lost his life to lung cancer. As a result, he created what he deemed an alternative product to combustible cigarettes, which provided a smoke-like product. This alternative product came onto the market in 2003 but saw international patented achieved in 2007. In the same year, e-cigarettes entered the United States market and gained popularity among individuals. The popularity aroused between both cigarette smokers and non-smokers (Sapru et al., 2020).

Since its availability in the United States, e-cigarette sales have climbed from \$274.6 million in 2012 to \$636.2 million in 2013. This represents an increase of 132.5%. By 2015, e-cigarette sales were near \$850 million (Sapru et al., 2020). The increase in profit is identified with an increase in use. The advent of e-cigarettes has changed the way nicotine products are being used and also the age of the users (Roberts et al., 2023). E-cigarettes have brought on the vaping epidemic, so-called because of the act of electronic vaping devices being used to administer nicotine (Roberts et al., 2023). Since its first arrival in the United States, the number of adolescents using e-cigarettes has increased tremendously, and it continues on an upward trend (Sapru et al., 2020). E-

cigarettes are now the most commonly used tobacco product among students in both middle and high school. The United States Health and Human Services report published in 2017 spoke to an increase in the current use of e-cigarettes among high school students from 1.5 to 11.3% between the periods of 2011 to 2017, and middle school students showed an increase from 0.6 to 4.3% for that same period (Sapru et al., 2020). Within one year, from 2017 to 2018, it was reported that 3.6 million adolescents in the United States were currently using e-cigarettes. This drastic increase was recorded in the 2018 National Youth Tobacco Survey Report (NYTS) (Sapru et al., 2020).

### **Devices**

E-cigarettes are devices that are powered by batteries and designed to deliver nicotine-infused liquid (e-liquid) through the process of heating, which results in the production of aerosol that can be inhaled, called vaping (White et al., 2020). The aerosol can be inhaled by the user through either the mouth or lungs which facilitates absorption into the bloodstream and exhalation of the remaining aerosol (Sapru et al., 2020). The devices are so designed that they resemble USB flash drives, pens, regular cigarettes, portable pocket pieces, and box mods. This facilitates not only different designs but also different sizes. E-cigarettes are of two different types, namely disposable and cartridge models. The disposable models are typically inexpensive and are best suited for beginners, while the cartridge model offers the rechargeable option and contains cartridges that may be refilled or exchanged after use (Sapru et al., 2020). Wherein combustible cigarettes produce smoke, e-cigarettes produce a vapor and give the user the opportunity to modify the device through the use of interchangeable parts and the

character of the aerosol being delivered through the manipulation of the voltage (Sapru et al., 2020).

The aerosol, also referred to as a gaseous mist, is produced at a temperature that is much lower than the point of combustion by heating the liquid that is within the cartridge. The liquid being used is a mixture of nicotine, propylene glycol, glycerol, water, various flavors, and toxic substances (Sapru et al., 2020). It has been revealed that there is also the presence of tobacco-specific nitrosamines (TSNAs), carbonyl compounds, polycyclic aromatic hydrocarbons (PAHS) (Sapru et al., 2020), formaldehyde, heavy metals such as nickel and chromium (Watts et al., 2022). The device that is being used can contain hundreds of puffs, and the cost can be as low as \$5.00, which makes it highly affordable for users (Watts et al., 2022).

While there are variations in the devices available, some, which are referred to as closed systems, cannot be modified by the user. This typically has a mouthpiece and a prefilled cartridge attached to a battery. One feature that is provided by the open-ended vaporizer system is not only the ability of the user to manipulate the device but also the ability of the user to increase the vape density, strength, and flavor of the aerosol that is being produced (Singh et al., 2020). In some instances, a greater level of expertise may be required to manipulate the device; however, it does provide the user with the option of not just using other substances but also increasing the intensity or strength of the substance being vaped (Singh et al., 2020).

The evolution of e-cigarettes has seen newer products dramatically change the vaping market within the United States among young smokers (Singh et al., 2020; as

cited in Barrington-Trimis and Leventhal, 2018). This is attributable to a more satisfying experience that is described to be had by e-cigarette users. The popular pod mod device, which was launched in 2015 and now controls over 70% of the retail market of e-cigarette products, is JUUL. JUUL has been able to capture the market through its sleek and modern design of the device. This makes it easily concealable by children and adolescents. The JUUL pods offer users the ability to customize their device through the use of covers, which are referred to as “skins.” The use of skins operates just as you would change the skin on the smartphone or the cases of the smartphone (Singh et al., 2020). They are further enhanced by the characteristic of being lightweight, making them ultraportable (Ahmad et al., 2022). The user-friendly design applied by JUUL also sees the level of concentration of nicotine in e-liquids being sold. They offer concentrations of 1.5%, 3%, or 5% nicotine levels. In addition to the levels of concentration, they have included a variety of flavors, such as cucumber, mango, mint, and vanilla, to name a few. Research revealed that the high nicotine concentration that has been detected in this popular brand has led many of its competing brands to increase their level of nicotine concentration to our range of 5 to 7% (Singh et al., 2020, as cited in Jackler & Ramamusthi, 2019). There is great variability among e-cigarettes as it relates to the designs, construction, electric power, liquid ingredients, and the constant evolution of the product (Breland et al., 2019). Both the design and the evolution of the product encourage the participation and use of e-cigarettes (Breland et al., 2019). By the end of 2018, JUUL had accounted for almost 80% of the e-cigarette retail market in the United States (Ahmad et al., 2022). These tobacco companies have nicely packaged e-cigarettes

into an appeal by brands through the use of cartoons, reduced-harm messages, and the use of social media influencers (Chen-Sankey et al., 2024). While different brands use different appeal strategies, as of 2021, the competition appears to be at its deepest between PUFF and JUUL. It was revealed that PUFF had usurped JUUL. PUFF offers disposable products, and JUUL features “pod-or cartridge-based products,” which may account for the patterns seen in the use of these products (Chen-Shankey et al., 2024). From first-generation e-cigarettes through to second, third, and now fourth-generation products, their level of appeal and attractiveness has increased with each generation. The size, shape, and colors are aspects that have been added to the upgrade done on these devices/products (Riwu Bora et al., 2023).

### **Patterns in Use**

Adolescents are more likely to be users of electronic nicotine delivery systems (ENDS). Studies reveal that adolescents between grades 9 through 12 are twice as likely than young adults of age 18 to 24 to be current users of e-cigarettes, and they are over four times more likely to be current users of e-cigarettes than adults (Shamblen et al., 2022). ENDS use among adolescents is predicted to increase even more (Shamblen et al., 2022). With the number of young adults who use e-cigarettes on a daily basis increasing from 2.4% in 2012 to 5.2% in 2015 (Sapru et al., 2020), there is much cause for concern as adolescent use exceeds that of young adults. E-cigarettes have risen to acclaim the position of the most popular tobacco product being used among middle school students and high school students. Figures recorded in 2019 by the National Youth and Tobacco Survey (NYTS) revealed that 34.2% of high school students were frequent e-cigarette

users, and approximately 46.1% of 12 graders are frequent e-cigarette users (Mirbolouk et al., 2022).

Data collected from a sample of US high schoolers nationally between the period of 2015 and 2019 provides further evidence that the current and frequent use of e-cigarettes has increased among the youth. The study also revealed that there was a great decline in the prevalence of combustible cigarettes and other tobacco products (Mirbolouk et al., 2022). While the increased pattern in current and frequent e-cigarette use may be attributed to a number of different reasons, there was a high level of psychosocial stress identified with the experiences of the many youths who engaged in the use of e-cigarettes. The number of first-time users of e-cigarettes has attracted a high prevalence rate. Many youths who are actively engaged in e-cigarette use were never exposed to combustible cigarettes. The idea is not to have youth initiated into the act as it brings on the “gateway effect” (Mirbolouk et al., 2022). With due effort made to reduce e-cigarette use among the American youth, the exposure and addiction to nicotine within this population could be curtailed.

### **Peers and Devices**

One aspect of the increase in popularity of e-cigarettes is attributed to the association that exists with peers’ usage (Cheng et al., 2023). The association between the use of tobacco products, including e-cigarettes, and the approval one gain from their friends cannot be underestimated. While it may extend to other substances, nicotine and marijuana vaping have been known to help seal the bonds that exist between children and adolescents as they participate in the act of vaping (Cheng et al., 2023). The bonds that

are formed or strengthened may vary among the genders. There was a stronger relationship between late adolescent girls than between boys. It was observed that girls between the ages of 12 to 15 years of age, with significant support from their classmates, were more likely to smoke than boys of the same age range (Cheng et al., 2023). The later years of 16 to 20 years of age revealed a close association between having friends who used e-cigarettes that was slightly different from what was seen in the earlier stage. The association that existed between the influence of friends and the likelihood of being an e-cigarette smoker was seen in an increase in that association among boys over girls. This provides evidence that clearly highlights an existing variation in the use of e-cigarettes and access between boys and girls as it relates to age (Cheng et al., 2023). As there are differences seen between boys and girls in their peer exposure and susceptibility, the teenage users often tend to be more males than females and this circle tends to see those with higher pocket money (Hanafin et al., 2021). Peers seem to be highly influential over their fellow counterparts in the use of e-cigarettes. This is apparent as peers play a critical role in curtailing the social factors that are able to influence the lives of children and adolescents. It tends to appeal to a sense of novelty seeking among adolescents, which will help form their perception of e-cigarettes and ultimately lead to their use (Cheng et al., 2023).

The adolescence period is such that the youth tend to explore their level of independence while trying to understand the role they play in their social environments and the impacts such environments have on them (Stalgaitis et al., 2020). During this period of development, they experience a sense of social identity that facilitates their

interaction with their immediate peers and, hence, the ability to be influenced. It becomes easy for experimentation of substances to take place. Another factor to consider is that this population is exposed to higher rates of adverse childhood experiences (ACEs). Different groups will have different adverse childhood experiences, making it easier for bonds to be formed and influences to be stronger. It provides a way of coping with trauma.

Understanding peer crowds is important as it can assist in identifying the potential health risks that might be associated with this practice. It is through this notion that interventions may be so designed to address the emerging trends identified in youth, as these interventions can be “peer crowd-tailored” (Stalgaitis et al., 2020). The association of peer influence brings about exposure to e-cigarettes and portrays messages of protobacco products (Glover-Kudon et al., 2019). The percentages recorded from as early as 2015 revealed that 5.6% of middle school students and 19.6% of high school students were e-cigarette smokers. These percentages together accounted for over 3.6 million students (Glover-Kudon et al., 2019). Many of the younger children have accredited their older counterparts with their source of e-cigarettes. Children and adolescents are most vulnerable to the use of e-cigarettes. This raises much concern as while these products are promoted by many as being safer than combustible cigarettes, they seem to have a negative impact on their cardiovascular health (Hanafin et al., 2021).

There are certain brands that seem to get the attention of the youth more readily than others. As competition between the tobacco companies heightens, the innovation of designs increases. JUUL has fast-tracked to become the fastest-growing and highest-

selling brand of vaping products being sold in the United States (McKeganey & Russell, 2019). The design, size, and shape of the devices being created have impacted this turn. It makes it much easier for peers to not only influence their counterparts but also to share the devices (McKeganey & Russell, 2019). The increase in the use of e-cigarettes and JUUL being the largest supplier of vape products to children resulted in the US Food and Drug Administration (FDA) denying authorization to market JUUL on June 23, 2022 (Galimov et al., 2024).

### **Marketing of E-Cigarettes and Curiosity Among Youth**

#### ***Marketing***

With the onset of the use of e-cigarettes came a decline in the use of combustible cigarettes (Shroff & Sreeramareddy, 2024). As the tides turned on this new invention, it was noticed that its use was more prevalent among the youth in high-income countries, and by the year 2020, there was a record list of 68 million e-cigarette users globally. Among these numbers, 9.8% of those aged 12-16 years of age were daily users (Shroff & Sreeramareddy, 2024). Youth became that special population of increased use because they were more inclined to be caught experimenting with these products. The experimentation became possible because their curiosity was aroused, and that became the driving force behind their need to try these products (Gentzke et al., 2022).

E-cigarettes are promoted by tobacco companies as “a safer alternative or harm reduction or smoking cessation tool for addicted conventional cigarette smokers,” and as a result of this marketing strategy, they are not strictly regulated around the world (Shroff & Sreeramareddy, 2024). In instances where there are indeed regulations implemented

within such countries, tobacco companies find the means necessary to bypass these regulations. For high-income countries, such as the United States, the marketing strategy is focused on social media (Gilmore et al., 2023). This has brought in play the importance and use of the internet. While social media marketing does exist in other countries besides the United States, the greater extent of such marketing is seen more prevalent in high income countries. Through the use of the internet and the many ways it offers for specific target groups to be looked at (Azagba et al., 2022). The most common social media platforms geared towards the promotion of e-cigarettes include Instagram, Facebook, Twitter, and YouTube (Shroff & Sreeramareddy, 2024). Many of these platforms offer discounts, starter kits, and newsletters updates on new products and are also topped with catchphrases and slogans. Two phrases used exclusively are “Eat, sleep, vape, repeat” and “Quit Smoking, Let’s Vaping” (Shroff & Sreeramareddy, 2024). Fourteen websites used strategies such as these, which account for 47% of the existing websites promoting the use of e-cigarettes (Shroff & Sreeramareddy, 2024). With discounts and offers accounting for 80% and 53% respectively it becomes the pulling force for attraction, and the problem further ensues when free samples of e-cigarettes and liquids are offered to individuals (Shroff & Sreeramareddy, 2024). The variation in the use of flavors by tobacco companies is considered to be a promotional strategy that makes the product attractive and brings about youth appeal (Shroff & Sreeramareddy, 2024).

In some instances, there are WhatsApp messenger links and even physical addresses to contact sellers (Shroff & Sreeramareddy, 2024). Social media also provides

links to websites, blogs, subscription platforms where access can be gained. Even while there is a disclosure made about the fact that e-cigarettes contain nicotine, it is still promoted as a healthier option than traditional cigarette use (Shroff & Sreeramareddy, 2024). The use of online marketing strategies by tobacco companies is not only well-established but also profitable. Money has been invested in the study of online marketing by these companies, which addresses content analysis of what is being promoted on social media and websites. The cleaner and healthier claims of no second-hand smoke add to the curiosity (Escobedo et al., 2020).

The investment in marketing these products with the intent to gain maximum profits is amplified with the use of celebrity endorsements and doctors (Shroff & Sreeramareddy, 2024). Celebrities appeal to a sense of improved social status, which is one claim promoted by tobacco companies. With healthier endorsements, less risky benefits, and social appetite being hot topics associated with the use of e-cigarettes, it makes it much more likely for children and adolescents to take a second look upon seeing these products. This is further enhanced by the lack of restrictions on checks to prevent access to minors and the absence of warning signs or verification of age, which makes the procurement of these products relatively easy for this population of interest (Shroff & Sreeramareddy, 2024).

The retail marketing of e-cigarettes has seen set targeted groups. This is evident in the use and prevalence rates recorded among sexual or gender minority groups, as these rates appeared to be high (Berg et al., 2022). Much lower rates were recorded in racial/ethnic minorities when compared to Whites. These figures revealed less than 3.4%

of ethnic minorities as opposed to 4.2% of Whites (Berg et al., 2022). In Canada, the indigenous youth population is considered to be at higher risk for the use of e-cigarettes than their counterparts as they are more likely to explore factors pertaining to vaping (Struik et al., 2022). Perception, experience, and access to these products vary among the indigenous youth. This is manifested in the difference that has been observed between those youth living on the reserves and those who live off the reserve (Struik et al., 2022). This may be attributed to limited access to vaping products as well as the financial means to maintain the lifestyle of those youth who live on the reserve, and as a result, they are less likely to participate (Struik et al., 2022).

The sales of e-cigarettes have contributed to the drive behind the growth of the tobacco market and the increased profitability of tobacco companies (Liu & Filippidis, 2024). New designs continue to be produced, and upgrades are being made to what previously existed. E-cigarette heated tobacco products (HTPs), tobacco-free oral nicotine, and the non-combustible products offered have revamped the marketplace and are responsible for the increase in sales and the high increase in the global tobacco retail value (Liu & Filippidis, 2024). This high rise in the global retail value of tobacco is more recognizable in high-income countries such as the United States as sales soar for these emerging products (Liu & Filippidis, 2024). It is important to note that these emerging products are nicotine products, and they do not contain any form of tobacco however, the companies remain the same. These emerging products are considered to be a part of the widescale tobacco market. Reflections are seen in the rise in earnings as they moved from US \$657 billion to US \$906 billion across 97 different countries (Liu & Filippidis, 2024).

High use of e-cigarettes by children and adolescents has been a result of both marketing and promotional practices taken on by these tobacco companies (Kirkpatrick et al., 2023). They have used cartoon images to help market their products. Exposure to such a marketing strategy can be associated with increased appeal and risk of e-cigarette use by children and adolescents (Kirkpatrick et al., 2023). Advertisements have now incorporated these cartoon characters, which is an indication of the intent to appeal to this population. This was adopted from the appeal seen in the use of the cartoon character Joe Camel in the earlier years of trying to make combustible cigarettes appealing (Kirkpatrick et al., 2023). The comicalness of cartoon characters makes light matters that should be taken seriously. In today's use of cartoon characters by companies manufacturing e-cigarettes, characters are applied to their logos, packaging, and labeling of their products (Kirkpatrick et al., 2023). There are more than 300 brands of e-cigarettes making use of cartoon characters on their electronic juice (e-juice) labels (Kirkpatrick et al., 2023).

Social media is not without its use of comical cartoon characters. From posts seen on Instagram, 21% of the e-liquid posts, which were from the manufacturers themselves, contained some aspects of a cartoon. 14% of children and adolescents are able to identify brands by cartoon characters (Kirkpatrick et al., 2023). Exposure to such comical characters for children and adolescents works towards increasing the perceived benefits of using e-cigarettes while lowering the perceived risks present. This clearly identifies the promotion of e-cigarettes to youth and increases the likelihood of the intention to try these products (Kirkpatrick et al., 2023).

### *Curiosity*

Not much is known about possible factors that may influence the mindset of children and adolescents to use e-cigarettes (Zaula-Arciniega et al., 2019). There is a driving force behind their motivation to use these products. There is a wide array of flavors available and an associated level of impulsivity that comes with the need to try e-cigarettes (Bold et al., 2017 as cited in Zaula-Arciniega et al., 2019). The sweet flavors with the customizable devices bring about a level of curiosity among youth and is the primary motivating factor for the use of e-cigarettes among middle school students (Zaula-Arciniega et al., 2019). The belief that e-cigarettes are safer than combustible cigarettes helps spur that level of curiosity. Researchers discovered that 70% of e-cigarette users stated that their reason for initiation was as a result of them being curious (Zaula-Arciniega et al., 2019).

It must be noted that the economic status of users varies across different countries and even within a country. The United States is no different and sees a difference in the socio-economic status of vapers. Regardless of their socioeconomic status, the commonality found for the primary motivation of initiation was a level of curiosity (Khouja et al., 2020). The motivation that comes about from being curious is more likely to facilitate continued smoking and not just initiating vaping (Khouja et al., 2020). Lack of knowledge about the devices and vaping itself facilitates curiosity (Mohd Hairi et al., 2022). This motivation has even led to the need to acquire and use illegal e-cigarettes, which are cheaper than those readily available on the market (Mohd Hairi et al., 2022).

The different flavors, association with their friends, and the ability they have discovered to use vape products discretely are all factors that increase curiosity among children and adolescents, ultimately leading to them using these products (Nicolaou et al., 2022). The brand JUUL is particularly easy to use and can be shared easily with others, seeking to enhance its appeal and increase its popularity on the market (Leavens et al., 2019). Through social norms and social networks, the curiosity of these products is intensified (Leavens et al., 2019).

The problem is further complex with the increased exposure to advertisements so designed to spur curiosity among youth who have never used e-cigarettes (Ebrahimi Kalan et al., 2020). 90% of the adult smokers that exist today began their nicotine addiction in their early years when they were adolescents (Ebrahimi Kalan et al., 2020). It is believed that the habit of the latter years started out of mere curiosity. It is the same with e-cigarettes as the high level of curiosity aroused among adolescents along with susceptibility are ultimately predictors for future use of e-cigarettes (Bold et al., 2017; Margolis et al., 2016; Nicksic & Barnes, 2019, as cited in Ebrahimi Kalan et al., 2020). Children and adolescents take on the use of e-cigarettes through the practice of experimentation. There is no clear intention to vape, but they ultimately experiment by becoming curious about the promoted products (Ebrahimi Kalan et al., 2020). The level of curiosity aroused may be triggered by several different things. In particular, sociodemographic and environmental factors play a key role in determining the level of susceptibility and curiosity developed about e-cigarettes (Ebrahim Kalan et al., 2020). Some of these factors may include gender, race, school level, exposure to e-cigarette

advertisements, second-hand arousal, and the use of noncigarette tobacco products (Ebrahimi Kalan et al., 2020). Being advertised as one of the most sophisticated smoke-free products appeals to youth (Phan et al., 2020). According to the International Tobacco Control Youth Tobacco and E-Cigarette Survey done in 2017, 41% of the youth exposed to these heated tobacco products reported ended up trying the products (Phan et al., 2020). Their curiosity led them to experiment.

Curiosity about e-cigarettes was found at the middle school stage and high school stage. This was further enhanced by their perception of e-cigarettes, as adolescents with high perceptions of e-cigarette harm were less likely to be as curious as those with a low perception of e-cigarette harm (Ebrahimi Kalan et al., 2020). The level of risk perceptions associated with the use of e-cigarettes is influenced by the marketing strategies of tobacco companies (Liu et al., 2020). Messages of reduced health risks and play on children and adolescents elevated emotions and personal beliefs, which make them see their involvement in such acts as a socially acceptable practice that influences their curiosity (Liu et al., 2020). This reveals that sociodemographic structure correlates to forming perceived risks, facilitating curiosity (Phan et al., 2020).

Online sites and social media provide the right avenue to spur curiosity. Many of the social media platforms are driven by adolescents themselves. Instagram is one of the social media platforms adolescents drive, and they relate to messages geared toward influencing their interaction with vaping products (Liu et al., 2020). The industry drives other social media platforms, such as Twitter and Facebook. 80% of what is on social media regarding e-cigarettes and vaping and the messages being promoted is driven by

the tobacco industry (Liu et al., 2020). Advertisements from these companies are bombarded across the social pages and accounts of individuals without them needing to subscribe or follow these companies directly (Liu et al., 2020). Social media platforms are a place to promote and sell tobacco and marijuana products both at a market level by companies and through individual sales. The sales are pre-empted by using memes, often viewed as comical and fun enhancement images designed to get the viewers' attention through attaining “likes”. Popularity increases with the number of “likes” received for these images or videos. There is also the option of sharing what one might think their friends or followers want to view or be a part of. Making these messages through pictures or videos visually appealing and using influencers, which may be celebrities, in some instances to endorse the messages being sent out sees curiosity about these products increased youths (Liu et al., 2020).

The social media platform TikTok prohibits its users from posting any content that may aid in soliciting or appealing to minors to purchase or use e-cigarettes (Vogel et al., 2024). Their algorithm is designed to exclude nicotine vaping content from video feeds. To bypass this process, some tobacco companies make use of influencers. These trendsetters endorse their message and products (Vogel et al., 2024). These influencers disclose the brand of their sponsorship as a requirement, which may appear in the feed of viewers as an advertisement (Federal Trade Commission, 2017, as cited in Vogel et al., 2024). This practice is very different on Instagram. On this platform, the brands are rarely ever disclosed, but the “video creator” and or “blogger” uses their content pages to appeal to children and adolescents, sending a positive message about the products and

bringing curiosity to these young viewers (Vogel et al., 2024). Through increased appeal, the act of experimentation is promoted among youth (Schneller et al., 2022).

Another aspect of increasing curiosity among children and adolescents that may lead to the initiation of the use of these products is that of specialized vape shops. Since the first onset of e-cigarettes and the advent of vape shops, there have been many changes in how they operate through sales and promotion (Huh et al., 2024). They promote e-cigarettes and e-liquids, and their employees are critical contacts for individuals who are interested in trying e-cigarettes for the first time, particularly children and adolescents (Huh et al., 2024). They both arouse curiosity and facilitate initiation. To be able to purchase e-cigarettes and e-liquids from vape shops creates the perfect scenario for children and adolescents who are curious about e-cigarettes to ask questions and seek answers to those questions (Harlow et al., 2023). This provides not only point-of-sale marketing for e-cigarettes but also a social source that facilitates a greater frequency of vaping. This is possible because 50% of tobacco and vape refuse to adhere to measures of age verification and see several underage being able to purchase products such as cannabis and e-cigarettes (Harlow et al., 2023).

Peers can also arouse curiosity about e-cigarettes. The power of influence that a peer has cannot be underestimated and remains strong in setting the stage to facilitate curiosity, which may lead to the initiation and maintenance of such practices (Dube` et al., 2023). The common practice of vaping, as seen among high school students and middle school students, is a result of shared increased curiosity and the support that they can provide for each other in aiding that process. Through this social setting, these groups

support each other. Widespread misperceptions of the role of nicotine in health harms go around much quicker in such settings. Misconceptions increase the odds of curiosity (Villanti et al., 2020).

### **Accessibility and Acquisition**

Curiosity about e-cigarettes leads to initiation (D'Angelo et al., 2021). Before there can be initiation, there has to be first accessibility and then acquisition. Initiation is further enhanced by marketing exposure. Marketing exposure is attained locally at convenience stores, small markets, pharmacies, and liquor stores (D'Angelo et al., 2021). This is often through retail e-cigarette advertisements, of which there is a favorite. The advertisements are imprinted in the mind through frequent convenience store visits, and initiation is enhanced through the source. The lack of regulation by the Food and Drug Administration (FDA) in the United States adds to the problem of ease of accessibility (Chen et al., 2020). There is currently no restriction on the sale of e-cigarettes to minors at the national level. Free samples are readily available, and no requirements have been placed for warning labels. With no required process or need for manufacturers to register with the FDA and be able to readily manufacture new products and easily release them on the market, the background for the accessibility of these products is set (Chen et al., 2020). The message of being safer than combustible cigarettes and the promotion of smoking cessation increase the level of accessibility (Hartwell et al., 2020).

The lack of enforcement of youth access laws makes it possible for minors to be able to frequently purchase any form of vaping device from retail locations as well as online (Mantey et al., 2019). With a determination to use these products, they can be

obtained quite easily. This signifies a social-environmental acceptance of adolescents using e-cigarettes (Mantey et al., 2019). It does appear that many young e-cigarette users had a greater prevalence of accessing e-cigarettes online than older e-cigarette users (Mantey et al., 2019). Online and vape shops are not the only access points for these products for children and adolescents. While the commercial sources make it possible for them to purchase what they desire, there is also the social source of obtaining these products. Through asking someone to purchase on their behalf, or simply purchasing from someone who is known to either them or through a referral their source and ability to obtain the products become clear (Graham-DeMello et al., 2023). In many instances, the first source of e-cigarettes for minors to begin initiation is from their peers or siblings and is generally obtained at school or home during that bonding time (Graham-DeMello et al., 2023). When these devices are not purchased for themselves, they are used in a social nature by simply borrowing and or passing around the devices (Baker et al., 2019).

Vending machines provide a different kind of accessibility to children and adolescents. Vending machines have no sales restrictions, marketing regulations, or form of taxation, and they are strategically placed at different points of sale to maximize profits (Mus et al., 2023). These machines serve as important distribution channels for industry, making it possible to capitalize on sales. The availability of the devices is within fingertip reach of the minors inclined to participate in the act of vaping. As there is no minimum age verification process needed, purchasing vaping devices and e-liquid has become much easier (Mus et al., 2023). These machines accept both credit cards and cash and offer a wide range of products at different prices. Products may range from US \$7.00

to US \$25.00, and the customers can choose between brands from an array of flavors (Mus et al., 2019).

Ease of accessibility and acquisition further complexes the problem and makes it possible for dual use of products among adolescents (Culbreth et al., 2021). This means that there can be a combination of e-cigarettes and combustible cigarettes. This allows other substances to be incorporated into e-cigarette devices (Culbreth et al., 2021).

### **Social Media**

Visualization of messages has become even easier and more appealing with the aid of social media. Social media content can be so designed that they are both appealing and time-consuming. Exposure to such content has been linked to an increase in the use of e-cigarettes among adolescents in the United States (Vassey et al., 2023). Within a one-year period of 2019 to 2020, low-priced disposable e-cigarette devices increased in use by approximately 1000%. This increase was reflected in the percentage increase from 2.4% to 26.5% recorded among high school users in the United States (Vassey et al., 2023). On average, more than 8 out of 10 adolescents are consumers of e-cigarettes and are drawn to flavored e-cigarettes (Vassey et al., 2023). These figures are attributed to the use of social media in promoting these e-cigarette devices.

In 2021, Instagram was recorded to have over one billion users worldwide and is the second-largest platform for marketing products, including e-cigarettes (Vassey et al., 2023). These electronically heated nicotine devices are promoted through content from different e-cigarette stores, brands, distributors, and influencers. Influencers come in the form of models, bloggers, and brand ambassadors, and they have garnered over one

million followers from 1000 to over one million. They are responsible for posting content that speaks to e-cigarettes and e-liquids on behalf of brands with the intention of earning from their posts. Their earnings can be monetary or non-monetary, such as free samples or devices (Vassey et al., 2023). The contents posted are designed to captivate young users and spur their curiosity. Influencers enhance the level of curiosity in young people and bring about the urge to experiment. Social networks are also formed through social media platforms, which facilitate the art of influencing young minds (Vassey et al., 2023). Once social networks are formed, there is no longer the need for mega-influencers to influence the market; rather, they facilitate an interconnection global networking of micro-influencers.

Understanding the impact of social media relies heavily on understanding the power of social influence. People have the power to influence the thoughts, feelings, and actions of others tremendously, and this is what these e-cigarette companies rely on (Amin et al., 2020). They understand the use of the Social Cognitive Theory and Capability Opportunity Motivation – Behavior Model and apply its technique to recruit new e-cigarette users. The idea of status gained by the use of e-cigarettes is appealing to adolescents, and their sense of curiosity is aroused. It is also attractive and considered safe to use, providing the perfect opportunity for tobacco companies to pull on intrigue (Amin et al., 2020).

Social media also helps in forming social connections. These connections formed may be between friends, family members, and peers, who also have the power to influence. This is possible because social norms are powerful mechanisms that lock into the

predispositions of what a group has aligned with, making it socially acceptable (Amin et al., 2020). Once there is the social acceptability of e-cigarettes, the initiation and use become easier (Amin et al., 2020). Twitter uses the art of microblogging, which allows users to broadcast brief posts that are referred to as tweets while still giving credit to the original creator of the post. This means that tweets made on these tobacco products by reputable individuals are shared or retweeted with their influence kept (Berg et al., 2019). Tweets allow for material regeneration within a social network, hence building and reflecting on social norms that influence behavior (Berg et al., 2019). Through tweets, advertising is done, which facilitates the attraction of new e-cigarette users, further expanding the tobacco market (Berg et al., 2019).

Social media platforms also provide the means for information to be shared easily and at a quick rate (Ketonen & Malik, 2020). As more postings are made and shared, it must be noted that these platforms portray and evoke a very high positive image of e-cigarettes, which becomes embedded in the “youth culture, luxurious lifestyle, sex appeal, and feelings of both freedom and relaxation” that is being promoted which ultimately leads to social acceptability among children and adolescents (Ketonen & Malik, 2020). The use of these platforms surpasses the means of sharing information. They also serve to bring about some level of gratification such as status-seeking, attention-seeking, and self-presentation (Ketonen & Malik, 2020). This promoted content is considered positive for users on these social media platforms (Jancey et al., 2024).

The constant exposure to advertisements for these products on these platforms propels the increase in the intention to use e-cigarettes (Amin et al., 2020). Influencers

build on their branding and are key to their identity performance, which makes it possible for them to impact social media users (Greene et al., 2022). The use of gender, hashtags, and branding enhances the positive impact that impacts perception that arouses curiosity and the intention of the act of initiation based on experimentation (Greene et al., 2022).

### **Perceptions**

Many of the beliefs that have been developed within the mindset of those who use e-cigarettes, particularly those of children and adolescents, have been accredited to the advertising done on these products. Much advertising is misleading and promotes claims that e-cigarettes are safe or harmless (Pettigrew et al., 2023). The lack of clearly visible designed health warning messages adds to the messages that get encoded in these young minds (Pettigrew et al., 2023). Tobacco companies are responsible for marketing e-cigarettes as a healthier alternative to combustible cigarettes which makes it rather attractive to children and adolescents since the perceived health risks are minimized (Peri et al., 2024). This has led them to believe that e-cigarettes are products that provide health benefits to their users (Peri et al., 2024).

The COVID-19 pandemic provided the perfect opportunity for tobacco companies to indoctrinate young minds, fostering a positive perception of these products (Chen et al., 2023). As a result of adverse psychosocial outcomes such as anxiety and depression and the need to free themselves of the high level of boredom that they faced, which they had not been accustomed to, their perception of e-cigarettes could have easily been altered (Chen et al., 2023). Social isolation and experience of greater levels of mental health problems, which came about as a result of prolonged time being spent at home due

to the restrictions of social distancing implemented, brought on the time for them to spend on their electronic devices (smartphones, tablets, computers) arousing curiosity and being captivated by the messages from the tobacco companies. These children and adolescents were at home and unsupervised and, in many instances, alone (Chen et al., 2023).

The variety of available flavors on the market added to the level of curiosity experienced and the perception of these products being less harmful (Chaffee et al., 2020). Non-tobacco flavors have been considered less perceived danger than products containing tobacco flavors (Chaffee et al., 2020). It has also been discovered that e-cigarette users have developed strong perceptions about the devices available and the ease of use of these devices (Chaffee et al., 2020).

Perception also seems to vary among different sociodemographic groups. Researchers found that more Latino youth were susceptible to e-cigarette use than their white counterparts (Alonso et al., 2023). This ethnic group, which accounts for 18.5% of the total population within the United States, contributes to more than one-quarter of the youths within the United States (Alonso et al., 2023). Their exposure to tobacco marketing is much higher than non-Latino youth and is influenced by a much broader range of factors that stand to influence their perception. For this group, their customs and social factors add to their curiosity as they view e-cigarettes as trendy and able to provide many social benefits (Alonso et al., 2023). For this ethnic group, e-cigarettes are believed to aid in the relief of stress as they help them to relax and cope with issues they face

daily. This propels us to see e-cigarettes as a much better alternative to combustible cigarettes (Alonso et al., 2023).

The youth are a target group for tobacco companies. Marketing strategies are so designed and created to be captivating, increasing their perceived accessibility of tobacco and tobacco brand recognition, which in turn increases susceptibility and leads to initiation (Kuipers et al., 2020). With perceived ease of accessibility and positive social norms being formed around e-cigarettes, the perception of children and adolescents will be in favor of these evolving tobacco products (Kuipers et al., 2020). Perception stimulates an appeal poise for the behavior of vaping (Al-Hamdani et al., 2022).

The biggest aid in getting children and adolescents to become e-cigarette users is to let them remain naïve about the nicotine contents of e-liquids. The popularity of e-cigarettes has increased among youth who are naïve about nicotine being included in what they are vaping (Becker & Rice, 2022). This level of naiveness has led them to believe that while combustible cigarettes are bad for them and pose many health risks, e-cigarettes are safe. Studies continue to report that the long-term health effects of e-cigarette use are not known (Hong et al., 2021). This provides a haven for vapers. With not much information to go on and their attention given to advertising, they fall prey to a lack of awareness of the harm of e-cigarettes and e-liquids (Becker & Rice, 2022). In addition, children and adolescents spend much of their time on social media platforms, which are great places to share information. In many instances, one has to attest that much of the information shared through social media is often misinformation, causing a

false sense of perception to be developed among children and adolescents, facilitating their acts of experimentation (Becker & Rice, 2022).

Perceived harm of e-cigarettes among children and adolescents is considered to be low (Gardner et al., 2023). The behavior that is displayed in their sense of appeal or pull towards these products is a result of their perception that fuels their curiosity. With brightly colored packages, a variety of fruit and candy flavors, and the strong social media presence that exists, their perception of e-cigarettes will likely be a favorable one and will continue to appeal to this population, which highlights the depth of the public health epidemic faced (Gardner et al., 2023).

### **Flavor**

The public health issue is that more young people are using e-cigarettes, and the word 'young' here refers to children and adolescents. With middle school students representing 14.1%, which is a count of 2.14 million, and high school students representing 3.3%, a count of 380,000 as the current use in 2022, the alarm of public health threat to this population increased (Seaman et al., 2023). It is known that e-cigarettes are available in a variety of flavors. With 84.9% of high school students who practice vaping reported that they used flavored products, this suggests that there is a special appeal to the youth through the variety of flavors used by tobacco companies (Seaman et al., 2023). The diversity and availability of appealing flavors are attractive to children and adolescents (Galimov et al., 2022). Flavors such as fruit, sweet, mint, and even menthol appear commonly used among adolescents. There is also an ice-hybrid flavor that has been introduced to the market, which has pulled on the curiosity of the

young. This ice-hybrid flavor combines the ice-cooling feeling with flavors such as blueberry, watermelon, and many other fruit flavors (Galimov et al., 2022). While it has become popular among this population of interest, ice-flavored e-cigarettes have been linked to the appeal and association of their curiosity power (Galimov et al., 2022). This appeal, which sparks a level of curiosity, makes it possible for initiation to take place. Once an experiment occurs with these products, it becomes a feeling of refreshing satisfaction. This is brought on through the synthetic coolant used in these products. Methone, eucalyptol, peppermint oil, and WS-3 are used in ice-flavored e-cigarettes to produce a strong method like cooling which repels the irritant effects of regular nicotine-flavored tobacco products (Galimov et al., 2022). This not only increases the appeal of these products to children and adolescents but promotes a much deeper aerosol inhalation of the e-liquid and encourages frequent use of the products (Galimov et al., 2022).

The use of the many different flavors has made it rather challenging for the FDA to implement some form of regulation on e-cigarettes (Cho et al., 2023). It is known that e-cigarettes pose great risks to children and adolescents but with the promotion of the possibility of smokers benefiting from e-cigarette use by tobacco companies has complicated what currently exists. (Cho et al., 2023). The experience may also be altered as they have the ability to make changes to the vaping devices and the e-liquid being used. FDA has cited that the appeal to children that currently exists is largely attributed to the appeal of flavored e-cigarettes (Ali et al., 2023).

Flavors increase curiosity and the main factor behind the initiation of e-cigarette use among children and adolescents is curiosity (Maalej et al., 2021). In many instances,

the reports of first-time use of tobacco products by this population were with a flavored product (Jackson et al., 2021). The youths themselves have attested to the appealing flavors as one of their top reasons for experimenting with e-cigarettes (Jackson et al., 2021). In most cases, the taste of the product is improved significantly, and regardless of the nicotine concentration, it is appealing to this population.

The use of different flavors also aids in the false sense of safety that is developed among children and adolescents regarding these products (Hammond et al., 2022). Fruit flavors, in particular, have made the use of e-cigarettes appear to be healthy (Hammond et al., 2022). Flavored e-cigarette sales have increased tremendously in the United States, and companies with top brands have seen this reflected in their profit. Studies revealed that between January 2020 and December 2022, the total US e-cigarette unit sales increased by over 46.6%. Showing units moving from 15.5 million to 22.7 million (Ali et al., 2022).

### **Sociodemographic Factors and E-Cigarettes**

The extent to which the public health problem of the use of e-cigarettes by children and adolescents has escalated can be attributed to the association made between sociodemographic factors. Sociodemographic factors of age, gender, and race or ethnicity have been noticed to have some effect on the use of e-cigarettes by adolescents (Okonkwo-Diogu et al., 2022). The use of e-cigarettes has been recorded to increase with the age of adolescents, showing that they are directly proportional to each other. What causes this relationship is another factor to be examined. A postulation is that there is a positive association between increasing age and an increase in the likelihood of using e-

cigarettes for adolescents (Okonkwo-Diogu et al., 2022). A possible reason for this association is the likelihood of more exposure to e-cigarette advertisements (Okonkwo-Diogu et al., 2022).

The level of exposure to e-cigarette advertisements and products varies among different ethnic groups. Studies revealed that a large number of high school users of e-cigarettes are non-Hispanic whites and males (Mshigeni et al., 2021). Due to the educational attainment of these ethnic groups and the perception garnered, there was a difference in the number of e-cigarette users. A stronger correlation was observed between Black Americans and Whites (Mshigeni et al., 2021). While the use of e-cigarettes by children and adolescents continues to increase, it is important to note that almost all aspects of demographic characteristics that can be thought of can be considered to be impacting the use of e-cigarettes as well the use of e-cigarettes also impacting them (Mshigeni et al., 2021). This suggests that the racial and social disparities that exist across the different ethnic groups are capitalized on by the tobacco industry in their marketing strategies (Cook et al., 2022).

This also highlights a bigger problem of social disparities and how individuals are exposed to different issues based on their communities. There is a disproportionate presence within the low-income and racial/ethnic minority communities of tobacco retailers (Lee et al., 2017; Rodriguez, Carlos, Adachi-Mejia, Berke & Sargent, 2013, as cited in Venugopal et al., 2020). Evidence from scientific research suggests that tobacco retailers are so poised with their close proximity and density to facilitate youth tobacco use (Berg, 2018; McCarthy et al., 2009; Mennis & Marson, 2016, as cited in Venugopal

et al., 2020). With the proximity and density considered in relation to where these children and adolescents live and attend school carefully thought out and capitalized on, the tobacco companies have a strong contribution to bringing about the environment that facilitates the use of e-cigarettes among this population (Venugopal et al., 2020). In these communities, children and adolescents are bombarded with advertisements from retail stores and all other forms of advertising they are exposed to. Students' use of ENDS is positively associated with the promotion level of the products within these communities (Venugopal et al., 2020). In recent years, there has been an increase in e-cigarette retailers within communities of lower socioeconomic status, in greater proportion among the Hispanic population (Venugopal et al., 2020). Tobacco retailers are more likely to reap the benefits in profits from selling tobacco products to minors in areas with high social disparity (Lee, Landrine, Torres & Gregory, 2016, as cited in Venugopal et al., 2020).

Marketing for low-income communities is even more effective because tobacco companies promote these products as fashion accessories to attract young users (Duo Yan et al., 2024). This population in these communities needs individuals to look up to as role models. Using celebrities to endorse these products makes them fall victim to the plot used by the tobacco companies (Duo Yan et al., 2024). This becomes so effective in appealing to their curiosity about e-cigarettes that it ultimately leads them to acquire a device and, in some instances, retain such, hence developing a habit and being considered e-cigarette users (Duo Yan et al., 2024). Researchers have long held that

curiosity is aroused because of these tobacco companies' effective advertising that aims to attract children and adolescents.

### **Health and Environment**

The popularity of the modernized tobacco nicotine product, e-cigarettes, has continued to evolve and is often preferred by users because they are small and, in many instances, affordable (Tilley et al., 2023). With 2022 reports stating that one in ten middle and high school students is considered an e-cigarette user (Tilley et al., 2023), and diseases and deaths related to the use of tobacco products are preventable (Gentzke et al., 2022), it makes much sense to assess the health and environmental implications of e-cigarettes use by children and adolescents. Many e-cigarette brands contain extremely high nicotine concentrations of approximately 50mg/mL, with the newest 5<sup>th</sup>-generation versions being able to deliver up to 7000 puffs (Tilley et al., 2023). It must also be recognized that the SARS-CoV-2 pandemic revolutionized the way children and adolescents access e-cigarettes. Access to e-cigarettes is the preferred nicotine concentration, and this is cause for concern (Tilley et al., 2023). While trying to highlight the positives of e-cigarettes, the tobacco companies have not given the public the possible negative effects that come with vaping.

The public associates the use of tobacco products with pulmonary health risks along with numerous heart diseases (Hong et al., 2021), but not enough information is there (Henning-Stout, 2023), and not enough is done to protect this precious population that has fallen victim to the tobacco companies (Lyzwinski et al., 2022). It is argued that the evidence that is available regarding the use of e-cigarettes for cardiovascular disease

is limited (Cristselis & Panagiotakos, 2024). This method of effectively promoting e-cigarettes as a healthier way to get over conventional tobacco products brings about the cause for concern about the potential long-term health impacts that may arise as a result of e-cigarette use (Cristselis & Panagiotakos, 2024). Children and adolescents who use e-cigarettes are exposed unnecessarily to respiratory health problems. Heightened asthma attacks, bronchitis, and respiratory tract irritation represent some of the respiratory issues that may impact this vulnerable population (Lyzwinski et al., 2022).

Studies reveal that regular use of e-cigarettes where the e-liquids used contain nicotine has been associated with changes seen in the heart rate of the users. Vascular calcification and impaired vascular function have also been observed (Cristselis & Panagiotakos, 2024). Prolonged use can lead to elevated systolic blood pressure. The misconception that is brought on by the marketing of flavored e-cigarettes is the platform for adverse health outcomes. An active e-cigarette user is often exposed to carbonyls, which have the potential to cause cardiotoxic effects. Many of these carbonyls can be detected in the vapors of the e-cigarette. One such carbonyl is formaldehyde, which is detected in propylene glycol-based solutions and is formed as a result of the overheating of the e-cigarette device. The heating of the e-liquid at high temperatures creates this toxic compound. Individuals who are exposed to formaldehyde are at increased risk of developing atherosclerosis, arrhythmia, myocardial infarction, and heart failure (Cristselis & Panagiotakos, 2024). E-liquids and vapors bring about exposure to metals, which also can impact the cardiovascular health of individuals. There are trace elements of mercury in e-liquids, and the vapor from e-cigarettes contains nanoparticles of nickel,

cadmium, lead, and tin. While the exposure to chromium and lead in the vapor is consistent with that of conventional cigarettes, the levels of nickel that e-cigarette users are exposed to are over 100 times higher than that which is contained in conventional cigarettes (Cristselis & Panagiotakos, 2024). Studies revealed that exposure to these metals in such forms impacts cardiovascular health using changes made to the nitric oxide-mediated flow-mediated dilation, causing aspects of stiffness that may result in acute toxic outcomes on the vascular system (Cristselis & Panagiotakos, 2024).

The most common effects seen in the use of e-cigarettes are increased heart rate, diastolic BP, and decreased oxygen saturation (Cristselis & Panagiotakos, 2024). Though it might be considered to be conflicting, there is evidence that suggests that there is also increasing stroke in addition to coronary heart disease. This signifies the detrimental acute effects of the use of e-cigarettes on cardiometabolic features (Cristselis & Panagiotakos, 2024). With these implications, it is believed that there might be long-term effects that may be similar to those seen with the use of conventional tobacco smoking products. E-cigarette users are also at risk of developing issues that are associated with underlying pathophysiological mechanisms that are implicated in the progression of cardiovascular diseases, such as endothelial cell dysfunction and oxidative stress, which may involve rapid surges in the number of circulating endothelial progenitor cells. All these ultimately lead to vascular injuries (Cristselis & Panagiotakos, 2024). These risks are magnified when it comes to children and adolescents because the flavored additives make it appealing without much or any thought given to the health effects. It is critical to this population because they are at a stage where it is crucial to their development.

Mental health is another health implication that must be considered and assessed as it relates to the use of e-cigarettes. There are several ways in which e-cigarettes may impact the mental health of their users, as the exposure to the nicotine content has implications in several adaptations seen in areas of the brain and has resulted in negative cognitive effects (Nguyen & Mital, 2022). It also limits the ability to respond to stress as well as the ability to cope with depression. The problem is magnified when youths may already be at risk for mental health conditions, as e-cigarettes will now increase the likelihood of them developing mental health problems (Nguyen & Mital, 2022). The use of e-cigarettes in adolescents has been documented to cause depression. These may include depressive symptoms, suicidal ideation, attention-deficit hyperactivity disorder, anxiety, impulsivity, and conduct disorders (Nguyen & Mital, 2022).

Habits critical to maintaining and supporting behavior in adulthood are often formed during the critical years of adolescence (Ling et al., 2023). This period, called adolescence, is critical not only for behavioral acceptance but also for the development of the body. Behaviors and habits formed during these years are carried to adulthood, and as a result, it is necessary to ensure that good and healthy habits are formed (Ling et al., 2023).

The use of e-cigarettes stands to be a health risk not only for the users but also for individuals who may experience secondary exposure (Su et al., 2021). This is because many communities have become socially favorable towards e-cigarettes. This leaves other individuals exposed to passive vaping. Passive vaping is being exposed to e-cigarette aerosol, which is fast becoming a public health problem, further complicating

that which currently exists as it relates to the use of e-cigarettes. Researchers have revealed that secondary exposure to e-cigarette aerosol is likely to have much worse impacts than what has been reported about second-hand tobacco smoking (Su et al., 2021). During vaping, the nicotine, glycerol, and flavor additives all become aerosolized and are inevitably inhaled by individuals near the vaping. These passive vapers, as they are called, are unaware of what they are inhaling and end up with their respiratory systems being both exposed and compromised (Su et al., 2021). The chemical constituents of the aerosol inhaled vary and may contain particles of various sizes ranging “from 10nm to several hundred nanometers” (Su et al., 2021). The range in size makes it possible for particles to deposit in the alveolar region as it contains an enormous surface area in the lower airways (Su et al., 2021). Information gathered from previous studies revealed that exposure to secondary aerosol may result in “reduced respiratory function, headache, dry mouth, ocular, nasal, and airway irritation symptoms, as well as exacerbate asthma symptoms in children and adolescents who may be asthmatic (Amalia et al., 2021). This means that the presence of secondary aerosol reduces indoor air quality tremendously. With the contents being nicotine, particulate matter (PM1, PM2.5, PM10), volatile organic compounds, propylene glycol (PG), glycerol, metals, tobacco-specific nitrosamines (TSNAs), and flavorings, the quality of the air non-e-cigarette smokers are exposed to is going to be compromised (Amalia et al., 2021). It must also be noted that many of the TSNA substances, such as N-nitrosornicotine (N) and nicotine-derived nitrosamine ketone (NNK) have been known to be carcinogenic at low levels (Amalia et al., 2021).

Sensory health effects are another factor that e-cigarette users face, as tobacco products are repeatedly known to result in a loss of taste and odor sensitivity (BinHamdan et al., 2024). These changes come as a result of disturbances that occur in the vascularization, shape, and taste buds. In addition to this, there is a higher plaque index, probing depth, clinical attachment loss, peri-implant bone loss, and detrimental impacts on oral health (BinHamdan et al., 2024). Tobacco products, once consumed, will affect the sense of taste and smell, and e-cigarette users stand to face the highest odds of experiencing sensory disorders (BinHamdan et al., 2024). The liquids used in e-cigarettes contain higher concentrations of nicotine, which causes irritation and bitterness over time.

The feeling received with the use of nicotine is one of sensual pleasure, especially if the nicotine is mixed with caffeine. Most of the children and adolescent populations across the world consume caffeine regularly. Studies reveal that 75% of children and adolescents aged 5 – 17 fall within the regular consumers of caffeine (Kristjansson et al., 2023). These come in several forms, such as sodas, coffee, tea, candies, and now the various energy drinks on the market. These caffeinated products are marketed to attract children and adolescents as their customers. The love for caffeine and the feeling enjoyed with its use makes the use of e-cigarettes by this population ideal. This propels the arm of curiosity and predicts the initiation of ENDS to be less than or equal to 13 years (Kristjansson et al., 2023). The initiation of the use of ENDS has a special appeal to children and adolescents and is associated with their curiosity about the products

(Santano-Mogena et al., 2021). This level of curiosity leads to the consumption of additional nicotine and may result in increased nicotine dependence (Jones et al., 2023).

Another public health issue is the ability to have mixed compounds or products in these vaping devices (Fiegel & Frank, 2023). Through intention, e-cigarette users can incorporate various substances along with changing the concentration of the e-liquid that is being used. According to the 2019 Youth Risk Behavior Survey (YRBS), marijuana was identified as a substance that is used by adolescents and recorded figures of use for high school students as over 36.8% (Jones et al., 2020, as cited in Fiegel & Frank, 2023). The co-use of marijuana and e-cigarettes has escalated the vaping public health problem. More children and adolescents are enjoying the mix of marijuana and e-cigarettes, but the mix can lead to additive effects on health and can propel behavioral changes (Fiegel & Frank, 2023). This mixing of substances is another element of curiosity seen as the element of why this is done as a result of their level of curiosity (Zhao et al., 2023).

In as much as ENDS can cause health issues through passive vaping, there are also environmental issues that may arise. Secondhand aerosol produces toxicants that alter the air quality of those in its presence (Addo et al., 2022). Residues from aerosol are also left on indoor surfaces to which this population is exposed. Another aspect of litter becomes a problem as e-cigarette devices are improperly disposed of and may result in the leaching of heavy metals, acids from batteries, and organic chemicals, which have the potential to cause harm to the population of interest as well as other organisms (Addo et al., 2022). These devices not properly disposed of may also be choking hazards for smaller children. Species such as birds and other animals may mistake these discarded

devices for food. In addition, batteries from these devices that are not properly disposed of may explode and result in burns or maybe the starter of a wildfire (Addo et al., 2022). Perhaps the area of targeted marketing is even more evident as it relates to disparities capitalized on by these tobacco companies (Addo et al., 2022). These communities face challenges and are often of lower socioeconomic status (Addo et al., 2022). Many vulnerable populations reference their use of JUUL, which signifies that marketing is strategic with the intent to target set populations (Hong et al., 2021).

### **Policies and Regulations**

The disposable e-cigarettes that fascinate children and adolescents to be partakers of tobacco products have been associated with many patterns that stem from the need for e-cigarette regulation (Han et al., 2024). The persistent use by this population and the potential associated risks attributable to its use are enough to suggest the need to protect this population (Han et al., 2024). This means that there is a need for regulation. There is a great level of unfairness in the selling and distribution of these tobacco products as the sales are embedded within the art of deception of an addictive product (Henriksen et al., 2020). Several retail stores that are distributors of e-cigarettes are located in regions that are in close proximity to schools. Not only does this make it easy for this population to access, but it was observed that, in many instances, some stores did not require any form of identification for purchasers (Henriksen et al., 2020). This makes it impossible to check on the age of those purchasing e-cigarettes. Far too many e-cigarette stores have limited or no signage that speaks to the age of purchasers and hence put this population at risk (Henriksen et al., 2020).

In an attempt to protect American children and adolescents, various states have taken measures to act. California has taken the initiative to limit the advertising of tobacco products that may appeal to children and adolescents (Henriksen et al., 2020). Flavored tobacco products are appealing. Flavors make it possible for this population to experiment with the concentration and strength of nicotine (Hall et al., 2021). Thought of flavors surpasses the health risks.

The use of an e-cigarette by children and adolescents and the potential health risks associated with their use have made it necessary to embark on campaigns that focus on educating this population about the potential health risks and, as such, postulate tobacco control media campaigns that may be classified as high, moderate, or low in terms of the level of information being disseminated (Levy et al., 2023). Strong support is needed to ensure that e-cigarettes and vapes are banned (Levy et al., 2023).

Interventions, policies, and regulations are necessary because while it is known that tobacco use poses significant health risks, the risks associated with use can be prevented (Benjakul et al., 2022). The World Health Organization (WHO) Framework Convention on Tobacco Control highly recommends that measures be implemented to monitor tobacco use to prevent minors from becoming new smokers. This is essential as minors' health can significantly impact a country's capacity to produce quality human resources for the future (Benjakul et al., 2022). Through teaching and learning activities that have been properly developed, it becomes possible for this target population to acquire the knowledge needed, enabling them to make sound and safe decisions that will be beneficial to their health. With this in mind, there is an increased need for public

health professionals to be more assertive in their roles as health promotion and disease prevention officers as they serve as the forearm of effectively improving the lifestyle of children and adolescents in promoting non-smoking behavior (Benjakul et al., 2022).

The lack of regulations makes it easier for e-cigarette manufacturers to capitalize on the use of sophisticated tactics to attract young consumers and eventually get them hooked on these nicotine products (Harrell et al., 2016; Savelli et al., 2015 as cited in O'Connell et al., 2022). With well-developed policies being designed and implemented, there comes the potential to influence health-related outcomes and behaviors at the structural, environmental, and social as well as the development of individual factors (O'Connell et al., 2022). The implementation of tobacco control policies should go beyond the surface to address conditions that affect this population, such as social and environmental conditions. If this is done, it becomes possible for local counties and states to modify the built environment so that exposure to advertising and the availability of the products can be duly addressed. More states are now geared at restricting youth access to e-cigarettes (Jun & Kim, 2021). However, within the United States, the policies vary across different states, but what is needed is a more comprehensive federal law-restrictive approach taken to protect the youth, restricting access to e-cigarettes and preventing youth vaping (O'Connell et al., 2022). The FDA has sought to place restrictions on tobacco products, but they were left with having no jurisdiction over where e-cigarettes can be used or taxed, implementing a higher minimum age for purchasers, or approving or restricting licensing on retailers (Jun & Kim, 2021).

In instances where states have decided to tackle this public health problem, changes have been noticed in that regulations implemented on e-cigarettes saw lower e-cigarette initiation and use (Jun & Kim, 2021). There are 17 states that now require licenses for retail sales. Maryland has gone as far as implementing the requirement of licenses for the shipment, manufacturing, distribution, importation, and sale of all nicotine delivery systems both into and within the state. In Utah, special codes must be attained, and permits must be granted by the local health department for sales and distribution (Jun & Kim, 2021). The packaging of e-cigarettes has been regulated by 24 states, most of which require child-resistant packaging. Still, only a few have required warning labels or have prohibited packaging appeal to minors (Jun & Kim, 2021). Massachusetts has passed a bill on flavored e-cigarettes to reduce their consumption. The Massachusetts House Bill No. 4196 (“An Act Modernizing Tobacco Control”) came into effect to impose a 75% excise tax on vaping products containing nicotine and ban the sale of all flavored except when sold in licensed smoking bars (Katchmar et al., 2021). The first state to permanently ban retail sales of all flavored tobacco products, they set a trend for other states to follow. This resulted in a significant reduction in the Greater Boston area regarding e-cigarette purchases (Katchmar et al., 2021). With regulations at the state level, health behaviors are likely to change as public risk perceptions change.

Use of e-cigarettes disproportionately impacts youth from low socioeconomic backgrounds (Bandura et al., 2023). Children and adolescents are the most vulnerable populations. Still, there is a cause for concern since those who reside in communities with high levels of poverty are placed at a significantly higher risk of becoming e-cigarette

users. This calls for an aggressive approach by policymakers to protect and prevent the harm of the nation's future by developing and implementing policies that limit their access to e-cigarettes (Bandura et al., 2023). Regardless of the challenges faced, such as enforcing bans on flavors, having a single national policy becomes important. This will reduce any possible confusion across states and ensure that regional policies are in keeping with what is considered to be standard. Working closely with the Centers for Disease Control and Prevention (CDC), the number of children and adolescents enticed by tobacco companies through advertisements can be reduced significantly. Taxation stands to deter the use as affordability is now questioned (Bandura et al., 2023).

However, the best way of reducing the use of e-cigarettes by children and adolescents is perhaps through education. Education provides knowledge that ultimately changes behavior through the use of multicomponent prevention strategies (Kelder et al., 2020). With the use of educational interventions, the current thoughts and ideas can be altered, and their perception of these products can be changed (Bandura et al., 2023). Therefore, it becomes necessary to target learning institutions for students and teachers. Identification of devices becomes important, and the misinformation that is available online can be addressed. For this to be successful, however, there has to be a partnership with the right stakeholders. A wide range of groups become important and should not be left out. These may include youth, their families and/or parents, health care professionals, educators, policymakers, and organizations with a wide range of social media publications and pages, particularly those of local health authorities, medical societies, and academic journals (Bandura et al., 2023). The perceptions and behaviors of retailers must also be

considered in their promotion and sales of ENDS for any such intervention or regulatory policy to be effective (Smiley et al., 2023).

The FDA has shortcomings in preventing children and adolescents from using e-cigarettes (Gee, 2020). These gaps must be found and addressed with great urgency. Some have been addressed, but more is still needed. The US House of Representatives has taken the initiative to address some shortcomings by passing legislation to protect the youth. This is reflected in HR 2339, the Protecting American Lungs and Reversing the Youth Tobacco Epidemic Act of 2020 (Gee, 2020). This act bans flavored vaping products without considering the type of electronic delivery system being used and has placed menthol-flavored products as outlawed (Gee, 2020). Through the passing of this bill, taxes could have been imposed on the nicotine that is in e-cigarettes. The bill has also allowed for grant programs to develop strategies that can assist in the cessation of smoking in communities that are underserved medically (Gee, 2020). It is, therefore, critical that policies be implemented to protect public health and change the existing norms regarding tobacco products (Agaku et al., 2020). The long-term consequences should also be examined, and the trickery of tobacco companies should be at the forefront of their minds as they will do whatever it takes to ensure the sale of their products to youths (Gee, 2020).

### **Definitions**

*Adolescents:* These are individuals who are in the adolescence period. The period of adolescence is the phase of life that is between childhood and adulthood and goes from ages 10 through to 19, and it is critical to human development (World Health

Organization, 2024). During this period, individuals, called adolescents, may experience rapid physical, cognitive, and psychosocial growth, which affects how they feel, think, make decisions, and interact with the world around them (World Health Organization, 2024).

*Children:* According to the United Nations Convention on the Rights of the Child (UNCRC), children are defined as those under 18 years (Lansdown et al., 2022).

*Combustible Cigarettes:* Cigarette tobacco that has been rolled for the purpose of smoking (Nishimura et al, 2023).

*Curiosity:* Curiosity is considered the art of having a desire for a thing without having an extrinsic reward present or associated with such desire (Markey & Loewenstein, 2014).

*Ease of acquisition:* Acquisition is getting something (Cambridge Dictionary, 2024). Therefore, ease of acquisition is the readiness or availability to acquire what is needed without a hassle.

*E-cigarette:* This is a battery operation device that may be in the shape of a cigarette, cigar, or pen which does not contain tobacco but contains a solution of nicotine, flavorings, and several different chemicals that mimic the effects of cigarettes through inhaled aerosol as a result of heat being applied to nicotine (National Cancer Institute, n.d.). This is also referred to as e-cig, electronic nicotine delivery system, and vape pen (National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health, 2016).

*E-cigarette user:* This is an individual who uses e-cigarette devices that typically deliver nicotine, flavorings, and other additives every day or some days (Centers for Disease Control and Prevention, 2021).

*Nicotine:* This is a plant alkaloid that is found in the tobacco plant and is an addictive central nervous system (CNS) stimulant that results in ganglionic stimulation in low doses and ganglionic blockage in high doses (National Cancer Institute, n.d.).

*Smoking:* Act of inhaling and exhaling the fumes of burning plant materials such as tobacco or marijuana and hashish (Britannica, 2024), which results in life-threatening addiction and has the potential to cause damage to every organ system in the human body (Aslam et al., 2024).

*Tobacco Products:* These are products made from the leaves of the tobacco plant, which contain high levels of the addictive chemical nicotine (National Cancer Institute, n.d.). These products are obtained through the curing and aging the leaves and are often smoked, chewed, inhaled, or used as dissolved tobacco (Cornelius, 2023).

*Vaping:* This is the simulation of smoking, which sees the inhalation of an aerosol (mist) that looks like water vapor created by an electronic cigarette (e-cigarette) or another vaping device that a battery has powered. The aerosol is inhaled into the lungs, where the nicotine and chemicals cross into the bloodstream (Department of State Health Services, 2024).

*Youth:* This is defined as those individuals who are between the ages of 15 and 24 years (United Nations, n.d.); however, for this study, youth refers to the combination of children and adolescents.

### **Assumptions**

The nature of the research necessitates making a few assumptions that might be considered appropriate. The study used secondary data gathered by the Centers for Disease Control and Prevention through the National Youth Tobacco Survey conducted in 2018. It was assumed that the sample used to collect the data was aimed at the intended population. It was assumed that the data was collected from across the United States of America. It was assumed that this data reflects those who have been exposed to the use of e-cigarettes. In keeping with the required analyses that were needed to answer the research questions, the assumptions made were necessary.

### **Scope and Delimitations**

For this research, I assumed that the use of e-cigarettes would be associated with factors such as flavors, ease of acquisition, curiosity, and e-cigarette devices within the United States of America. These variables were analyzed against the controlled variables age, race, and sex to determine if such a relationship existed. Data was gathered from youth across America, and as a result, the study may be used to generalize the behavior of the youth population that exists within the United States of America.

### **Limitations**

There might be have been limitations in providing a true reflection of the number of individuals participating in the survey, as it was administered in schools and would not have included individuals outside of the general school system. Children and adolescents who are homeschooled would not have been captured in the survey. The information being gathered was sensitive, and youth might not have answered accurately if they were

concerned that their answers might not be anonymous. Another limitation existed in the way the data was collected through the use of the survey questions. Only one question was used to gather data regarding the independent variables.

### **Significance**

This study is significant in that it gives insight into the motivations behind the e-cigarette and vaping materials use among children and adolescents so that it is possible to develop educational programs and legislation focused on reducing the use among this population.

### **Summary and Conclusion**

This research was carried out to test the existence of the possibility of associations between e-cigarette devices, flavors, ease of acquisition, curiosity about e-cigarettes, and the use of e-cigarettes among the American youth. Current research has revealed some levels of associations between flavor and the use of e-cigarettes (Galimov et al., 2022). However, no studies examined the element of curiosity as it relates to the flavors on the market, nor curiosity regarding e-cigarette devices. Through this research, it will become possible for policies and interventions to be planned and implemented that will aim at targeting tobacco companies in their marketing strategies that are geared toward children and adolescents while creating programs that aim at educating them about the dangers of the use of e-cigarettes and the importance of taking care of their health. The gap identified in the literature gathered from research done within the past five years has now been filled, and future research will benefit from understanding the association between curiosity and the use of e-cigarettes between children and adolescents. With the

population being studied nationwide, policies could be created at the national level to protect this group being studied. The next section of this study focuses on the methodology and design. This looks at the collection of the data and the size, the sampling technique applied, the rationale behind the study's design, and possible threats to validity. A summary will also be included.

## Section 2: Research Design and Data Collection

This research is quantitative. It was designed to assess associations between peer influence, curiosity about e-cigarette devices, and use of e-cigarettes among American youth and associations. Independent variables in this study were peer influence, curiosity involving e-cigarette devices, appealing flavors, and ease of acquisition. The dependent variable is use of e-cigarettes.

In this section, the research design and rationale, methodology, data analysis plan, threats to validity, and ethical procedures are examined. I also address the population of interest and sampling procedures.

### **Research Design and Rationale**

The study included children and adolescents between 10 and 18. I used secondary data that were obtained from the CDC NYTS. Data were gathered via a three-stage cluster nationally. A nationally representative sample of students in grades 6 through 12 from across 50 states along with the District of Columbia was used to gather data. Data were collected in 2018 and self-administered via paper-and-pencil questionnaires. I used correlation tests and regression analysis to determine associations between variables. I used correlation analysis to determine if there were relationships between variables while quantifying strength and direction of those relationships. I used regression analysis to determine how variables related to each other and how changes that occur with one variable affected other variables . Using data that were collected by the CDC eliminated the need to create instruments for collecting data from the population of interest.

## **Methodology**

### **Population**

I focused on children and adolescents who were in grades 6 through 12 across 50 states within the United States and District of Columbia. There has been an increase in the use of e-cigarettes by this group, and public health practitioners have recognized the need to address this problem. However, if this is to be done, it is necessary to understand the possible associations or links that may exist between the use of e-cigarettes and what might be considered as motivation for vaping. The resulting sample size for the 2018 National YRBS was approximately 20189 students. Both research questions was assessed and analyzed to determine if there is an association between peer influence, curiosity of e-cigarette devices, and the use of e-cigarettes among the American youth while controlling for age, sex, and race; and to determine if there is an association between appealing flavors, ease of acquisition and the use of e-cigarettes among the American youth while controlling for age, sex, and race.

### **Sampling Procedure**

The NYTS survey seeks to measure items that are related to tobacco use among middle school and high school students in order to provide national data about this population. Some of the data that it provides includes the beliefs, attitudes, behaviors, and exposure to tobacco influences (Office on Smoking and Health, 2021). This data was obtained through items measured that relate to the use of tobacco, demographics, youth access to tobacco products as well as exposure to secondhand smoke (Office on Smoking and Health, 2021). The data is available in a number of format such as SAS, Microsoft

Access, and Microsoft Excel. The questionnaire, codebook, and methodology report was obtained. While this data is available for public use, users are expected to adhere to stipulated standards for both analysis and reporting of the data. The confidentiality of the participants is maintained, and no identification of the associated database can be obtained, neither can there be a link created by any of the states.

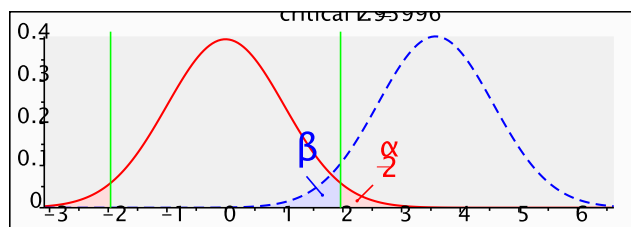
Validation of the data collection from the sample was done in collaboration with the schools during what was conducted as a sample validation. Though the reason was not stated, schools that were found to be ineligible were replaced. This resulted in a total of 279 schools, representing 54.9%, participating in the study. There were refusals, which totaled 229 schools. Some refusals were at the district level, which did not allow for contact to be made with the schools, while some were at the school level. One hundred and six of them were due to district-level refusals, and 123 were school-level refusals. From these schools, an estimated sample size was determined. The estimated sample of 42,000 students before school and student non-response led to an expected total of 17,850 participating students in large schools after accounting for non-response. Medium schools were expected to yield 7,000 and small schools 4,375 students. This would result in an expected total of 22,684 students participating; however, in 2018, 20189 students participated in the survey (Office on Smoking and Health, 2021).

In determining whether or not the sample size was best suited for this research, a power of analysis had to be conducted. The G\*Power Analysis tool allows for checks to be done to verify the sample size that is being used in conducting the research. In

essence, it determines the minimum sample size that is needed to detect a statistically significant effect in the study (Faul et al., 2009).

## Figure 2

### *Power of Analysis*



Logistic regression was used. The power of analysis test computes the minimum required sample size given  $\alpha$ , power and effect size (Faul et al., 2007). The test was two-tailed with an Odds Ratio of 1.3,  $\Pr(Y=1/X=1)$ HO being 0.2,  $\alpha$  error of probability of 0.05, and Power  $(1 - \beta)$  error of probability of 0.80, with  $R^2$  other X being zero. The test was calculated under the assumption that X is normally distributed with a mean of zero and a standard deviation of 1. With a critical z value of 1.9599640 and the actual power being 0.9501294, the minimum sample size required was 1188 (Faul et al., 2007).

## Operationalization

In this study, the independent variables were peer influence, curiosity about e-cigarette devices, appealing flavors, and ease of acquisition of e-cigarettes. The dependent variable was use of e-cigarettes. The variables were measured through use of questions. Sex was classified as a dichotomous nominal variable. It was measured by

asking: Question 2.. Respondents could answer with female or male. Race was classified as a nominal variable. This variable was measured through data by asking Question 5.

Respondents were American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, or White. They were also allowed to select multiple groups, indicating their multiracial status (see Table 1).

**Table 1**

*Operationalization of Variables*

Variable name	Type	Categorization	Levels of measurement
Peer influence	Independent	If one of your best friends were to offer you an e-cigarette, would you use it? A. Definitely yes B. Probably yes C. Probably not D. Definitely not	Ordinal
Curiosity about e-cigarette devices	Independent	Have you ever been curious about using an e-cigarette? A. Definitely yes B. Probably yes C. Probably not D. Definitely not	Ordinal
Appealing flavors	Independent	What flavors were the e-cigarettes that you have used in the past 30 days? A. Menthol B. Mint C. Clove or spice D. Fruit E. Chocolate F. Alcoholic drinks (such as wine,	Nominal

			<p>margarita, or other cocktails).</p> <p>G. Candy, desserts, or other sweets</p> <p>H. Some other flavor not listed here (Specify:_____)</p>	
Ease of acquisition of e-cigarettes and refills	Independent	During the past 30 days, how did you buy your e-cigarette devices, pods, cartridges, or e-liquid refills?	Ordinal	
		<p>A. I bought them myself</p> <p>B. I had someone else buy them for me</p> <p>C. I asked someone to give me some</p> <p>D. Someone offered them to me</p> <p>E. I got them from a friend</p> <p>F. I got them from a family member</p> <p>G. I got them from a store or another person</p> <p>H. I got them in some other way (Specify:_____)</p>		
Use of e-cigarettes	Dependent	Have you ever used an electronic vapor product?	Categorical	
		<p>A. Yes</p> <p>B. No</p>		
Age	Covariate	How old are you?	Ordinal	
		<p>A. 9 years old</p> <p>B. 10 years old</p> <p>C. 11 years old</p> <p>D. 12 years old</p>		

			E. 13 years old F. 14 years old G. 15 years old H. 16 years old I. 17 years old J. 18 years old K. 19 years old or older	
Sex	Covariate	What is your sex?	A. Male B. Female	Nominal
Race	Covariate	What race or races do you consider yourself to be?	A. American Indian or Alaska Native B. Asian C. Black or African American D. Native Hawaiian or Other Pacific Islander E. White	Nominal

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### Data Analysis Plan

Data analysis was completed via the NYTS using SPSS Version 28. Data were downloaded and filtered in order for there to align with research questions.

### Research Questions

RQ1: What is the relationship between peer influence, curiosity about e-cigarette devices and the use of e-cigarettes among American youth when controlling for age, sex, and race?

H<sub>0</sub>1: There is no relationship between peer influence, curiosity about e-cigarette devices and the use of e-cigarettes among American youth when controlling for age, sex, and race.

H<sub>a</sub>1: There is a relationship between peer influence, curiosity about e-cigarette devices and the use of e-cigarettes among American youth when controlling for age, sex, and race.

RQ2: What is the relationship between appealing flavors, ease of acquisition of e-cigarettes and use of e-cigarettes among the American youth when controlling for age, sex and race?

H<sub>0</sub>2: There is no relationship between appealing flavors, ease of acquisition of e-cigarettes and use of e-cigarettes among the American youth when controlling for age, sex and race.

H<sub>a</sub>2: There is a relationship between appealing flavors, ease of acquisition of e-cigarettes and use of e-cigarettes among the American youth when controlling for age, sex and race.

### **Statistical Test**

The data was analyzed using the binary logistic regression test and multinomial logistic regression test. The binary logistic regression test was best suited for research question one because it seeks to predict the relationship between variables where the dependent variable is of a categorical nature (Poston et al., 2023). In other words, whenever the dependent variable is of two categories, then the best-suited statistical test is the binary logistic regression. The p-value was critical in deciding whether to accept or

reject the null hypothesis. For instance, if the calculated p-value is above 0.05, then we fail to reject the null hypothesis. If, however, the calculated p-value falls below 0.05, the alternative hypothesis is accepted, which means that the null hypothesis will be rejected (Frankfort-Nachmias et al., 2021). Multinomial logistic regression was best suited for research question two because data regarding preferred flavor and acquisition of e-cigarettes were captured only from those who had answered yes to using e-cigarettes, each having different categories. The multinomial logistic regression test is used when the outcome variable has more than two nominal categories and the relationship between the outcome variable and one or more independent variables is to be modeled (Laerd Statistics, n.d.)

### **Threats to Validity**

#### **External Validity**

In research, if there are inaccurate inferences made, then they are considered to be a threat to external validity (Frankfort-Nachmias et al., 2021). One possible threat to consider is whether the sample size is a true representation of the population of American youth. Seeing that the sample being used represents American youth from 10 to 18 years of age, a reasonable number should be used to adequately represent this population. This is needed so that any conclusions drawn from the analysis of the data will be accurate.

#### **Internal Validity**

Threats to internal validity may occur if the procedure or tests being used interfere or threaten the data analysis (Frankfort -Nachmias et al., 2021). To reduce the element of threat to internal validity, the choice of statistical tests was carefully selected for the data

type being analyzed. This means that any assumptions made had to be tested and analyzed during the data analysis stage of the study.

### **Statistical Conclusion Validity**

In conducting the research study, it is possible that inaccurate inferences can be made when the data lacks statistical power (Frankfort-Nachmias et al., 2021). For this research study, each variable being analyzed has been carefully assessed for the most appropriate measure.

### **Ethical Procedures**

The Centers for Disease Control and Prevention has designed and created the National Youth Tobacco Survey to capture data in its purest and truest form, thinking about the safety of the data collected and the protection of any information that may be deemed relevant to the personal identification of the participants. The data is available for public use and examines the prevalence of youth tobacco use. The data collected provides a national benchmark for data on commercial tobacco use behaviors and related risk factors among youth in the United States (Centers for Disease Control and Prevention, 2024). It serves as a baseline for assessing any progress that is made as the United States works toward meeting Healthy People 2030 goals that aim at reducing youth tobacco use within the country. The availability of the data for public use means that checks have already been put in place to ensure that there are no breaches of data security.

### **Summary**

In this section of the research, the methodology has been analyzed for the chosen data. The variables chosen were assessed along with the strategy for analysis, threats to validity, and ethical implications that may arise.

### Section 3: Presentation of the Results and Findings

This quantitative study involved use of secondary data from the CDC through the NYTS. This was used to determine associations between peer influence, curiosity, appealing flavors, ease of acquisition, and use of e-cigarettes when controlling for age, sex, and race. Binary logistic regression was used to determine if such associations existed in order to answer research questions. Multinomial logistic regression was used to create comparisons of different groups and determine associations between age, race, and preferred flavor, as well as age, race, and acquisition of e-cigarettes.

RQ1: Is there a relationship between peer influence, curiosity about e-cigarette devices, and use of e-cigarettes among American youth when controlling for age, sex, and race?

H<sub>0</sub>1: There is no relationship between peer influence, curiosity about e-cigarette devices, and use of e-cigarettes among American youth when controlling for age, sex, and race.

H<sub>a</sub>1: There is a relationship between peer influence, curiosity about e-cigarette devices, and use of e-cigarettes among American youth when controlling for age, sex, and race.

RQ2: Is there a relationship between appealing flavors, ease of acquisition of e-cigarettes, and use of e-cigarettes among American youth when controlling for age, sex and race?

H<sub>0</sub>2: There is no relationship between appealing flavors, ease of acquisition of e-cigarettes, and use of e-cigarettes among the American youth when controlling for age, sex and race.

H<sub>a</sub>2: There is a relationship between appealing flavors, ease of acquisition of e-cigarettes, and use of e-cigarettes among the American youth when controlling for age, sex and race.

This section includes outcomes of the study. I analyze how data were accessed, baseline descriptive statistics and frequencies, and an overall summary of findings. Discussions about results from analyses conclude this section, leading to Section 4.

### **Accessing Data for Secondary Analysis**

Data were obtained through the NYTS from the CDC, which was available online for public access. However, data have since been removed due to executive orders from President Donald Trump. The NYTS was a nationally representative voluntary survey of U.S. students that assessed behaviors and attitudes regarding health in terms of demographic and health-related contexts. Survey results have been used to determine prevalence of tobacco use, increased use of specific tobacco products such as e-cigarettes, and e-cigarette flavor preferences. The 2019 survey was obtained in Excel format and analyzed using SPSS 29.

A few discrepancies were noticed. Covariate race data were captured through individual survey questions instead of being captured as one variable. This meant each question had to be taken into consideration, and as a result, each race had to be treated as a variable. Native American Indians and Native Alaskans were not included in the study

as their numbers were relatively small ( $n = 2$ ). The U.S. FDA, National Cancer Institute, and CDC have used data in the survey to identify and examine trends involving use of tobacco. This resulted in validation of the dataset. Handling of missing data is critical when ensuring validity and integrity of the study are maintained.

### **Statistical Analysis**

I used binary and multinomial logistic regression to test hypotheses. I used binary logistic regression to test associations between use of e-cigarettes and curiosity, peer influence, and flavor choice and accessibility. Initially, binary logistic regression was considered for both research questions, but because of how data were captured, multinomial logistic regression had to be used for RQ2. Data regarding acquisition and flavor of e-cigarettes was only captured from those individuals who had answered yes to using e-cigarettes. As a result of this, flavor and acquisition could not be used to predict use of e-cigarettes, but could be used to model factors associated with use and preferred flavor. SPSS was used to determine statistical relationships between variables. Statistical tests were conducted with a level of significance that was set at 0.05.

### **Data Cleaning and Editing**

Before data could be analyzed, it had to go through the process of cleaning. Data were cleaned and edited where necessary, and variables were recoded. The variables age and race were entered as string variables. They were renamed and recoded to numeric variables. Native American Indians and Alaska natives were excluded from the study because there were only two respondents who selected that option. All other races were included in analysis. A total of 20,189 individuals were included in the study.

**Missing Value Management**

The number of missing values for variables was relatively small and did not impact statistical calculations. With a small number of values missing, it made it ideal for missing values to be handled using listwise deletion.

***Descriptive and Demographic Characteristics***

Variables were analyzed to understand how they were distributed. Demographic characteristics of covariates were in keeping with the population under study. Participants were in middle and high school. Age ranged from 9 to 19. Respondents were categorized as male or female. Races were Asian, Black or African American, Native Hawaiian or other Pacific Islander, and White. Respondents were allowed to select multiple races. There were behavioral characteristics that were also analyzed, which were curiosity, peer influence, and appeal of flavors, as well as places where e-cigarettes could be acquired and use of e-cigarettes by this group. All other races was used as the reference category to account for selection of multiple races.

**Sample Representativeness**

Students from grades 6 to 12 were recruited through a wide range of schools. The National Youth Tobacco Survey used students from the targeted schools to represent the population of American youth across the entire country. Not all schools targeted participated in the survey, but with 54.9% of the schools actively participating, the data was gathered. In instances where schools refused to participate in the survey, no replacement was made for these schools. Of the 170 participating schools, a total of

20189 students were surveyed (Office on Smoking and Health, 2021). All the participants were within the age range desired for the research questions.

### Descriptive Statistics

Table 2 describes the descriptive frequencies and percentages of the responses collected from the dependent variable. The dependent variable, the use of e-cigarettes, captured data through the question: Have you ever used an e-cigarette, even once or twice? The respondents could select from two categories: yes or no. Of the 20189 participants, 19796 responded to this question. There were 14725 participants who answered 'no' while 5071 answered 'yes.' This is represented by 72.9% and 25.1% respectively.

**Table 2**

*Frequency of Use of E-Cigarettes*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	14725	72.9	74.4	74.4
	Yes	5071	25.1	25.6	100.0
	Total	19796	98.1	100.0	
Missing	System	393	1.9		
Total		20189	100.0		

The highest use was seen between the ages of 12 and 15. 12 years old recorded 2875, 13 years old 3013 respondents, 14 years old recorded 2930 respondents, and 15 years old recorded 2881 respondents.

**Table 3***Distribution of Age of Respondents*

		Frequency	Valid Percent
Valid	9 years old	58	.3
	10 years old	6	.0
	11 years old	1007	5.0
	12 years old	2875	14.3
	13 years old	3013	15.0
	14 years old	2930	14.6
	15 years old	2881	14.4
	16 years old	2789	13.9
	17 years old	2719	13.5
	18 years old	1630	8.1
	19 years and older	162	.8
	Total	20070	100.0
Missing	System	119	
Total		20189	

Respondents were almost equal in terms of gender. Of the total 20189 responses, 10069 were males and 10120 were females. This means that 50.1% of the respondents were male, while 49.9% were female. Of those who used 3411 admitted that they had been curious about e-cigarettes, representing 16.2%, and 1960 admitted that they had been influenced by their peers. The highest number of e-cigarette users was White. 12624, which represents 62.5% of the respondents who used e-cigarettes, were White. Acquiring e-cigarettes was more popular through individuals they knew, such as a family member or a friend. It was revealed that 594 of the respondents acquired their e-cigarettes from a family member, and 2033 acquired their e-cigarettes from a friend. For those who purchased their e-cigarettes, the most popular place of purchase was from the Internet, which recorded 196 respondents, gas stations, which recorded 396 respondents, and vape shops, which recorded 676 respondents. The most common flavors among e-cigarette

users were menthol or mint (1251 respondents), candy (1138 respondents), and fruit (1789 respondents).

**Table 4**

*Frequency and Percentages of Variables*

Variables	Frequency	Percent
Sex		
Female	10120	50.1
Male	10069	49.9
Race		
Asian	1219	6.0
Black	3836	19.0
Native Hawaiian or Other Pacific Islander	577	2.9
White	12624	62.5
Curious about e-cigarettes	3411	16.9
Peer Influence	1960	9.7
E-cigarette Use		
Acquisition		
Gas station	396	2.0
Grocery store	69	.3
Drug store	108	.5
Mall	89	.4
Internet	196	1.0
Vape Shop	676	3.3
Other Place	117	.6
From a family member	594	2.9
From a friend	2033	10.1
From some other person	360	1.8
Flavor		
Menthol or mint	1251	6.2
Clove or spice	104	.5
Fruit	1789	8.9
Chocolate	249	1.2
Alcoholic	364	1.8
Candy	1138	5.6
Other flavors not listed	755	3.7
No flavored products	16605	82.2



Table 6 shows that there were more individuals who had reported not using e-cigarettes than there were reported to have used e-cigarettes when examining females and males. For females, 75.8% reported to have not used e-cigarettes while 24.2% reported to have used e-cigarettes. For males, 72.9% reported to have not used e-cigarettes while 27.1% reported to have used e-cigarettes. The table also revealed that the smallest percentage of users of e-cigarettes came from those who considered themselves to be Black or African American while the largest percentage of users came from those who considered themselves to be White.

**Table 6**

*Use of E-Cigarettes by Sex and Race*

		Use of E-cigarettes			
		No		Yes	
		n	%	n	%
Sex	Female	7558	75.8	2409	24.2
	Male	7169	72.9	2662	27.1
Race					
	Asian	974	81.1	227	18.9
	Black	3057	82.3	656	17.7
	Native Hawaiian	442	78.5	121	21.5
or	Other Pacific				
	Islander	8781	70.4	3695	29.6
	White				

The role of curiosity and peer influence was examined. Of those who answered yes to using e-cigarettes, 89.8% of them reported being influenced by their peers. Among respondents who indicated they were curious about e-cigarettes, 80.1% reported e-cigarette use. The results of this analysis are presented in Table 7.

**Table 7**

*Crosstabulation Between Use of E-Cigarettes and Curiosity and Peer Influence*

		Use of E-cigarettes			
		No		Yes	
		n	%	n	%
Curiosity	Yes	674	19.9	2715	80.1
	No	14051	85.6	2356	14.4
Peer Influence	Yes	197	10.2	1743	89.8
	No	14528	81.4	3328	18.6

Methods of purchasing e-cigarettes were also examined. The main sources of acquisition were the Internet (95.9%), from Vape shops (97.7%), from a family member (98.0%), and from a friend (98.7%). Table 8 shows the results.

**Table 8**

*Crosstabulation Between Use of E-Cigarettes and Acquisition*

		Use of E-cigarettes			
		No		Yes	
		n	%	n	%
Acquisition					
Gas station	Yes	15	3.8	375	96.2
Grocery	Yes	14	20.9	53	79.1
Drugstore	Yes	15	14.2	91	85.8
Mall	Yes	10	11.8	75	88.2

Internet	Yes	8	4.1	186	95.9
Vape shop	Yes	15	2.3	651	97.7
Some other place not listed	Yes	9	7.8	106	92.2
From a family member	Yes	12	2.0	577	98.0
From a friend	Yes	27	1.3	1992	98.7
From some other person	Yes	27	7.6	326	92.4

Table 9 shows that for those who used e-cigarettes, the flavors that appealed to them were menthol or mint, fruit, and candy. For those who answered yes to using e-cigarettes, 1105 of them, representing 89.3%, liked menthol or mint flavor, 1622, representing 91.2% of the respondents, liked fruit flavor, and 1039, representing 92.1% liked candy flavor.

**Table 9**

*Crosstabulation Between Use of E-Cigarettes and Flavors*

		Use of E-cigarettes			
		No		Yes	
		n	%	n	%
Flavors					
Menthol or mint	Yes	132	10.7	1105	89.3
	Yes	20	20.6	77	79.4
	Clove or spice				

	Yes	156	8.8	1622	91.2
Fruit	Yes	59	23.9	188	76.1
Chocolate	Yes	77	21.3	284	78.7
Alcohol	Yes	89	7.9	1039	92.1
Candy	Yes	88	11.8	659	88.2
Other flavors	Yes	13949	84.9	2477	15.1
not listed	Yes				
No flavored product					

### Statistical Assumptions

Statistical assumptions are critical in running an analysis. These assumptions ensure that what is being reported is accurate and no false conclusions are drawn from analyses. In using a binary logistic regression, the independent variables are considered predictors of the dependent variable, but before this can be done, the assumptions must be tested. The first assumption that must be tested is that the dependent variable is measured on a dichotomous scale (Laerd Statistics, n.d.). The dependent variable, use of e-cigarettes, had two categories: yes or no. This meant that the first assumption was met. The second assumption is that there are one or more independent variables, and these are either continuous (where it's an interval or ratio variable) or categorical (where it has an ordinal or nominal value) (Laerd Statistics, n.d.). In this study, all the independent variables were ordinal. The third assumption is that there is some amount of independence, and the dependent variable must have mutually exclusive categories (Laerd Statistics, n.d.). In this instance, the categories of the dependent variable had the

categories yes or no, which were mutually exclusive. The fourth assumption speaks to the sample size. There must be a minimum sample size that has been determined through a priori power analysis (Laerd Statistics, n.d.). In this study, the minimum sample size of 1188 was determined by the use of G\*Power analysis. The sample size used for this study was 20189. The fifth assumption is that there are no significant outliers (Laerd Statistics, n.d.). The data revealed no outliers, as the variables were categorical. The sixth assumption is that there is no multicollinearity present. In this study, the two predictor variables were not highly correlated with each other. This was determined by the use of Pearson's Correlation, which also indicated that the variables had a perfect linear correlation. The final assumption describes a linear relationship between any continuous independent variables and the logit transformation of the dependent variables. In this study, the variables being tested are categorical. In dealing with categorical variables, no linearity in the logit test is required, as the assumption of linearity in the logit only applies to continuous independent variables (Laerd Statistics, n.d.).

In using the multinomial logistic regression, the independent variables were also considered predictors of the dependent variables, and assumptions were tested to see if this test could be conducted. The first assumption is that of independence of observation (Laerd Statistics, n.d.). Each observation was independent of the other, and there was no repetition present. Hence, the first assumption was met. The second assumption is that there is no multicollinearity among the predictors (Laerd Statistics, n.d.). The independent variables used in this study were ordinal. The third assumption is that the dependent variable is unordered (Laerd Statistics, n.d.). In this instance, the dependent

variable was nominal and could be identified from the value labels. The fourth and final assumption speaks to having an adequate sample size for each category selected (Laerd Statistics, n.d.), and there are at least 10-20 cases for each category of the predictor variable.

### Statistical Findings and Data Analysis

This study aimed to investigate the relationship between peer influence, curiosity about e-cigarettes, and the use of e-cigarettes among the American youth, as well as the relationship between appealing flavors, ease of acquisition, and use of e-cigarettes among the American youth.

#### *RQ1*

The first data analysis was done on peer influence, curiosity about e-cigarettes, and the use of e-cigarettes.

#### **Table 10**

##### *Omnibus Tests of Model Coefficients*

		Chi-square	df	Sig.
Step 1	Step	7533.624	8	<.001
	Block	7533.624	8	<.001
	Model	7533.624	8	<.001

Table 8 revealed that a Chi-square ( $\chi^2$ ) of 7533.524 was obtained, a degree of freedom of 8 and a strong level of significance. ( $\chi^2 (8) = 7533.524, p < .001$ ). This means this model is statistically significant. As a result, the predictor variables have a statistically significant relationship with the predictor variables and contributing to the outcome in a substantial way.

**Table 11***Model Summary*

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	14888.920 <sup>a</sup>	.318	.468

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Table 9 revealed that the model is a good fit. The model yielded a -2 Log likelihood = 14888.920, Cox & Snell  $R^2 = 0.318$ , and Nagelkerke  $R^2 = 0.468$ . This indicates that 31.8% of the variance of the outcome is explained by the model, while 46.8% of the variance in the dependent variable (use of e-cigarettes) is explained by the model.

**Table 12***Classification Table*

	Observed	Predicted		
		Use of E-cigarettes		Percentage Correct
		No	Yes	
Step 1	Use of E-cigarettes No	14102	546	96.3
	Yes	2245	2804	55.5
Overall Percentage				85.8

a. The cut value is .500

Table 12 revealed that there was 85.8% accuracy in identifying those who were non-users of e-cigarettes and 55.5% accuracy in identifying the users of e-cigarettes.

**Table 13***Use of E-Cigarettes Prediction Based on Curiosity, Peer Influence, and Demographics*

B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)
---	------	------	----	------	--------	---------------------

							Lower	Upper	
Step 1 <sup>a</sup>	Curiosity	2.546	.055	2107.449	1	<.001	12.756	11.442	14.221
	Peer Influence	2.210	.090	606.573	1	<.001	9.116	7.646	10.869
	Sex	.123	.042	8.550	1	.003	1.131	1.041	1.228
	Asian	-.427	.102	17.576	1	<.001	.653	.535	.797
	Black	-.362	.067	29.002	1	<.001	.696	.610	.794
	Pacific Islander	.003	.135	.001	1	.982	1.003	.771	1.306
	White	.283	.054	26.925	1	<.001	1.327	1.192	1.476
	Age	.301	.011	799.454	1	<.001	1.351	1.323	1.379
	Constant	-4.088	.094	1878.651	1	<.001	.017		

- a. Variable(s) entered on step 1: Curiosity, Peer Influence, Sex, Asian, Black, Pacific Islander, White, Age.
- b. Female is the reference category for sex
- c. All Other Races is the reference category for race

Table 13 revealed that having an increase in curiosity by a unit increases the likelihood of the odds of use of e-cigarettes by a factor of 12.76 times. It is a strong, significant predictor of the outcome variable. Peer influence had Exp(B) of 9.1, indicating that as the influence of a peer increases, the use of e-cigarettes increases significantly. Sex was significant but weak, and revealed that being male increases the use of e-cigarettes by 13.1. Being Asian was significant, but it reduced the odds of the use of e-cigarettes by 34.7%. Being black or African American was found to be significant, but it reduces the likelihood of the use of e-cigarettes by 30.4%. This suggests that Asians and Blacks were less likely, when compared to all other groups to use e-cigarettes. Native Hawaiian or Other Native Pacific Islander was not found to be significant ( $p = .982$ ). As a result, it has no meaningful effect on the use of e-cigarettes. Being White was found to be statistically significant when compared with all other groups, and increases the likelihood of the use of e-cigarettes by 32.7%. Age was found

to be a strong significant predictor. An increase in age results in an increase in the use of e-cigarettes by 35.1%.

The relationship between peer influence, curiosity about e-cigarette devices, and the use of e-cigarettes among the American youth when controlling for age, sex, and race was analyzed using binary logistic regression. The logistic regression revealed that there was a level of significance between curiosity and peer influence and the use of e-cigarettes among the American youth, with a -2-log likelihood of 14888.920,  $p < .001$ , and  $B = 2.546$  and  $2.212$ , and  $\text{Exp}(B) = 12.756$  and  $9.116$ , respectively. This indicates that there is indeed a relationship between the variables, as the likelihood of the use of e-cigarettes increased with these variables. As a result, we reject the null hypothesis and accept the alternative hypothesis that there is a relationship between peer influence, curiosity about e-cigarette devices, and the use of e-cigarettes among the American youth when controlling for age, sex, and race.

RQ2 Data analysis for the second research question focused on flavor preference and the ease of acquisition of e-cigarettes among those who had answered yes to using e-cigarettes. The top three flavors (menthol or mint, candy, and fruit) and top three places of acquisition (family member, friend, and vape shop) were chosen based on the frequent responses. The results of the analysis are shown in Tables 14-17.

**Table 14**

*Model Fitting Information for Acquisition*

Model	Model Fitting			
	Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	1085.897			

Final	954.933	130.964	18	<.001
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Table 14 revealed that a Chi-square ( $\chi^2$ ) of 130.964 was obtained from the multinomial logistic regression test. It indicates that there is a difference seen in the acquisition of e-cigarettes as it relates to the demographic variables. The degrees of freedom are 18, and there is a strong level of significance as the p-value is less than 0.001. ( $\chi^2$  (18) = 130.964,  $p < .001$ ). This means this model is statistically significant. This indicates that the predictor variables have a statistically significant relationship with where the respondents obtained their e-cigarettes for use.

**Table 15**

*Parameter Estimates for Acquisition*

Acquisitio <sup>n</sup>	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
							Lower Bound	Upper Bound
Family member	Intercept	5.349	.737	52.632	1	<.001		
	Sex	.219	.295	.550	1	.458	1.245	.698 2.221
	Age	-.053	.082	.422	1	.516	.948	.808 1.113
	Asian	-1.819	.437	17.334	1	<.001	.162	.069 .382
	Black	-.454	.436	1.087	1	.297	.635	.270 1.492
	Pacific Islander	-.952	.630	2.282	1	.131	.386	.112 1.327
	White	-1.249	.410	9.270	1	.002	.287	.128 .641
Vape Shop	Intercept	5.606	.737	57.830	1	<.001		
	Sex	-.029	.295	.009	1	.923	.972	.545 1.732
	Age	-.068	.082	.698	1	.403	.934	.796 1.096
	Asian	-2.121	.440	23.269	1	<.001	.120	.051 .284
	Black	-.818	.437	3.502	1	.061	.441	.187 1.039
	Pacific Islander	-1.070	.633	2.858	1	.091	.343	.099 1.186
	White	-.958	.411	5.436	1	.020	.384	.172 .859
Friend	Intercept	2.215	.799	7.689	1	.006		
	Sex	-.122	.318	.148	1	.700	.885	.474 1.651
	Age	.018	.089	.041	1	.839	1.018	.856 1.211
	Asian	-1.398	.510	7.511	1	.006	.247	.091 .671
	Black	-.484	.482	1.008	1	.315	.616	.240 1.585

Pacific Islander	-.472	.709	.444	1	.505	.624	.156	2.501
White	-.500	.445	1.264	1	.261	.607	.254	1.450

- The reference category is: Some Other Place.
- Female is the reference category for sex
- All Other Races is the reference category for race

Table 15 indicates that Asian individuals were less likely to obtain their e-cigarettes from a family member, a vape shop, or a friend, when compared to other places. Whites were significantly less likely than other races to obtain their e-cigarettes from a family member or a vape shop when compared with other places. Sex and age were not found to be significant predictors in any of the categories of places where e-cigarettes were obtained. The model yielded a Nagelkerke  $R^2$  of 0.031, indicating that 3.1% of the variance (the places of acquisition of e-cigarettes) is explained by the model. The McFadden  $R^2$  obtained was 0.014, which is low. While the model is statistically significant, it does suggest that there is only a small proportion of any variation seen in the places where e-cigarettes have been obtained by users that may be attributed to age, sex, and race. This does suggest that there are other factors that may be influencing the outcome.

**Table 16**

*Model Fitting Information for Flavor*

<u><i>Model Fitting Information for Flavor</i></u>				
	Model Fitting Criteria		Likelihood Ratio Tests	
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	1412.869			
Final	1193.434	219.436	18	<.001

Table 16 revealed a Chi-Square of 219.436, degrees of freedom of 18, and a p-value  $< .001$  ( $\chi^2(18) = 219.436, p < .001$ ). This means that age, sex, and race help in explaining the preferred e-cigarette flavors used.

**Table 17**

*Parameter Estimates for Flavor*

Flavor <sup>a</sup>	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
							Lower Bound	Upper Bound
Fruit	Intercept	3.857	.293	173.870	1	<.001		
	Sex	-.043	.109	.158	1	.691	.958	.774 1.185
	Age	-.146	.032	21.327	1	<.001	.864	.812 .919
	Asian	-.518	.257	4.083	1	.043	.595	.360 .985
	Black	.108	.202	.287	1	.592	1.114	.750 1.654
	Pacific Islander	-.441	.328	1.807	1	.179	.643	.338 1.224
	White	-.957	.164	34.225	1	<.001	.384	.279 .529
Menthol or mint	Intercept	2.267	.313	52.345	1	<.001		
	Sex	.027	.117	.052	1	.819	1.027	.816 1.292
	Age	-.075	.034	4.868	1	.027	.928	.868 .992
	Asian	-.634	.286	4.912	1	.027	.530	.303 .929
	Black	-.105	.218	.231	1	.631	.900	.587 1.381
	Pacific Islander	-.654	.372	3.087	1	.079	.520	.251 1.078
	White	-.693	.175	15.611	1	<.001	.500	.355 .705
Candy	Intercept	.970	.348	7.771	1	.005		
	Sex	-.349	.127	7.567	1	.006	.706	.550 .905
	Age	-.006	.037	.028	1	.867	.994	.924 1.069
	Asian	-.503	.328	2.359	1	.125	.605	.318 1.149
	Black	-.291	.251	1.340	1	.247	.748	.457 1.223

Pacific Islander	-.931	.469	3.936	1	.047	.394	.157	.989
White	-.150	.198	.574	1	.449	.861	.584	1.269

- a. The reference category is: Other Flavor.
- b. Female is the reference category for sex
- c. All Other Races is the reference category for race

Table 17 revealed that age, sex, and race were significant in determining the preferences of e-cigarette flavors. Respondents who were of the younger age group were significantly more likely to have fruit and menthol as their preferred e-cigarette flavor. It was also revealed that females were more likely to prefer candy-flavored e-cigarettes than males. Asians and Whites were less likely to have fruit or menthol as their preferred flavor than other races. The model revealed a Nagelkerke  $R^2 = 0.047$ , indicating that only 4.7% of the variation seen in the preferred flavors is explained by the model.

The relationship between appealing flavors, ease of acquisition of e-cigarettes, and the use of e-cigarettes among the American youth, when controlling for age, sex, and race, could not have been analyzed as the original hypotheses could not have been tested based on how the data were captured. Among those who used e-cigarettes, flavors such as menthol or mint, fruit, and candy were popular. In addition, among the respondents who used e-cigarettes, they were more likely to have obtained their e-cigarette from either a family member, friend, or a vape shop. When comparing fruit flavored e-cigarettes with other flavors or menthol with other flavors, age was a significant factor to consider. It was found that in these two comparisons, the choice of these flavors decreases with an increase in the age of the respondents. Comparing candy flavored e-cigarettes with other flavors, sex was found to be significant, as more females seemed to prefer candy flavored e-cigarettes than males. For places of acquisition, being White was found to be

significant, which indicates an association between where respondents were likely to get their e-cigarettes if they were white. It was found that it was more likely that e-cigarettes would be acquired from some other place if they were white rather than from a family member, friend, or vape shop.

### **Summary**

Binary logistic regression was used to assess whether or not there was an association between peer influence and curiosity about e-cigarettes and the use of e-cigarettes among American youth when controlling for age, sex, and race. Multinomial logistic regression was used to determine the relationship between appealing flavors, the ease of acquisition, and the use of e-cigarettes among American youth when controlling for age, sex, and race. The results revealed that there was a significant relationship between peer influence, curiosity about e-cigarette devices, and the use of e-cigarettes among the American youth. In the first logistic regression, the results revealed that both curiosity and peer influence are statistically significant and are strong predictors of the use of e-cigarettes among the American youth. This means that the odds of the American youth using e-cigarettes increase a great deal with curiosity and peer influence. The second logistic regression revealed that there were associations between being White and where e-cigarettes would be likely obtained. Those who are White are more likely to obtain their e-cigarettes from a place other than a family member, friend, or vape shop. The use of menthol and fruit flavored e-cigarettes decreased as the age of respondents increased, and females had a preference for candy flavor over males.

The results of this study show that there are factors that influence the use of e-cigarettes among the American youth, and these factors include curiosity, peer influence, appealing flavors, and ease of acquisition. This is critical in understanding the increase in the use of e-cigarettes by this population. Having realized these associations, it calls for an exploration into seeing the depth of the existing association and contextualizing the increase in the use of e-cigarettes and how public health practitioners and advocates can use this information to help in bringing about the reduction in the use of e-cigarettes by this population. Public health interventions that are geared towards reducing the use of e-cigarettes by children and adolescents may find this information useful in developing their programs and strategizing areas to target, making their programs successful. The next section, section 4, of this study aims to use the findings that have been presented so that they can be interpreted in a meaningful way using existing literature. The next section will also highlight the possible future research within public health and what the implications for social change are.

#### Section 4: Application to Professional Practice and Implications for Social Change

Use of tobacco products has led to a global public health crisis. The problem has been further intensified because there has been an increase in the number of children and adolescents who are using tobacco products since the onset of e-cigarettes (Mirbolouk et al., 2020). Tobacco products contain many toxic substances that are detrimental to the health of those who use them and are exposed to them (Sapru et al., 2020). With the decrease in the age group of users, it became necessary to analyze what possible reasons are for attraction of e-cigarettes for this population. Even with implementation of various policies, e-cigarette use remains a public health problem because of the number of children and adolescents who have taken on this practice.

The purpose of this study was to determine if there were associations between peer influence, curiosity about e-cigarette devices, and use of e-cigarettes among American youth when controlling for age, sex, and race. Also, I aimed to determine if there were associations between appealing flavors, ease of acquisition of e-cigarettes, and use of e-cigarettes among this population when controlling for the same variables. I used the 2018 NYTS conducted by the CDC. The CDC uses the NYTS for data on commercial tobacco use involving behaviors and risk factors that exist among youth in the United States. This survey helps in meeting Healthy People 2030 goals through creation of tobacco prevention and control programs that result in reducing use of tobacco among youth. Results can be used to build on current literature by identifying use of e-cigarettes among this population.

### Summary of Key Findings

I used binary logistic regression to determine if associations between peer influence, curiosity about e-cigarette devices, and use of e-cigarettes among American youths when controlling for age, sex, and race. I used multinomial logistic regression to determine associations between age, sex, race, appealing flavors, source of acquisition, and use of e-cigarettes among this population. Results of these analyses were there was a significant association between peer influence, curiosity, and use of e-cigarettes among this population. Results also indicated there was a significant association between choice of flavors and acquisition of e-cigarettes in terms of age, sex, and race for this population. Analysis showed use of e-cigarettes increased in the population as age increased, meaning older youths were more likely to use e-cigarettes than those who were younger. Gender also played a factor as analysis showed males were more likely to use e-cigarettes than females. As it relates to race, analysis determined Whites were more inclined to use e-cigarettes than any other race. Multinomial logistic regression was used to analyze RQ2. Results showed there was some associations between certain flavors and age, flavors and sex, and being White and place. Flavor preferences varied among sexes, as females were more inclined to prefer candy flavor. In addition, younger users were more likely to prefer fruit and menthol or mint flavors. Asians were significantly less likely to have gotten their e-cigarettes from family members, friends, or vape shops, and Whites were significantly less likely to have gotten their e-cigarettes from family members or vape shops when compared with other places.

## Interpretation of Findings

### RQ1

Findings indicated there is an association between peer influence, level of curiosity about e-cigarettes, and use of e-cigarettes when controlling for age, sex, and race. This means influence of peers is linked with use of as well as curiosity about e-cigarettes. As a result of this analysis, I rejected the null hypothesis. The alternative hypothesis was accepted.

This study revealed there were associations between peer influence and level of curiosity among children and adolescents which lead them to try e-cigarettes. Stalgaitis et al. (2020) found peers have a significant influence on behaviors of youths and adolescents are trying to understand where they fit in within social environments, and they are therefore more likely to become susceptible to the influence of peers and exhibit lack of independence. Findings of this study showed the need for approval of peers was higher among girls compared to boys. Peer influence was associated with increased risk of e-cigarette use by adolescents (Chang et al., 2023). This study revealed peer influence was a key factor in determining use of e-cigarettes.

Adekeye et al. (2025) stated use of e-cigarettes was linked with perceptions of e-cigarettes, social influences and norms, marketing and advertisement impact, curiosity and experimentation, and awareness of risks. Adekeye et al. indicated the importance of curiosity and social influence as peers are able to influence each other on a social level. In this study, while associations between peer influence and e-cigarette use were addressed, I focused on level of curiosity rather than their perceptions of harm.

Frequency of use of e-cigarettes was associated with impulsivity, as interesting flavors stimulated impulsivity (Zavala-Arciniega et al., 2019). Results showed curiosity was linked with peer influence, but no prediction could be made regarding use of e-cigarettes and choice of flavor.

Influence is also determined by prices of products (Mohd Hairi et al., 2022). It is important that they have funds to purchase these items. The price of e-cigarettes was not examined in this study; however, acquisition among peers was examined, and one of the common sources for e-cigarettes was friends.

Another important factor highlighted from a previous study was that curiosity about e-cigarettes was increased because of flavors, friends, and the ability to use these vape products discreetly (Nicolaou et al., 2022). This study examined flavor preferences and the role of peer influence but did not examine these factors in terms of their impact on curiosity. The close association between the acceptability of tobacco products such as e-cigarettes and the use of e-cigarettes was also established by previous studies. This association was attributed to the marketing strategies applied by tobacco companies towards e-cigarettes that are aimed at raising their level of curiosity (Liu et al., 2020). While factors contributing to curiosity were not examined, in this study curiosity and peer influence were found to be statistically significant predictors of the use of e-cigarettes.

## **RQ2**

The factors associated with flavor choice and acquisition were examined instead of the impact of appealing flavors and the ease of acquisition on the use of e-cigarettes. With data captured only from those who used e-cigarettes for these variables, they could

not be used as predictors. Hammond et al. (2022) suggested that the primary reason for the initiation of the use of tobacco products was the flavors, as they create an appeal to this population. Cho et al. (2023) examined the relationship with flavors as a catalyst for the use of e-cigarettes and refuted the claim that flavors were behind the surge seen in the youth using e-cigarettes, suggesting the need for further study of the role of flavor in the use of e-cigarettes among youth. Ibukun et al. (2025) revealed that adolescent e-cigarette use was largely influenced by appealing flavors as well as social factors such as peer influence. This study could not adequately report flavor as a predictor of the use of e-cigarettes, but revealed that age was found to be a significant predictor of the flavor preference, as the younger respondents were significantly more likely to prefer fruit and menthol over other flavors.

The positive association between flavors, as promoted and marketed through social media, and the increase in the curiosity power of the youth, resulting in their use of e-cigarettes, was also established by Galimov et al. (2022). Flavors do play a role in promoting a level of attractiveness because they alter the e-cigarette experience, and provide the option of the use of sweet flavors, which have been found to be preferred by the youth (Jackson et al., 2021). Similarly, the current study also found that candy and fruit flavors, which are sweet, are preferred by this population. Couch et al. (2023) also highlighted the link between advertisements of the use of smoke-free nicotine products and the appeal to women and different groups in their use of e-cigarettes. This study found that females were more inclined to select sweet flavors than males. Similarly, in

this study, the age of the respondents was found to be a significant predictor of the choice of flavor.

Accessibility has also been associated with the prevalence of e-cigarette usage. Mantey et al. (2019) examined methods of acquisition and determined that younger users had a greater prevalence of e-cigarette use than older users due to the ability to access retailers online. These findings were different from those of this study, as in this study, online retailers were not common sources for acquisition of e-cigarettes.

Baker et al. (2019) found that while there were many different sources for e-cigarettes for youth acquisition came through the social nature of borrowing and passing around vaping devices. The results of this study showed that there are other sources from which this population may obtain their e-cigarettes. The most common sources being from a family member, friend, or vape shop. Glover-Kudon et al. (2019) also examined the association of peer influence and access to tobacco products and found that younger students were able to obtain products from older students. While this study was not able to differentiate the age of the source, it did reveal that one of the preferred sources of attaining e-cigarettes was from friends. Do et al. (2023) reported that the source acquisition of e-cigarettes differed significantly across age, gender, region, flavors, and device type, but found vape shops to be the highest source among the users. This study did not find sex and age to be significant predictors in determining the source of acquisition of e-cigarettes, but revealed that Whites were significantly more likely to obtain their e-cigarettes from a source other than a family member or vape shop.

This study revealed that family members and friends are common sources for the acquisition of e-cigarettes for children and adolescents. This shows the power of individuals to be influenced by those with whom they can associate using e-cigarettes. Their peers would have shared similar characteristics such as age, possible environmental space, social norms, as well as similar belief systems. Along this line, it is now possible to have behavior and attitudes altered that will fit the context and dynamics of the group. People adjust themselves and accept the beliefs of others (Gavrilets et al., 2024). This provides additional information on what existed previously in other studies regarding the use of e-cigarettes and provides statistical evidence as to where they are likely to acquire their e-cigarettes for use.

#### **Interpretation of Findings in the Context of the Theoretical Framework**

The social cognitive theory is the theoretical framework on which this research was built. Having an understanding that social influence and the impact of social reinforcement are critical (Glanz et al., 2015), aids in understanding this public health crisis. SCT focuses on the maintenance of behavior and not just on initiating behavior change (Kwon & Silva, 2020), and as a result, is ideal in understanding both the initiation of the use of e-cigarettes and the supported behavior. In understanding what makes the American youth users of e-cigarettes, it is important to understand the factors that have caused the initiation of the behavior, and the environment in which the behavior is being practiced is also considered. SCT supports the hypothesis that the behavior of American youth regarding e-cigarettes are impacted by social influence.

SCT underscores the point that the population of interest can engage in activities that are at risk to them, which may result in poor health conditions. The results indicated that peer influence, curiosity, appealing flavors, and ease of acquisition were statistically significant in predicting the use of e-cigarettes. Peer influence works with the concept of social influence and the ability to initiate and maintain behavior. Even the level of curiosity can be triggered by social factors and reinforced through peer influence. The need to be like others deemed more important or having attention (Leary & Gabriel, 2022), plays on both curiosity and peer influence. The need for attention and the feeling to be liked stand to drive curiosity. The behavior now focuses on the need to belong and hence highlights the social acceptance that this framework promotes. The impact of social reinforcement aids in the use of e-cigarettes through the acquisition of sources they are comfortable with, such as individuals whom they can relate to. While there are certain flavors that this group may find more appealing than others, even the selection of flavors can be embodied in the social influence and reinforcement of this behavior. Through SCT, the use of e-cigarettes is not only initiated, but the behavior is maintained through support that facilitates a level of comfort and a sense of belonging to their group.

### **Limitations of the Study**

There were a few limitations for this study. The study relied on secondary data CDC NYTS. The information that was collected in the survey was considered sensitive information. This means that it might have been a deciding factor in how the questions were answered by the participants. As a result, they might not have answered some questions correctly. Another limitation is in the age of the dataset that was used in the

study. The 2018 dataset was used. Initially, the dataset from a more recent year was chosen; however, as a result of President Trump's executive order, the data were removed from the CDC website. Although the data were later returned to the website, this did not occur until the data collection and analysis for this study were concluded. Using the dataset from 2018 may not reflect the latest trends in the use of e-cigarettes within the population of American youth. Despite these limitations, the study provides valuable insights on the use of e-cigarettes and on how curiosity, peer influence, appealing flavors, and ease of acquisition impact the use of e-cigarettes among the American youth.

### **Recommendations for Future Research**

The aim of this study was to address the gap found in the existing literature concerning the use of e-cigarettes among the American youth and understanding the relationship that exists between curiosity, peer influence, appealing flavors, ease of acquisition, and the use of e-cigarettes. The findings revealed that curiosity and peer influence significantly predicted the use of e-cigarettes among this population and may provide valuable information that may help public health practitioners, educators and other public health stakeholders in evaluating and implementing measures to assist in the reduction of the use of e-cigarettes among the American youth. There are possible factors to consider in the future that include social, biological, and economic variables such as communities or environments that are prevalent in the e-cigarette epidemic, education, and or knowledge regarding e-cigarettes, acquisition through individuals, that is, acquiring e-cigarettes from individuals who were known to users. A qualitative study can be conducted to gain an understanding of the increase in the number of e-cigarette users

in the age group 16 – 17. The use of focus group discussions would be ideal in gaining insight into why there is an increase in the use of e-cigarettes within this age group. This can focus on the triggers as determined by socioeconomic factors and the liberty of autonomy in making decisions regarding their health and the use of e-cigarettes. Future research could also be conducted into the reason behind the high numbers seen in e-cigarette users among this population from individuals who received their e-cigarettes from people they knew, such as a family member, a friend, or other individuals who were not listed in the CDC survey. Research can also be conducted into determining the relationship between the difference in acquisition from places as opposed to the acquisition from people, and the reason behind the difference in the use of e-cigarettes between the different mediums of acquisition. It was revealed in the study that the respondents who acquired their e-cigarettes from individuals they knew or could relate to were more likely to use e-cigarettes. The numbers were higher for the acquisition of e-cigarettes from individuals than it was from places where it could be purchased. Another possible future study can be conducted to determine the reason behind the differences seen in the races and determine if socioeconomic factors were a factor in the use of e-cigarettes among the races in this population.

This study can be used in the future as a platform to stand on and a foundation to understand the reason behind the relationship between the variables being studied. The study revealed that there is a relationship between curiosity of e-cigarettes, peer influence, and the use of e-cigarettes among the American youth when controlling for age, sex, and race. The study also examined factors that contribute to flavor preference

and source of acquisition. Future studies can seek to determine if flavors and ease of acquisition are also associated with e-cigarette use for this population.

### **Public Health Practice and Field-Based Products**

The results of this study were used to develop four field-based products to help address the public health problem of e-cigarette use by children and adolescents. A policy memo was created to highlight the depth of the problem, what programs currently exist in addressing the problem of e-cigarette use by children and adolescents, and what can be done to address where current programs and interventions have fallen short.

In addition, an intervention plan was created to capitalize on the role of peer influence on e-cigarette use (Appendix B). The intervention will incorporate the use of peer counselors to help deter the practice of using e-cigarettes and provide the support needed to prevent initiation of the act. Having trained peer counselors will lead to an increase in knowledge regarding e-cigarettes and their health risks to help reduce the number of users between the ages of 9 and 19. The graphical depiction of the components of this plan can be found in Appendix C.

Lastly, I also developed a fact sheet that can be distributed to youth between the ages of 9 and 19. This fact sheet provides information on the contents of e-cigarettes the health risks associated with its use and some fatalities which occurred as a result of the use of e-cigarettes.

### **Implications for Positive Social Change**

The research conducted on determining the relationship between curiosity, peer influence, appealing flavors, ease of acquisition, and the use of e-cigarettes among

American youth stands to impact more than addressing public health issues or the creation of public policies. It stands to form the baseline needed to address social issues as well as biological factors, such as neurological functions, biochemical conditions, and physical health conditions that may arise as a result of the use of e-cigarettes. With the correct understanding of the established relationships discovered actions and behavior can be adjusted so that there can be the creation of new skills by adults, children, and adolescents that will seek to improve how they relate to and with each other.

Understanding key factors such as the level of freedom given to children as they move from childhood to adolescence, and also, throughout the different years in their adolescence period might help in forming the right social constructs that will help them in becoming emotionally stable and not having the need or desire to fit into a group in order to be accepted hence they will be able to make better decisions regarding their health. An increase in age brings on a level of feeling mature. This maturity often results in an increase in freedom, and may give adolescents the belief that they are now at the stage where they can do what they like because they should be allowed to make decisions that govern their lives. With an increase in chronological age, biological changes are displayed. Adolescents may reflect a more mature look, which may give them a sense of autonomy to make decisions that would have been under scrutiny. In addition, as habits are formed among individuals, the adolescence period tends to be the ideal period that seeks to facilitate such (Kankaanpää et al., 2022). Childhood practices would see the formation of habits by the time they get to late teens.

A high level of acquisition from individuals known to this population shows that people who are in close contact can influence others. Having a social construct that facilitates familiarity can be one that provides a certain level of trust, and as a result, the environment needed to create the behavior, the use of e-cigarettes, is born. This means that individuals from whom e-cigarettes are acquired are individuals whom they trust. A positive influence is needed to bring about social change for this group of individuals. Information shared among closely knitted individuals can also bring about a change in the perception. The results of this study indicate that youths often value the perceptions of their peers and obtain e-cigarettes from friends and other adults.

Research into the use of e-cigarettes by children and adolescents must be continued as the full health implications of their use are not fully known. Tobacco use has been known to contribute to a number of health conditions, including lung diseases and heart diseases (Hong et al., 2021). With this understanding and further work done, the prevention of the use of e-cigarettes can be realized, which will result in better health outcomes not just for children and adolescents but also for adults. By not engaging in the practice of using e-cigarettes while being a child or an adolescent, they will be able to realize improved health conditions. With the collaborative effort of the stakeholders, public health professionals, educators, community leaders, and policy makers, positive social change can be realized. Through the creation of effective policies, advocacy, and educational awareness programs, the use of e-cigarettes among children and adolescents can be reduced, and the health of the population improved.

## Conclusion

The use of e-cigarettes by children and adolescents continues to be a major public health problem. There are variations seen in the age group in increasing use as the age increases, differences in males and females, and different ethnic groups. The diseases associated with the use of e-cigarettes are preventable, as smoking is a developed habit. By reducing the likelihood of use by this population, it prevents the formation of undesirable habits that will ultimately impact the health of populations and their quality of life. Children and adolescents, and those who are placed to care for them, can help in guiding their lifelong choices that will promote a healthy lifestyle.

E-cigarettes are appealing to children and adolescents because they come in flavors that appeal to their taste buds. By introducing flavors that this population can relate to and find enticing, it is an attractive avenue to initiate the use of e-cigarettes. Children are born with a level of curiosity (Bjerknes, Wilhelmssen & Foyn-Brown, 2023). Things that appeal to their curiosity can lead to exploration and experimentation. This facilitates the initiation of the practice. As children and adolescents form who they are to become, their character, they stand to be influenced by socio-ecological factors (Barrington-Trimis et al., 2015; Kinnunen et al., 2015; Stanwick, 2015; Vanyukov et al., 2012, as cited in Shamblen et al., 2022). Peer influence, hence, becomes possible and easy as they look to those they know and associate with, and having a strong bond makes it possible for peers to introduce e-cigarettes among themselves. With high curiosity, peer influence, and low perceived harm of e-cigarettes, this population finds the ground on

which they build their premise that e-cigarettes are safer to use than combustible cigarettes.

Use of e-cigarettes is not only a problem with this population because they are influenced by their peers and have an increased level of curiosity regarding e-cigarettes, but they can also be easily acquired. There are places and individuals from which e-cigarettes can easily be obtained for use. Places where children may visit frequently, such as the mall, convenience store, gas station, grocery store, or the Internet, are easy pickup sites to have their curiosity by site transformed into the acquisition of items. In instances where places might not be considered, obtaining e-cigarettes for use directly from individuals who are known to them gives a sense of autonomy. This population then thinks the use of e-cigarettes is justified or simply alright to use.

The onset of the use of e-cigarettes can lead to many health risks. With not enough known about the potential dangers of the use of e-cigarettes, it becomes necessary to prevent this population from initiation. Seeing that the diseases associated with the use of tobacco products are preventable, everything must be done in the realm of public health to prevent these diseases rather than cure them and protect this population, and aid them in making the right choice regarding their health.

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## Appendix A: Policy Brief Memo

### Introduction

Children and adolescents are drawn to e-cigarettes despite using e-cigarettes being dangerous for their health. With many of the contents of e-cigarettes being

carcinogenic, and not enough being known about e-cigarettes, it is necessary to protect our children and prevent them from being exposed to this killer.

#### Scope of the Problem

The United States has a high number of adolescents vaping, making it appear normal (Jones & Salzman, 2020). The number of adolescents using e-cigarettes more than doubled between 2017 and 2019, leading to a public health crisis (Printz, 2020). This is cause for concern because the age of users gets lower and lower, and the users feel e-cigarettes are safe.

#### Current Approaches

Currently, the CDC has an educational campaign that looks at providing adults (parents/guardians) with information about what they need to know about protecting youths from the harm of vaping. There is the Help Line, which offers live online chats and emails provided by the American Lung Association, where individuals can ask questions regarding vaping. However, while these approaches provide information and may offer support, they do not address the issue in terms of social influences, nor do they incorporate the community into addressing the issue.

#### Proposed Program or Policy

The proposed program will see the use of behavioral peer counselors, trained by psychologists, in bringing about behavioral change. Through targeting the support network of the initiation and maintenance of the practice, a reduction in vaping can be realized. With local health clinics working with schools, training peer counselors to disseminate information on health risks associated with the use of e-cigarettes, this can be achieved. The production of materials for distribution, the training of peer counselors, and transportation for the distribution of the materials will incur costs.

#### Major Constituencies

The key stakeholders are the students, school administrators, teachers, behavioral counselors, and or psychologists, along with the Department of Health and the Department of Education.

#### Conclusion

The contents of e-cigarettes are toxic to our health. It is imperative that we protect the next generation by guarding their health. To achieve the goals set out in Healthy People 2030, this epidemic must be curbed. Integrating peer counselors to provide information on the dangers of e-cigarettes can help achieve this goal. The use of e-cigarettes by children and adolescents must be reduced. Only then do we have a future.

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## Appendix B: Public Health Intervention

### **Problem Definition:**

The United States has recorded explosive increase in the number of adolescents vaping and there is an attempt made to renormalize smoking (Jones & Salzman, 2020). The data gathered from national surveys continue to reveal a drastic increase in the use of e-cigarettes by adolescents (Jones & Salzman, 2020). The increase in the number of adolescents using e-cigarettes has led to a public health crisis within the United States. Vaping has become an epidemic for adolescents. Between 2017 and 2019 the number of e-cigarette users more than doubled (Printz, 2020). This is alarming because the age group of those using e-cigarettes is becoming lower and lower. On average 25% of 12<sup>th</sup> graders, 20% of 10<sup>th</sup> graders, and 9% of 8<sup>th</sup> graders have been reported as using nicotine vaping products (Printz, 2020). The new trend by adolescents must be broken because even with slight increase in percentages it accounts for a large number of adolescents. For instance, the 10% increase recorded between 2017 and 2018 accounted for over 1.3 million teenagers (Jones & Salzman, 2020). This deadly practice must be stopped.

### **Goal Setting:**

In order to realize success in this public health intervention, the following goals must be achieved.

1. Increase the awareness of the health risks associated with the use of e-cigarettes among the 9 – 19 age group.
2. Provide a support system for users of e-cigarettes (9 – 19 years old) who are attempting to quit.
3. Achieve a 25% reduction in the number of children and adolescents (9 – 19 years old) who use e-cigarettes.
4. Partner with 5 local health clinics and schools to train peer counselors.
5. Partner with 5 local health clinics and schools to distribute educational materials regarding the dangers of e-cigarettes.
6. Encourage better health decisions by promoting the dangers of the contents of e-cigarettes.
7. Reduce the number of children and adolescents using e-cigarettes in trial communities by 10% within 6 months of the launch of the campaign (to be measured by follow-up questionnaires on the use of e-cigarettes).

### **Target Population:**

The target population is individuals between the ages of 9 and 19 (children and adolescents).

### **Intervention Strategies:**

The intervention will seek to implement educational and behavioral strategies. Education sessions will be conducted in schools, psychologists will train peers as counselors, and social media messages will be created that are geared towards informing them about the health risks associated with vaping.

Implementation Plan:

Activity	Details/Description	Timeframe	Individual Responsible	Outcome
Identifying stakeholders	Send out invitational letters to become a part of the program and meet with stakeholders	Week 1 – 3	Public Health Education Officer	Confirmed list of stakeholders
Creating a campaign brand	Formulate slogans, logos, flyers, and brochures	Week 2 – 4	Communications Team	Campaign materials are ready for distribution
Schools educational sessions	Conduct educational sessions in schools	Week 5 – 13	Health Education Officers	20 educational sessions conducted
Check-in	Mid-campaign check-in on work done	Week 12	Research Team, Statisticians	Progress report generated
Training of peer counselors	Children and adolescents will be trained in how to offer support and leadership to their peers	Week 14 – 18	Behavioral Counselors and Psychologists	40 peer counselors trained (2 per school)
Social media messages	Sharing of videos and posts on social media platforms	Week 15 – 24	Communications Team	4 posts per week
Post implementation check-in		Week 21 – 23	Research Team, Statisticians	Compared to the

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Evaluation	Evaluating the knowledge and behavior of the target population	Week 24	Health Education and Promotion Officer	initial data gathered  Provide a detailed report of the process
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**Evaluation Plan:**

Stakeholders will complete a questionnaire that will seek to address impact and behavior change. Questions to be included are:

Was there an increase in the knowledge of the participants?

Was there a reduction in the use of e-cigarettes by children and adolescents?

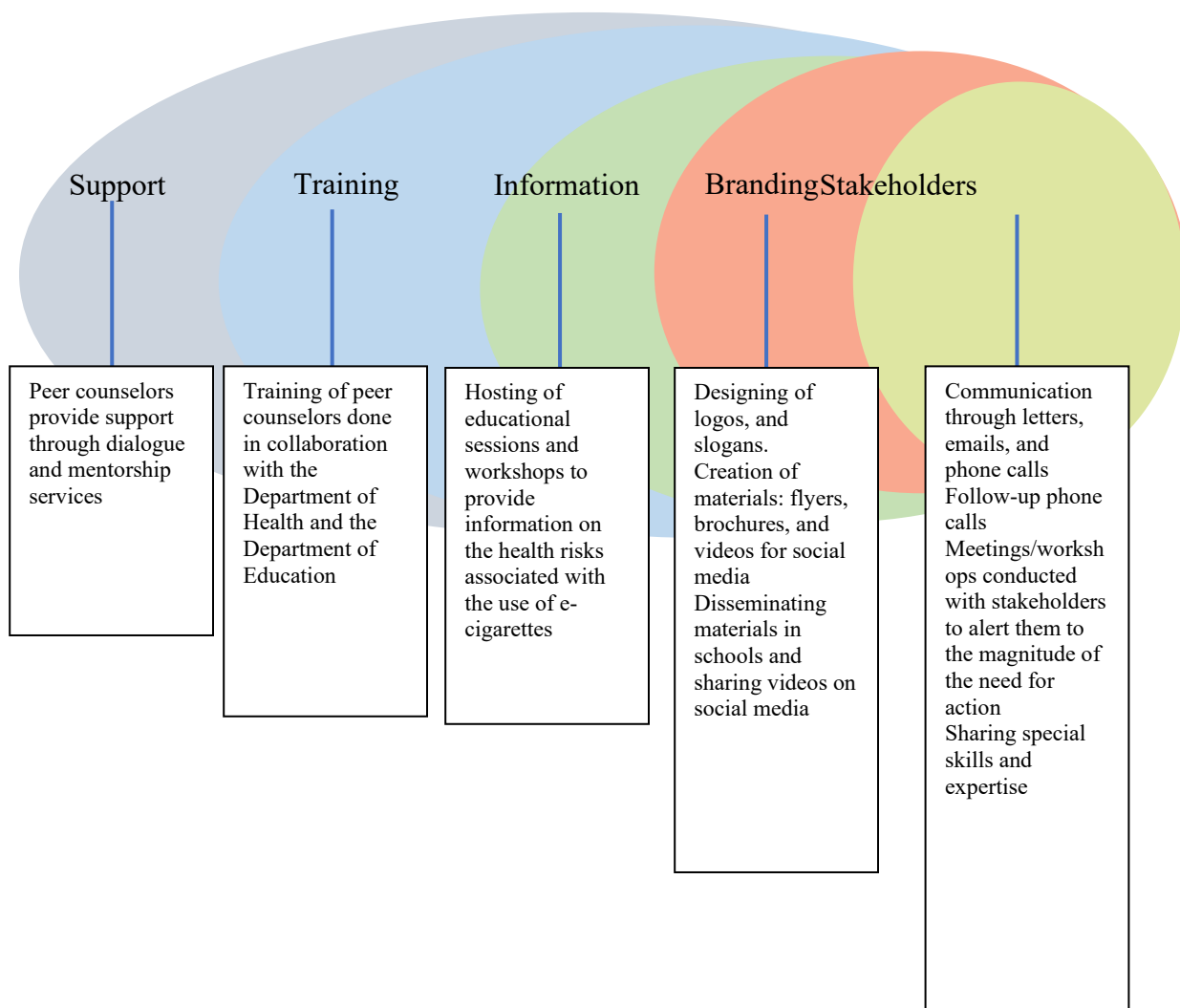
Is there a quantifiable amount that the campaign reached?

Was the campaign strategies effective?

How effective was the partnership between stakeholders?

What can be improved?

Appendix C: Visual Representation of Intervention Plan Framework



## Appendix D: Fact/Information Sheet

**The Youngest Death Recorded from Vaping**

January of 2020 started on a sad note for one Texas family. Their 15-year-old son died as a result of injuries to his lungs from vaping. Vaping is the common term used for the use of e-cigarettes. Following his death, CNN reported that there had been 57 confirmed deaths across 27 states.

(CNN Report: <https://edition.cnn.com/2020/01/09/health/cdc-vaping-lung-injury-evali-teen-update-bn#:~:text=Follow%20CNN-,Texas%2015%2Dyear%2Dold's%20death%20is%20youngest%20vaping%20lung%20injury,fatality%20in%20the%20United%20States&text=Vaping%2Drelated%20lung%20injuries%20have,and%20Prevention%20said%20on%20Thursday.>)

**Contents of E-cigarettes**

The "e-juice" that fills e-cigarette cartridges usually contains nicotine (which is extracted from tobacco), propylene glycol, flavorings, acrolein, diacetyl, diethylene glycol, heavy metals (such as lead, nickel, tin), cadmium, benzene, and carcinogens.

(American Lung Association: <https://www.lung.org/quit-smoking/e-cigarettes-vaping/whats-in-an-e-cigarette>)

**Health risks associated with the use of e-cigarettes**

The inhalation of harmful chemicals found in e-cigarettes can cause irreversible lung damage and lung disease. E-cigarettes can cause acute lung injury and chronic obstructive pulmonary disorder, asthma, and lung cancer. Some of the diseases that are associated with vaping have no cure. Chronic obstructive pulmonary disorders can worsen with time and do not have a cure. COPD may include emphysema or chronic bronchitis. In this condition, the lungs may become damaged or clogged with phlegm. Having COPD puts an individual at a higher risk of developing other health issues.

(American Lung Association: <https://www.lung.org/quit-smoking/e-cigarettes-vaping/impact-of-e-cigarettes-on-lung>)

There is no tobacco product that is considered to be safe. This includes e-cigarettes. E-cigarettes should not be used by children, adolescents, or women who are pregnant, or are considering to be pregnant.

There is still much to learn about e-cigarettes and their short-term and long-term effects on health.

(Centers for Disease Control and Prevention: Health Effects of Vaping: <https://www.cdc.gov/tobacco/e-cigarettes/health-effects.html>)