10-3-2024

Vaping Dangers in Colorado Adolescence

James Clay Willis
Walden University

Walden University

College of Education and Human Sciences

This is to certify that the doctoral dissertation by

James Clay Willis, Jr.

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. David Brown, Committee Chairperson, Health Education and Promotion Faculty
Dr. Scott McDoniel, Committee Member, Health Education and Promotion Faculty
Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2024

Abstract

Vaping Dangers in Colorado Adolescence

By

James Clay Willis, Jr.

MA, Walden University, 2018

BS, Graceland University, 2016

Dissertation Submitted in Partial Fulfillment

Of the Requirements for the Degree of

Doctor of Philosophy

Health Education & Promotion

Walden University

November 2024

Abstract

In the last five years, the marketing of vaping and electronic cigarettes (‘e-cigarettes) has sky-rocketed among adolescents enrolled at middle school and high school campuses in the United States. In Colorado, the number of adolescents using vaping and e-cigarettes is at a high level. Colorado is seeing such high usage include because of appealing flavors, low cost, wide availability and discreet designs. For this study a quantitative secondary data analysis of the 2019 Healthy Kids Colorado Survey was conducted to investigate the effect of vaping and e-cigarette advertising on adolescents. The type of advertising (i.e., television, radio, and social media) and the demographics (age, sex, race) of the viewer were compared to determine the effects of advertising on the use of vaping and/or e-cigarettes among adolescents in the state of Colorado. The constructs of Bandura’s Social Learning Theory were used to validate the effects of advertising on the adolescent population. Binary logistic regression, Pearson correlation, and linear regression were performed on a subsample of 703 adolescents who took the Healthy Kids Colorado Survey in 2019. The findings from the dangers of vaping among adolescents in Colorado indicate that 701 adolescents in middle and high school were encouraged to vape due to radio ad listings, TV commercials, and social media ads. 85% of participating teens had come across a vape advertisement. Stores use advertisements to sell e-cigarettes to adolescents in return for bringing more adolescents to their stores. Addressing the dangers of marketing and promoting of e-cigarettes among adolescents is critical for protecting the health and well-being of future generation. It is important for educators, lawmakers, school officials, parents, and healthcare providers to work together to help prevent e-cigarette usage among adolescents and promote positive lifestyle behaviors.

Vaping Dangers in Colorado Adolescence

By

James Clay Willis, Jr

MA, Walden University, 2018

BS, Graceland University, 2016

Dissertation Submitted in Partial Fulfillment

Of the Requirements for the Degree of

Doctor of Philosophy

Health Education & Promotion

Walden University

November 2024

Dedication

I dedicate this research to my parents, James and Teandra Willis. My parents gave me the ethic of working hard and giving my all to everything I do. I would have to dedicate this research to my stepdaughter, who gives me the courage and the strength to keep going when life gets hard. I dedicate this research to my sisters, Jaymie and Marriah Willis, and my brothers, John Martin and Brandon Martin, for giving me the courage to be myself. I would like to dedicate this research to my friends, my aunts, uncles, cousins, nieces, and nephews, and lastly, to a family member who passed away in 2020 due to vaping.

Acknowledgments

First, thank God for making everything possible; nothing is possible without Him. Next, I would like to thank my chair Dr. David Brown, for his guidance and support, leading me to become an excellent researcher and pushing me to be a student. Next, I would like to acknowledge and thank my committee member, Dr. Scott Mcdoniel for his direction and guidance. As I can attest, the process is not easy. I would also like to thank Dr. Nicole Brown, my university research reviewer, for her helpful recommendations for the proposal. Finally, I want to acknowledge my friends who without their love and support, would have made nothing in my life possible, especially my brother, Dr. Abraham Anderson.

Table of Contents

List of Tables

Chapter 1: Introduction to the Study

Background

Smoking tobacco products is one of the major causes of preventable deaths in the United States (Centers for Disease Control and Prevention [CDC], 2021). Tobacco products have increased in sales due to the popularity of e-cigarettes among youth in the United States. Over 5.5 million Americans 18 years of age and younger who smoke tobacco products are expected to die prematurely from smoking-related illnesses. This statistic represents about 1 in every 13 Americans who are 17 years old or younger (CDC, 2020b). Approximately 25% of high school and 8% of middle school students have increased their usage (CDC, 2020a). With knowledge of tobacco products being a too high cause of death and causing nearly 443,000 deaths with 8.6 million individuals suffering from health illnesses, e-cigarettes remain a concern for adolescents' newer generation (CDC, 2020a).

E-cigarettes are responsible for the deaths of 443,000 individuals and are responsible for more than 8.7 million individuals having life-threatening illnesses each year in the United States (CDC, 2020a). As of February 18, 2020, a total of 2,807 individuals have been taken to the hospital because of the number of e-cigarettes or vaping use-associated lung injury (EVALI) cases in the United States that hospital administrators have reported to the CDC from all states across the United States including the District of Columbia, and two U.S. territories (i.e., Puerto Rico and U.S. Virgin Islands). Since then, the number of deaths related to the EVAIL cases among adolescents in the United States has increased. In 2019, 68 people died due to e-cigarette

use across the United States (CDC, 2020). Among those individuals admitted to the hospital from smoking or vaping products, 66% were male. Fifteen percent of patients were under 18, 37% were 18 to 24, and 24% were 25 to 34 (CDC, 2020). Since the release of e-cigarettes, tobacco companies have made more than $2 billion in sales due to how e-cigarettes are being marketed and promoted (Fraga & National Center for Health Research, n.d.).

Over 4,000 chemicals and ingredients are used to produce e-cigarettes, containing glycerol, propylene glycol, nicotine, benzoic acid, and flavorants (Alzahrani et al., 2018). Health officials have had concerns that the promotion and marketing of e-cigarettes are causing severe health concerns for adolescents. There is a need to understand how the relationships regarding the advertising and marketing of e-cigarettes tobacco products among adolescents cause nicotine dependency for adolescent users (Alzahrani et al., 2018).

The Food and Drug Administration (FDA; 2020) described electronic cigarettes as battery-operated products meant to deliver flavor, chemical actions, and nicotine. The FDA characterized e-cigarettes as devices that turn chemicals with highly addictive nicotine into an aerosol inhaled into the respiratory system by the user. In the United States, 15.7% of adolescents ages 13–18 reported using electronic cigarettes (Cooper et al., 2016). The nicotine solution's heat generates a vapor that remains inhaled without the usage of burning tobacco (Cooper et al., 2016).

Health professionals in the United States are concerned that e-cigarettes limit clean indoor air quality because the devices can be used indoors, which can lessen an

individual's chance of smoking cessation (Cooper et al., 2016). E-cigarettes serve as a way for users to inhale nicotine without smoking and become nicotine dependent. Individuals who have never smoked traditional cigarettes may experiment with e-cigarettes (also known as vaping) (Cooper et al., 2016). E-cigarettes are popular among adolescents mainly because of the many flavors; this population can cause youth to develop nicotine addiction before reaching adulthood, which could later cause a child to switch to other harmful substances products (Cooper et al., 2016).

E-cigarette sales have dramatically increased since 2015, with sales gaining over $6.2 billion since their release in the United States (King et al., 2018). The popularity of e-cigarettes has become a global and national debate between lawmakers and health professionals who contest e-cigarettes as harmful among adolescents (King et al., 2018). In the state of Colorado, e-cigarette usage has become exceptionally high among adolescents. One in 5 teens stated that they use e-cigarettes in public places and at home (Public Health Institute, n.d.). The rate of vaping e-cigarettes among youth in Colorado is twice the national average. It has become the most tried substance among adolescents after alcohol in Colorado (Public Health Institute, n.d.). In 2018, e-cigarette sales nearly tripled in sales to adolescents. According to the Public Health Institute (n.d.), 1,200 middle school and 1,500 high school students vaped e-cigarettes in 2019.

As the popularity of e-cigarettes continues to rise in the United States and Colorado, health officials are concerned about the harmful effects e-cigarettes could potentially have on human health. Scientific studies on e-cigarettes have highlighted the potential for it to become a national crisis study. As adolescents continue to vape e-

cigarettes and sales continue to climb, the promotion and marketing of e-cigarettes have huge health concerns among high school students.

Problem Statement

Adolescents in the United States have continued to show increased interest in tobacco and e-cigarette products (Crawford, 2018). In the United States, e-cigarette usage among adolescents in middle and high school rose from 3.6 million in 2018 to 6.4 million in 2019 (Crawford, n.d.). In 2018, the U.S. surgeon general declared e-cigarette vaping among adolescents an epidemic (Farzal et al., 2019). Since 2018, over 1.3 million adolescents have experienced vaping e-cigarettes (Farzal et al., 2019). The marketing and promotion of vaping has resulted in concerns about the health of adolescents in the United States. Hospitals across the United States have seen an increased number of adolescent patients with life-threatening conditions due to vaping. Vaping affects the lungs, heart, and other major organs (Tsai et al., 2020). Health experts have reported severe lung damage in people who vape, including some deaths among adolescents (Farzal et al., 2019). In 2019, over 1,500 adolescents in the United States started getting sick and experiencing respiratory illnesses related to vaping. The youngest to have died from vaping was 13 years old. (Farzal et al., 2019). Over 150 cases and more than 100 adolescents have been hospitalized (Farzal et al., 2019). Twenty-nine states have reported adolescent deaths from vaping.

Sixteen percent of hospitalized patients reported acquiring vaping e-cigarette products only from commercial sources (recreational and medical dispensaries, vape or smoke shops, stores, and pop-up shops; (State of Delaware, n.d.). Sixty-eight percent

reported acquiring vaping e-cigarette products only from informal sources (i.e., family/friends, dealers, online, or other sources; State of Delaware, n.d.). Pediatricians across the United States reported alarming symptoms in adolescents who started vaping (Balingit, 2019). Pediatricians noticed that youth had explosive anger, extreme mood swings, insomnia, and headaches (Balingit, 2019). Some teens were vaping nicotine products until they vomited and were going to extremes to keep vaping even after facing severe consequences (U.S. Department of Health and Human Services [USDHHS], 2016).

Many hospitalized patients indicated that they became turned on to vaping e-cigarettes after seeing commercials and social media advertisements (ADs) online regarding the marketing and promotion of vaping e-cigarette products such as JUUL. Sanginiti, 2020). Eighty percent reported hearing about vaping e-cigarette products from commercial and informal sources such as social media platforms like Twitter, Facebook, and Instagram (CDC, 2020). Tobacco companies paid celebrities to endorse popular vaping products like JUUL (Sanginiti, 2020). JUUL is an e-cigarette the size of a universal serial bus drive with cartridge flavors such as mango or creme brulee inside ("4 Marketing Tactics", 2018). It became prevalent for adolescents to start vaping because of the flavors it offered (Hansen et al., 2018).

Some adolescents said they did not know that the vapor contained nicotine (Jones & Salzman, 2020) Researchers studying adolescent vape use have found this to be a common misconception (Golan et al., 2023). Adolescents were at risk of becoming addicted to nicotine without their knowledge. Because the devices were marketed and

promoted as a healthier alternative to cigarettes, many adolescents, even those repulsed by traditional tobacco products, believed they were safe products without health risks (Hansen et al., 2018).

Colorado leads the nation in adolescent vaping. Approximately 30% of teenage youth vape in Colorado compared to the national average of 13.2% (Public Health Institute, n.d.). Understanding adolescents' curiosity about tobacco products comes from the numerous accounts surrounding Colorado's marijuana legalization (Rapaport, 2019). Young adolescents who used e-cigarettes stated that because marijuana was legal in Colorado, they became curious about the flavors that e-cigarettes contain. Adolescents have also indicated that they had laced e-cigarettes with marijuana to get a better high from the drug (Rapaport, 2019). Jenssen and Boykan (2019) demonstrated how many e-cigarette brands, such as JUUL, NJY, Blue e-cigs, and Mig Vapor, became more popular than other vaping devices because of the odorless smell and many flavors. Flavoring mechanisms have caused a health crisis on a global and national scale.

The FDA (2020) believed that the spike in e-cigarette sales is due to marketing and promoting these vaping products. With the newly flavored e-cigarettes developing worldwide, one of the primary sources for vaping products such as JUUL, other popular e-cigarettes, and vaping products is the unknown health consequences products may cause. The problem is that among adolescents, there is a lack of awareness and a lack of health education regarding the dangers of vaping the ages of 12–and 18 years old, which may further ease respiratory issues, cardiac issues, and even death (Kanyadan & Ganti, 2019).

Research indicated that adolescents aged 12–18 years old experience negative health impacts from vaping, including nicotine addiction, nicotine dependency, and effects on multiple anatomical systems (Alzahrani et al., 2018). Researchers believe that vaping products, such as e-cigarette nicotine products, contain a liquid chemical substance that can be absorbed through the skin and may cause a poisoning risk to adolescents and young children. (Alzahrani et al., 2018). At high enough doses, nicotine is very toxic. Nicotine e-liquid, the fluid used in an e-cigarette, can cause poisoning if swallowed or absorbed through the skin and may even be fatal. (Alzahrani et al., 2018). Nicotine can lead to myocardial infarction, neurological disorders, and other health risks (Alzahrani et al., 2018). Nicotine harms adolescent brain development, that could impair memory and attention span and cause behavioral impairments (Pepper et al., 2018).

Researchers demonstrated the dangers of vaping surrounding adolescents, stating youth lack awareness and understanding of how marketing substances for profit have targeted adolescents. (Pepper et al., 2018). Big tobacco companies profit while withholding information on the products' effects on youth and adolescents (Gibson-Young & Martinasek, 2018). With the lack of education and drug prevention programs to help adolescents understand the dangers that vaping products have, the risk of marketing encouraging adolescents vape use is high. Due to the increase of marketing techniques involving vaping towards adolescents, adolescents have become a high-risk target for behaviors and adverse mental health outcomes, notably depression and suicidality (Chadi et al., 2021). Positive social change may occur if health educators can help 11–19-year-

olds become more health-conscious about the harmful effects of flavored vaping products.

Additional public health measures about the side effects of vaping causes may help adolescents ages 11–19 become more health conscious regarding vaping. Adolescents who vape have sleeplessness and restless nights, poor performance in school, increased sexual desires, and increased alcohol usage (Data and Statistics, 2020). According to the CDC (2020a), 30.5% of surveyed adolescents noticed lower academic performance after they started vaping. Sleep patterns can be affected by nicotine, causing adolescents to stay awake too long.

Research Questions

RQ1: Is there a relationship between e-cigarette usage, marketing exposure from social media, radio stations, television (TV) ADs, and vaping products available to adolescent-aged individuals (11–19 years) in Colorado?

$H_0$1: There is no relationship between e-cigarette usage, marketing exposure from social media, radio stations, TV ADs, and vaping products available to adolescent-aged individuals (11–19 years) in Colorado.

H_a1: There is e-cigarette usage, marketing exposure from social media, radio stations, TV ADs, and vaping products available to adolescent-aged individuals (11–19 years) in Colorado.

RQ2: To what extent, if any, do age (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and social media platforms) predict e-cigarette usage in Colorado?

$H_0$2: There is no extent to which adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and social media platforms) predict e-cigarette usage in Colorado.

H_a2: There is an extent to which adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and social media platforms) predict e-cigarette usage in Colorado.

RQ3: To what extent, if any, do race/ethnicity of adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station, and social media platforms) predict e-cigarette usage in Colorado?

$H_0$3: There is no extent to the race/ethnicity of adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio stations, and social media platforms) predict e-cigarette usage in Colorado.

H_a3: There is an extent to which the race/ethnicity of adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio stations, and social media platforms) predict e-cigarette usage in Colorado.

Purpose of the Study

The purpose of this study was to investigate a possible relationship between vaping products advertised via endorsement and other platforms towards adolescents without associating the health risks of vaping and the increased use of vaping products by adolescents and subsequent incidences of illnesses (see Dinardo & Rome, 2019). Over 38% of students around the nation have had some exposure to e-cigarette advertisements. (see Dinardo & Rome, 2019) Consumers' advertising exposure to students regarding e-

cigarettes allowed further advertising communication and commercialization of e-cigarettes for 30 days, allowing a boost in sales and vaping exposure among adolescents (Hansen et al., 2018). The risk factors of vaping among adolescents remain concentrated on the amount of exposure to advertisements, celebrity endorsements, and social media posts regarding the popularity of vaping and using e-cigarettes (Hansen et al., 2018).

In Colorado, the average number of adolescents vaping in the state doubled, leaving the state suppressing the national average of adolescents who experience vaping (Public Health Institute, 2020). Over 27,000 students started smoking tobacco products in the sixth and seventh grades. By the time adolescents reached high school, they had switched to vaping popular e-cigarettes such as JUUL (Public Health Institute, 2020). Fifty-eight percent of adolescents in Colorado middle and high school students stated that they had been vulnerable to e-cigarette ADs in retail stores. (Public Health Institute, 2020).

In comparison, 44% of adolescents said they saw them on TV and in other ADs (Jenco, 2019). Fifty-eight percent of adolescents started vaping because of ADs that they saw in stores, on TV, and on social media platforms (Jenco, 2019). Colorado students in middle and high school started to vape at least 10 times or more a month.(Jenco, 2019).

In Colorado, adolescents who vape are 90% more likely to become addicted to nicotine (Public Health Institute, 2020). E-cigarettes contain over 7,000 chemicals in the pods. The form of nicotine in e-cigarettes is two to 10 times more concentrated than in traditional tobacco cigarettes (Jenco, 2019). A single pod from one vape includes 0.7 milliliters of nicotine. That is the equivalent of someone smoking 20 regular cigarettes a

day. Over 6.3 million adolescents vape nationwide; in Colorado, over 27,000 students vape each year, causing more harm to adolescent health (Dinardo & Rome, 2019).

Residents in Colorado spend an estimated $24 million a year on tobacco products, yet the number of adolescents vaping continues to increase (Pepper et al., 2018). More than 90% of adolescents' vaping products contain nicotine (Public Health Institute, 2020). Colorado has a national crisis among adolescent vaping. The danger of adolescents' vaping has become an increasing concern among health officials because more adolescents are developing health issues such as lung disease and cardiac health risks. (Public Health Institute, 2020). As more and more adolescents vape in middle and high school, even healthier adolescents may become hospitalized with dire health concerns (Public Health Institute, 2020).

Colorado's hospitals reported 11 cases of vaping (Jojola & Newman, n.d.). Most patients reported having trouble breathing (Dinardo & Rome, 2019). While no deaths were reported in Colorado, Colorado hospitals were still on high alert due to-increased vaping (Daley, n.d.). Over 2,807 hospitalizations were recorded, as reported in all 50 states. Sixty-eight deaths were confirmed as of February 2020 as being caused by vaping. Over 149 adolescents across the states have remained hospitalized with severe lung illness after vaping. (Dinardo & Rome, 2019) The inhaling ingredients found in e-cigarettes have high levels of toxins that cause irreversible lung damage and lung diseases (CDC, 2020).

Definition of Terms

Addiction: The state of being enslaved to a habit or practice or to something that

is psychologically or physically habit-forming, like narcotics, to such an extent that its cessation causes severe trauma.

E-cigarettes: A device used to simulate the experience of smoking that has a cartridge with a heater that vaporizes liquid nicotine instead of burning tobacco.

Harm reduction: A public health perspective and intervention that seeks to reduce the adverse effects of drug use.

JUUL: A vaporizer brand for the highly concentrated nicotine-containing liquid used to vape. It is popular among underage users (Urban Dictionary, n.d.)

Nicotine: One of more than 4,000 chemicals found in the smoke from tobacco products such as cigarettes, cigars, and pipes, it is the primary component in tobacco that affects the brain (*Urban Dictionary*, n.d.).

Substance dependence: A maladaptive pattern of substance use, leading to clinically significant impairment or distress, as manifested by three or more of the following occurring at any time in the same 12-month time.

Traditional cigarette: Conventional tobacco-containing cigarettes that are burned and used to inhale smoke.

Vaping: The process of inhaling vapor from e-cigarettes.

Assumptions

This study was based in Colorado. The indicators of nicotine addiction questions used in this data analysis are the Susceptibility to Smoking Index questions. The various brands and types of e-cigarettes have different flavors, carbon monoxide, and nicotine

content due to manufacturing. The apparatus used is reliable and valid because of its long-standing history as part of the U.S. surveillance systems.

Limitations

Several challenges and regulations have occurred since I began my research that may have affected this study. The foundation of the National Youth Tobacco Survey (NYTS) data collection used the Healthy Kids of Colorado Survey (HKCS) to interpret current and future data on how e-cigarettes affect adolescent youth's health (Health, 2019). While the data are correct for the current years, a baseline assessment of how teenagers will evaluate the data in the future is needed. The secondary data from the NYTS includes questionnaires that consist of self-response questions, where the respondents may not have to answer the questions correctly due to recall bias (Health, 2019).

Since adolescents are considered a vulnerable population, it was not possible for me to directly survey or interview them. Instead, I conducted a secondary analysis using the 2019 HKCS) A limitation of performing a secondary analysis was that I could not confirm the data collection process. An additional limitation was that I used the more current data available, which may not accurately reflect the current views of the population.

Scope and Delimitations

This study had the following delimitations: The study was delimited to a quantitative, cross-sectional design. The study was delimited to vaping among early and middle adolescent students based on race/ethnicity, gender, socioeconomic status,

education, and age. This study was delimited to the HCKS. Not all variables, subjects, and conditions were specified beyond the study's scope.

Significance of the Study

Pepper et al. (2018) suggested that the marketing of vaping products to adolescents can impact behaviors and can cause adolescents to become addicted to. There is a lack of intervention programs that help adolescents understand how advertising and marketing ADs for products such as e-cigarettes vaping can encourage use, resulting in severe health risks, including mental health risks and respiratory illness. The U.S. Department of Health and Human Sciences has demonstrated that nicotine use is addictive population (Researchers Explore Health Effects of E-Cigarettes, 2018). In many efforts, the role in the development of vaping cessation programs remains hindered because of nicotine dependence evaluation (Boykan et al., 2019). The emphasis on examining nicotine dependence and its association with various types of newly developed e-cigarettes has researchers looking at the amount of nicotine and carbon monoxide within one vaping pod (Dinardo & Rome, 2019). The lack of information found in the literature limits a public health professional's ability to obtain the necessary knowledge and skills to create interventions to help a population under the age of 18 reduce tobacco usage.

Additionally, the USDHHS and the FDA denied the request to regulate e-cigarette products (Data and Statistics, 2020) This study may be the first step that healthcare professionals may use to assess nicotine addiction/dependence within their community or in participatory interventions. It also may provide a scientific base for continuing

advocacy for e-cigarette product regulation. One of the social change implications acquired from this study may be to help design and implement effective health education programs and cessation programs that use nicotine dependence and the dangers of vaping as the foundation of their development. Initially, educating and addressing an individual's risk factors surrounding the risks of vaping and the level of nicotine dependence may help bridge the gap in establishing more precise epidemiological data on ways to educate adolescents about vaping and the increased risk of nicotine addiction. This research may help physicians, public health practitioners, and policymakers regulate the amount of nicotine used in vaping products.

Summary

The U.S. public health agencies' decades-long campaign achievements against the tobacco industry remain threatened by the electronic cigarette movement (Buckell & Sindelar, 2019). Adolescent use of nicotine products remains a problem and appears connected to the advertising for and use of e-cigarette and vaping products. The literature review in the next chapter will further discuss the ongoing debate about electronic cigarettes and the health problems e-cigarettes cause among adolescents due to the promotion and marketing of e-cigarettes. The methodology is presented in Chapter 3. The findings are presented in Chapter 4, and the discussion and interpretation of the findings are explained in Chapter 5.

Chapter 2: Literature Review

One of the most significant problems in the United States is the usage of e-cigarettes. The history of electronic cigarette use in the United States is essential. Since the release of e-cigarettes in 2004, the number of adolescents using the products has continuously grown—a rapid rise in vaping among adolescents in middle and high school (USDHHS, 2016). Vaping poses a danger that can harm adolescents extensively, such as nicotine addiction, which can be extremely harmful to the adolescent brain (USDHHS, 2016). One out of 5 middle and high school students on a national level use e-cigarettes currently (U.S. FDA, 2018).

The underlying reason that vaping is such a dangerous concern amongst teenagers is what it requires and its use. Electronic cigarettes heat oils, liquids, cannabis, or other substances to cause vaporization (Douglass & Solecki, 2017). Vapes have a variable amount of nicotine in them, depending on the brand a consumer is using. Nicotine causes elevated heart rate, high blood pressure, and constricted vessels in the arteries, causing behavioral and cognitive impairment; it is also highly addictive (Douglass & Solecki, 2017).

Vaping has the potential to lead to performance issues for students in middle and high school, including failing grades. The e-cigarettes that adolescents tend to experiment with have a higher level of nicotine than traditional cigarettes (Goldenson et al., 2017). Among adolescents, both middle and high school students vaped out of curiosity. Sixty percent reported they were vaping for the flavor and did not realize that e-cigarettes contained potent amounts of nicotine (Goldenson et al., 2017). The vapor from e-

cigarettes exposes several chemicals, leading to substances that cause health effects among adolescents (USDHHS, 2016).

Vaping among teenagers caused an outbreak of lung injuries and deaths among adolescents (Blaha, 2017). One of the many reasons that adolescents' lungs and immune systems are at risk is because there are over 700 toxic chemicals in e-cigarettes (Heydari et al., 2017). One of those harmful chemicals that e-cigarettes contain is vitamin E acetate. Vitamin E is a thickening agent used in tetrahydrocannabinol vaping products. Other harmful chemicals that e-cigarettes contain are propylene glycol, vegetable glycerin, acetaldehyde, acrolein, and formaldehyde. Many of these chemicals in e-cigarettes have been tested and are known to cause lung diseases, cardiovascular disease, and chronic obstructive pulmonary disease with an acute lung injury (Heydari et al., 2017). The marketing ADs suggest that e-cigarette vaping products are a safer alternative to smoking than traditional regular cigarettes (Heydari et al., 2017). However, the FDA has not found any e-cigarette brands or vaping products to be a safe or effective alternative to help individuals quit smoking (Data and Statistics, 2020).

Vaping among adolescents has caused severe lung disease and respiratory illness. In 46 states, including Colorado, over 805 reported cases of adolescents have been admitted to the hospital due to respiratory illness within 90 days of vaping (Chaffee et al., 2017). Two-thirds of these cases were for e-cigarette users 18 years old and younger. Teenagers who previously had no experience with tobacco or e-cigarettes became addicted to nicotine. One in 4 high school seniors described using nicotine e-cigarettes in the past 30 days, followed by 1 in 5 high-school juniors and one in 11 eighth graders. The

rates were even higher for kids reporting vaping over the past 12 months (Chaffee et al., 2017).

One of the rare side effects of vaping among adolescents is nicotine-induced seizures (Chaffee et al., 2017). The nicotine in e-cigarettes increases adrenaline, activates the sympathetic nervous system, raises the heart rate, and narrows blood flow to the heart and lungs (Chaffee et al., 2017). Individuals who used e-cigarettes were more likely to develop chronic lung disease, including asthma, bronchitis, and emphysema, after the first 30–60 days (Prokhorov et al., 2017). Vaping can cause chemical burns to the lung tissue due to the toxic metals in chemicals, leaving scars on the lungs. The vitamin E oil in e-cigarettes clogs the lungs and even causes e-cigarettes to explode due to the overheating of batteries (Prokhorov et al., 2017).

Literature Search Strategy

I analyzed available literature to address the gap in knowledge regarding the lack of awareness and lack of health education regarding the dangers of vaping between the ages of 12–18 years old that may further increase respiratory issues, cardiac issues, and even death (see Kanyadan & Ganti, 2019). The literature review focuses on the vaping dangers among adolescents in Colorado. Research indicates that adolescents aged 12–18 experience negative health impacts from vaping, including nicotine addiction, nicotine dependency, and effects on multiple anatomical systems (Alzahrani et al., 2018). Researchers believe that vaping products, such as e-cigarette tobacco products contain a liquid chemical substance that can be absorbed through the skin and may cause a poisoning risk to adolescents and young children (Alzahrani et al., 2018).

The literature review sources came from electronic databases such as EBSCO host, SAGE Journals, and Research Gate. Several terms within the literature review will help support the literature and the research discussing vaping in Colorado. The critical words researched used were *vaping*, *JUUL*, *JUULing*, *E-cigarettes*, *nicotine*, *nicotine dependency*, *nicotine addiction*, *harm-reduction*, *addiction*, and *traditional cigarettes*. The literature review begins with the types of electronic cigarettes, e-cigarettes versus conventional cigarettes, e-cigarette endorsements, the popularity of e-cigarettes, and the promotion of e-cigarettes and vaping in Colorado. I applied Bandura's social learning theory (SLT) as the theoretical framework for this study. Bandura (1973) concentrated on observing children and how they follow the individuals around them in numerous ways, becoming influenced by models such as celebrities, TV actors, and peers at school.

SLT and Vaping

Bandura (1973) found that children observe individuals around them in numerous ways, such as being influenced by models such as celebrities, actors, and peers at school (McLeod, 2016). Adolescents in Colorado perform actions learned from the environment by observing what they see around them (McLeod, 2016). E-cigarettes have become popular in recent years among adolescents because of the models in their environment. TV and social media ADs use celebrities to promote e-cigarettes, allowing adolescents to reproduce the behavior and indulge in negative behavior. (McLeod, 2016).

Bandura's SLT and how negative reinforcement plays a role in nicotine dependence among e-cigarettes has been investigated (Stewart, 2019). SLT provides an outlook on how adolescents imitate and study their peers' behavior (Bandura, 1973).

Individuals learn by watching others and mimicking those they admire (Bandura, 1973). Negative reinforcement has provided empirical evidence referring to the marketing and usage of adolescents and their behavior regarding the use of vaping due to the marketing of e-cigarettes (Stewart, 2019).

Bandura (1973) believed that children are frequently surrounded and influenced by many influential models such as their parents, characters on TV, friends within their peer group, and teachers at school. These models often provide examples of behavior to observe and imitate (i.e., masculine and feminine, pro- and antisocial; McLeod, 2016). Bandura felt that adolescents mimic and pay more attention to the models they look up to and their behaviors. Adolescents may mimic and model after celebrities who endorse vaping due to the influence Bandura suggested.

Literature Review

Types of Electronic Cigarettes

E-cigarettes, also known as e-vaporizers or electronic nicotine delivery systems, are battery-operated devices used to inhale an aerosol that contains nicotine (though not always), flavorings, and other chemicals (Cooper et al., 2016). They can resemble traditional tobacco cigarettes (cig-a-likes), cigars, pipes, or even everyday items like pens or universal serial bus memory sticks. Other devices, such as those with fillable tanks, may look different. Types of e-cigarettes often hold the nicknames of e-hookahs, hookah pens, vapes, vape pens, and mods (customizable, more powerful vaporizers; Boykan et al., 2019). Regardless of their design and appearance, these devices generally operate similarly and are made of similar components (Cooper et al., 2016). Four hundred and

sixty different e-cigarette brands are currently on the market (Boykan et al., 2019). E-cigarettes are popular among teens and are now the most used tobacco among youth in the United States (Boykan et al., 2019). Their easy availability, alluring ADs, various e-liquid flavors, and the belief that they are safer than cigarettes have helped make them appealing to this age group.

Boykan et al. (2019) found that 1 in 4 teens reported using e-cigarettes for dripping, in which individuals produce and inhale vapors by placing e-liquid drops directly onto heated atomizer coils. Teens reported the following reasons for dripping: (a) to create thicker vapor (63.5%), (b) to improve flavors (38.7%), (c) and to produce a more substantial throat hit—a pleasurable feeling that the smoke creates when it causes the throat to contract (27.7%; Boykan et al., 2019). The nicotine in e-liquids is readily absorbed from the lungs into the bloodstream when a person uses an e-cigarette (USDHHS, 2020). Upon entering the blood, nicotine stimulates the adrenal glands to release the hormone epinephrine (adrenaline; Barrington-Trimis & Leventhal, 2018). Epinephrine stimulates the central nervous system and increases blood pressure, breathing, and heart rate (Barrington-Trimis & Leventhal, 2018). As with most addictive substances, nicotine activates the brain's reward circuits and increases levels of a chemical messenger in the brain called dopamine, which reinforces rewarding behaviors (Barrington-Trimis & Leventhal, 2018). Pleasure caused by nicotine's interaction with the reward circuit motivates some individuals to use nicotine repeatedly despite risks to their health and well-being.

E-cigarettes Versus Traditional Cigarettes

There are many close similarities between traditional cigarettes and e-cigarettes. First, looking at the physical appearance, e-cigarettes are shaped in likeness to regular cigarettes to allow the user to still hold the substance with one hand (Buckell & Sindelar, 2019). E-cigarettes tend to give the same nicotine sensation as regular cigarettes. Most cigarettes have a filter on end made of cellulose acetate, which is biodegradable (Buckell & Sindelar, 2019). Many cigarettes also have various chemical additives, which alter the flavor, make nicotine more addictive, and enhance the blend's burning properties (Buckell & Sindelar, 2019).

Like regular tobacco cigarettes, e-cigarettes consist of chemical additives such as formaldehyde and acetaldehyde (see East et al., 2018).E-cigarettes have a cartridge of fluid consisting of dissolved solvents, flavors, and nicotine and are refillable (Jeong, 2018). In this chapter, I will describe the current literature on electronic cigarettes with more emphasis on the science of electronic cigarettes, the most user demographics, and the controversial therapeutic benefits electronic cigarette manufacturers claim it brings to smokers (see East et al., 2018).

E-cigarette Endorsements

Phua et al. (2018) analyzed how big tobacco companies utilized celebrities to promote and market e-cigarettes among adolescents. Eighteen million high school and seven to 10 middle school students vaped due to the advertising ADs of e-cigarettes they saw or heard (Phua et al., 2018). The FDA requires a warning of health concerns on the packaging; however, big tobacco companies noticed no product marketing restrictions

(Phua et al., 2018). They allowed companies to use celebrity endorsements via social media, Instagram, Twitter, and Facebook as outlets to reach adolescents to encourage them to try their products (Phua et al., 2018).

Celebrities use social media platforms such as Instagram, Facebook, and Twitter to target the millions of fans and supporters who follow them by endorsing how e-cigarettes are a safer option than smoking regular tobacco cigarettes (Phua et al., 2018). Many adolescents and young adults follow celebrities on social media, even those 21 years old. Forty-three percent of followers who follow celebrity artist Snoop Dogg found that his followers started vaping after the legendary artist posted a video of him vaping with a message stating that e-cigarettes are less harmful than regular cigarettes (Phua et al., 2018). Other celebrities started promoting e-cigarette usage by posting similar videos and posting their fan base about their favorite e-cigarette.

Sales continue to rise among adolescent users who decide to vape in middle and high school. More than 23 million high school students stated that they initially decided to start vaping after seeing an AD on Facebook, Twitter, or Instagram that had to do with one of their favorite celebrities using that product (Phua et al., 2018). Over 50% of students chose that product (Phua et al., 2018).

Popularity of E-cigarettes

Among the 460 electronic brands that are promoted and marketed towards adolescents, one of the new electronic cigarettes sweeping the nation among adolescents is JUUL e-cigarettes (Crawford, n.d.). This literature looks at the dangers of e-cigarettes among adolescents and the promotion and marketing of e-cigarettes. P.A.X. Labs

introduced the JUUL electronic cigarette on June 1, 2015. In July 2017, Juul Labs was spun out of P.A.X. Labs as an independent company (Crawford, n.d.). In July 2018, Juul raised $650 million, giving it a valuation of $15 billion. The marketing of JUUL and advertising among adolescents allows companies to market the JUUL tobacco product as a substitute for conventional smoking (Crawford, n.d.).

The challenge is that when companies market a new product, sales are the primary thought (King et al., 2018). Many companies that advertise new tobacco products do not realize the impact that advertising has on adolescents. The average sale for JUUL e-cigarette products among youth was 11.3% throughout the United States (King et al., 2018).

The promotion and marketing of JUUL e-cigarette tobacco products and other e-cigarette products, according to the media, has been appealing among adolescents and has been reported to be used in high schools and middle school classrooms (King et al., 2018). Twenty-five percent of youth are using JUUL, ranging from 15 to 25 years old, yet the challenge is knowing if more males are using JUUL or more females (King et al., 2018).

JUUL tobacco products have reached $2 billion on the market; one of the challenges is the cost of JUUL (Fraga & National Center for Health Research, n.d.). Among numerous states across the country, the JUUL cost range is deficient in price, ranging from $5 to $11, making it accessible to adolescents throughout different convenience stores. Along with other popular vaping product brands, JUUL is involved

in numerous lawsuits alongside TruBlu and more than 100 e-cigarette brands targeting adolescents (King et al., 2018).

Promotion of E-Cigarettes

Since introducing e-cigarettes, there have been serious concerns about how e-cigarettes are being marketed and promoted for teenagers. At the end of the 2016 school year, 4 out of 5 middle and high school students, more than 20 million adolescents, were exposed to the marketing and advertisement of e-cigarettes (CDC, 2017). In the United States, there are few federal regulations on marketing e-cigarettes, allowing companies such as JUUL TruBl to advertise and market e-cigarettes on radio and TV stations to adolescents despite the ban in 1971 on cigarettes being able to be promoted through both outlets. E-cigarette companies utilize the Internet, retail environments, recreational events, and venues to reach adolescents, and statistically, it has worked (CDC, 2017).

Several e-cigarette companies/manufacturers promote and market e-cigarettes to adolescents by offering scholarships ranging from $250 to $5,000 in college scholarship funds. Students were informed that they should write essays on the benefits of vaping (“4 Marketing Tactics”, 2018). Another way e-cigarettes are marketed to adolescents is by running ADs on social media feeds and timelines. E-cigarette companies like JUUL rely heavily on social media to market and promote their products. Since the launch of JUUL, the company has spent more than $1 million to market and promote its development on Facebook, Instagram, and Twitter to help encourage images and company-sponsor ADs that have the words JUUL, cool, having fun, freedom, and sex appeal (Chu et al., 2018). Substantial social media platforms such as Facebook, Instagram, and Twitter all use a

mathematical algorithm that allows social networks to prioritize which/ what content a user sees in their feed (Barnhart, 2019). Algorithms are subsequently used to help create AD content to predict what that user likes. The Algorithms used by Facebook, Twitter, and Instagram are specifically designed to help determine what ADs to post on a user's account. This is achieved by a system that monitors how many clicks a user clicks on a post they like, heart a picture, and the number of hashtags a user may use in a bar (Barnhart, 2019). Social media has promoted vaping and e-cigarettes among adolescents; fifty-five percent of every user's account logs into Facebook, Twitter, and Instagram (Barnhart, 2019). Eighty-five percent of middle and high school students have been exposed to e-cigarette advertisements in retail stores, social media, magazines/newspapers, or TV/movies since 2014 (Barnhart, 2019). Along with other e-cigarettes, the company's social media growth has risen around this marketing technique. The tweets went from 765 regarding the JUUL e-cigarette a month to an average of 30,565 tweets by the end of the 2017 school year (Chu et al., 2018).

E-cigarette companies also use music events to reach their potential users. Blue eCigs sponsored the Sasquatch Music Festival with a vapor lounge for important individuals and surprise guest appearances from top celebrities. The e-cigarette JUUL sponsored the Music in Film Summit, promoting their product by having individuals utilize a social media booth and sample it (Chu et al., 2018).

One of the most powerful techniques that e-cigarette manufacturers used to attract customers to their products was introducing appealing flavors. In 2009, the Family Smoking Prevention and Tobacco Control Act banned flavors in cigarettes except for

menthol. Members of the e-cigarette companies found a loophole and capitalized on this regulation by offering kid-friendly flavors (Chu et al., 2018). One of the loopholes that members found was using disposable e-cigarettes. This loophole allowed adolescents to purchase disposable e-cigarettes, which come in flavors like watermelon and blue raspberry, to remain on the market (Lichtenberg, 2017). Flavors included cotton candy, gummi bear, and watermelon to ensure e-liquids look like everyday food items. Over 43% of adolescents stated that they tried e-cigarettes because of the many appealing flavors (Chu et al., 2018).

About 70% of middle and high school students were exposed to advertisements in retail stores, magazines/newspapers, TV/movies, and the Internet (CDC, 2017). The exposure to the marketing and promoting advertising of e-cigarettes has contributed to increased vaping usage of e-cigarettes among adolescents. In 2014, more than 18 million middle and high school students were exposed to e-cigarette ADs, representing 7 out of 10 students in the United States (CDC, 2017). One in every 2 middle and high school students was exposed to the ADs in retail stores, while nearly 2 out of 5 middle and high school students watched or saw video ADs online regarding e-cigarettes (CDC, 2017).

Vaping in Colorado

Colorado is known for numerous things, such as mountains, ski resorts, beautiful winter cabins, and the X-games in Aspen in January. Colorado has made national headlines for a different reason besides the law that passed the usage of marijuana across the state (Public Health Institute, n.d.). E-cigarette usage has continued to become a severe problem across the state over the last 5 years, and it continues to rise. Dr. Jerome

Adams, the U.S. Surgeon General, declared youth e-cigarettes an epidemic. Vaping among Colorado youth is twice the national average (Public Health Institute, n.d.). In the year 201,7, vaping among ninth-grade students was 18.5% and rising. Among 10th graders, 25.3%, 11th graders, 31.7%, and growing among 12th-grade students, the rise of e-cigarette usage was over 31.8% (Public Health Institute, n.d.).

In 2018, over 101 purchases of e-cigarettes adolescents purchased sales. Adolescents as young as 11 years old were caught vaping in school bathrooms and classes (Public Health Institute, n.d.). In that same year, over 25,000 teenagers began getting suspended for vaping on school grounds among middle and high school students. In the same year over in Colorado, pulmonologist Grace Houser reported that the use of vaping e-cigarette products among adolescents in middle and high school rose to 3.6 million adolescents using the tobacco product. In 2019, that number nearly doubled to 5.3 million (Public Health Institute, n.d.).

Colorado leads over 37 states among adolescent middle and high school students vaping electronic cigarettes. Around 6% of adolescents say that they frequently vape (Vaping and E-Cigarettes, 2018). According to state officials, many students started vaping as early as the eighth grade; however, with the rise of the new popular e-cigarette JUUL, that number increased. Vaping continues to soar mainly because the JUUL brand of e-cigarettes is odorless and consists of more flavors, attracting users to vape (Vaping and E-Cigarettes, 2018). Advertisement companies focused on promoting and marketing the new e-cigarette as a mechanism to get more adolescents to experience and start

vaping. The JUUL Company has grossed over $1 billion in marketing sales (Vaping and E-Cigarettes, 2018).

As an educator, I witnessed firsthand how dangerous vaping can be. I have seen firsthand teaching in middle school classrooms where students are hiding in the back of the classroom and secretly vaping with each other. The students range from sixth to eighth grade. The e-cigarette devices are so small that they are nearly undetectable, so educators cannot notice what a child is doing in the classroom. Educators have roughly a 25:1 ratio of students, and when the classroom is so disruptive, most educators cannot keep track of all student habits. Students have been caught vaping in classrooms and posting their experiences on social media platforms. Students often ask to go to the bathroom in school and will get caught by faculty when they are caught vaping. The state of Colorado was investigated because vaping continues to be a massive epidemic among adolescents in middle and high schools.

Vaping has caused over 27% of newly acquired middle school students and high school students to start vaping (Vaping and E-Cigarettes, 2018). Within the freshly caught middle and high school classes, more than 45% of the students tried e-cigarettes for the first time within the last year, making it second the most-tested substance in the state (Vaping and E-Cigarettes, 2018). In Colorado, the state has submitted documentation from hospital records stating that there is an outbreak of lung illness among adolescents associated with vaping (Vaping and E-Cigarettes, 2018). While Colorado currently has the highest vaping rates among adolescents in the nation, more and more hospitals have reported adolescents 18 years and younger hospitalized with

lung illness associated with vaping e-cigarettes (Public Health Institute, n.d.). Many of those adolescents, within the first 30 days, started to experience shortness of breath, chest pain, cough, fatigue, and possible fevers (Public Health Institute, n.d.).

Summary

Chapter 2 began by introducing e-cigarettes, restated the problem, and the study's purpose to discuss in the literature review. I identified the literature search strategies and significant sections of the chapter. This chapter included the theoretical framework from Albert Bandura. Bandura's SLT concentrated on children's behavioral actions by modeling actions and mimicking models that children look up to. It focuses on adolescents developing their favorite celebrities' behaviors. It focused on comparing e-cigarettes versus traditional cigarettes, e-cigarette endorsements, the popularity of e-cigarettes, promoting e-cigarettes, and vaping in Colorado.

Chapter 3, the research methodology section, begins with the introduction, restatement of the purpose of the study, and discussion of significant areas. Chapter 3 will include the research questions, theoretical framework, and approach to address the literature gap. This chapter will discuss recruitment, sample size, population, data collection, techniques for gaining research data analysis, ethical considerations, and a summary.

Chapter 3: Methodology

The purpose of this study was to determine if there is an association between the advertising of vaping products geared toward adolescents without crucial information about the health risks and the increased vape use in Colorado teenagers. I conducted a secondary analysis using the HKCS. In this chapter, I describe the research methodology, explain the target population and research setting, describe the method of collecting data used to identify patterns presented from the research, address the process verification, discuss ethical considerations, and provide a chapter summary.

Quantitative Research Methodology

In this study, I used a quantitative methodology to help identify emerging behavioral changes in adolescents and vaping. I used a binary logistic regression model analysis, Pearson correlation, and linear regression model for data analysis.

Research Design and Rationale

I conducted a quantitative study to examine if there is a relationship between e-cigarette usage, marketing exposure from social media, radio stations, TV ADs, vaping products, and access to health education/prevention programs for adolescent individuals (11–19 years) in Colorado. Quantitative secondary data analysis can help improve data quality evaluation and ensure current methods of analyzing data.

The quantitative methodology conformed to the program guidelines designed for this study. The quantitative database, the HKCS from 2019, included all variables recognized in an approved databank. Quantitative data sets desired variables (dependent and independent) were selected to compute the research outcome. A quantitative analysis

was used to assess the possible relationship and level of influence using Pearson correlations, logistic, and linear regression models.

I used a linear regression model to determine whether age (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and social media platforms) predict e-cigarette usage in Colorado. The Pearson correlation helped determine the relationship between e-cigarette usage, marketing exposure from social networking sites, radio stations, TV ADs, vaping products, and access to health education/prevention programs available to individuals (11–19 years) in Colorado. The logistic regression model helped determine to what extent, if any, the race/ethnicity of adolescent individuals (11–19 years) and the e-cigarette market (TV ADs, radio stations, and social media platforms) predict e-cigarette usage in Colorado. This study's independent variables were marketing exposure from social media, radio, TV ADs, vaping products, and access to health education prevention programs. The dependent variable was e-cigarette usage. The HKCS project is Colorado's largest continuously conducted health survey system("HKCS Overview," n.d.). In the HKCS, some core questions are asked yearly (fixed core), and others are asked every other year (rotating core) to meet the organizational requirement. The HKCS was the selected database. No expenses were incurred in extracting the secondary (quantitative) data. The secondary data are available to the public online.

Sample Population of Secondary Data Analysis

Population sampling is the process of selection from a particular population ("HKCS Overview," n.d.). The sampling process focused on adolescents in Grades six through 12 enrolled in Colorado state schools. The data I used explored current adolescent knowledge related to e-cigarette use, marketing exposure from social media, radio, TV ADs, and vaping products before and after access to health education prevention programs.

Sample Population Size

The sample population size used in the HKCS dataset consisted of 1,305 students selected using random numbers provided by the CDC. Within the regional state high school and middle school samples, the classroom size is 30 students in a sorted classroom combined following the same protocol. The average class sizes helped determine how many classrooms would garner approximately 100 students per grade level of sixth grade through 12th grade, totaling a sample size of 700 students.

For active consent schools or by request, the data become oversampled by 50% to cut the number of estimates suppressed ("HKCS Overview," n.d.). For high schools with less than 400 students enrolled and middle schools with less than 300 enrolled, administrators offered to survey all eligible and consenting students (i.e., a census). The offer was determined on a case-by-case basis and designed to reduce the logistical burdens of administering the survey and meet the school's need for robust estimates. The population comprises students from different ethnicities, including White, Black, and Hispanic.

This study's sample size was set up by conducting a statistical power necessary to prevent a Type II error; using the G*Power version 3.1.9.7 statistical software, the statistical test used was logistic regression. Logistic regression allowed the data to be used as a priori power analysis. G*Power allowed the sample size to be available for the study using logistic data analysis. A small effect size of 0.5 will yield a high statistical power of 80%. The research questions' total sample size was 700. The Statistical Package for the Social Sciences (SPSS) was used to perform all data analysis calculations. For this study, I used ratio and nominal values.

Sampling Criteria

In this quantitative analysis, I analyzed secondary data from HKCS. The HKCS original data sets comprised a survey regarding questions administered to middle and high school students. The classroom setting was used to obtain data about current vaping knowledge and use among adolescents.

Setting

The setting for this project was in the state of Colorado. HKCS used the state's only comprehensive survey regarding adolescents' health and well-being (HKCS Data Request, 2020). Middle and high school administrators in schools, districts, and communities use HKCS. HKCS helps provide school administrators with how to address health-related issues among adolescents. The HKCS helps address adolescent health issues and offers additional health program funding for schools, community organizations, and local and state government agencies (HKCS Data Request, 2020).

The HKCS was designed and implemented through Public Health and Environment, Education, Colorado School of Public Health, and over 40 organizations. The HKCS is administered every other year from August through December. Principals and teachers from each middle and high school across the state of Colorado discuss the best methods to provide and oversee the usage of the HKCS and how it will be distributed and used effectively (HKCS Data Request, 2020).

Sampling Sample Selection and Recruitment Process

The HKCS was used as a two-stage stratified clustered sampling design. Stage 1 was obtained by the Colorado Department of Education, which listed public high, middle, and charter schools (HKCS Data Request, 2020). The second stage of classroom sampling was sorted by classrooms in each grade level, then alphabetically by teachers' last names, followed by a school with 10 or fewer students (HKCS Data Request, 2020).

Schools across Colorado asked 114 questions to male and female students between the ages of 11–12 in middle school and students in the ninth through 12th grade in high school who voluntarily participated in the project. Over 53,850 students were surveyed, with 47,146 high school students and 6,704 middle school students participating. One hundred ninety schools were surveyed, including 157 high schools and 33 middle schools. The HKCS was administered in 50 counties throughout Colorado in 2019 (HKCS Data Request, 2020).

Method of Collecting Data

For this study, I used secondary data from the HKCS. The HKCS was initially distributed statewide to students via SurveyMonkey, an online survey tool ("HKCS

Overview," n.d.) The administration switched from using SurveyMonkey to another online tool called Qualtrics ("HKCS Overview," n.d.). Surveys were completed during the advisory class period in the fall of 2019. The state is divided into 21 health statistics regions. Some of the areas consisted of one county and multiple school districts. Other regions had numerous counties and multiple school districts (HKCS Data, 2019).

The state officials decided on two ways for districts and schools to participate voluntarily. The first way of participation was designed as an opt-in option for schools. This design was meant for schools that wished to administer the survey but were not selected during the random sampling. The HKCS was accessible to schools, and many schools across Colorado took advantage of the survey (HKCS Data, 2019). Schools and classrooms were also selected randomly to represent the state and each of the health statistical regions. The selection process was designed to gather information equally from each area of Colorado as well as each population of students.

The principal and school coordinators provided each classroom with survey samples, distributed the survey packets to sample classrooms, and returned completed sampling packets (HKCS Data, 2019). The packets included class-level tracking forms with numbers of enrolled students, presurvey information letters for the parents, instructions regarding how the survey was administered, any conflict of interest, confidentiality agreements, and questionnaires (HKCS Data, 2019). The school staff that participated in the survey were told to sign a confidentiality agreement form, and data was collected with signed commitments that students' answers would be confidential.

The compiled HKCS data are available to the public from the Healthy Kids Colorado website. I downloaded the data sets into Microsoft Excel and put the data into SPSS. A logistic regression analysis was used to determine if there was a relationship between the amount of e-cigarette usage, the marketing exposure of e-cigarettes from social media platforms, radio stations, TV ADs, vaping products, and the access to health education prevention programs available to early, middle adolescent students in Colorado.

Measurement Instrument

HKCS uses weights to analyze unequal sampling rates and school and student nonparticipation ("HKCS Overview," n.d.). It helped weed out other discrepancies between grades, sex, and ethnicity among the overall school population. HKCS constructed a series of factors that helped weigh out other product factors, including statewide middle school data. High school data were weighed out on state and regional factors for core questions (HKCS Data, 2019).

The school selection probability helped assess the chance for a school to be selected by the HKCS statewide. The number of middle or high schools chosen was multiplied by an individual's enrollment total. The regional sampling fractions were weighted out and calculated similarly, except that the enrollment totals for individual students are regional. The number of selected schools varies slightly among regions (HKCS Data, 2019).

Weighing out the schools that did not participate was calculated by the number of schools and classroom selection. The design of this factor was based on which schools

participated in the survey (HKCS Data, 2019). Classroom nonparticipation was adjusted to account for the nonparticipation classrooms within the selected schools and calculated within the grade levels of each school (HKCS Data, 2019). The sum of enrollments for the chosen classes was multiplied by the overall enrollment for the participating classes. Teachers' tracking forms were used to obtain classroom enrollment information during the survey administration (HKCS Data, 2019). According to the original data, a total of 190 state-selected middle schools and high schools and 53,850 state-selected students were used to participate in the study. Most schools that participated in the original survey came from Adams County. Table 1 presents the sampling strategy.

Table 1

Sampling Summary, 2017 HKCS

Type of school	Sampled schools	Eligible Schools	Participating schools	School RR	Sampled students	Participating students	Student RR	Overall RR
Regional high school	196	194	157	81%	64,716	47,146	73%	59%
Middle school	42	41	33	80%	8,691	6,704	77%	62%
YRBS high school	40	40	36	90%	5,765	4,095	71%	64%
Ute tribal concentration*	6	6	6	100%	2,155	1,703	79%	79%
1,305 chronic disease grantees	12	12	12	100%	1,565	1.288	82%	82%

Note. *Some schools are also in the state sample.

Table 2 presents data regarding the response rates by each region.

Table 2

Response Rates by Region, 2017 HKCS

Region	Selected students	Completed surveys	Student R.R.	Selected schools	Participating schools	School RR	Final RR
1	1,530	1,195	78%	10	8	80%	62%
2	3,589	2,373	66%	10	9	90%	59%
3	3,989	2,841	71%	10	10	100%	71%
4	3,147	1,990	63%	10	8	80%	50%
5	673	518	77%	10	5	50%	39%
6	1,030	864	84%	10	7	70%	59%
7	2,918	2,259	77%	9	9	100%	77%
8	1,623	1,345	83%	10	10	100%	83%
9	2,334	1,851	79%	9	9	100%	79%
10	2,895	2,260	78%	10	10	100%	78%
11	1,131	835	74%	7	5	71%	53%
12	4,865	4,060	83%	10	10	100%	83%
13	1,548	1,341	87%	7	6	86%	75%
14	14,325	11,042	77%	10	8	80%	62%
15	2,031	1,609	79%	10	5	50%	40%
16	1,979	1,733	88%	10	5	50%	44%
17	579	488	84%	6	3	50%	42%
18	4,257	2,913	68%	10	8	80%	54%
19	2,718	1,413	52%	7	6	86%	45%
20	3,145	2636	84%	9	9	100%	84%
21	4,410	1,580	36%	10	7	70%	25%
Total	64,716	47,146	73%	194	157	81%	59%

Description of Variables

Independent Variables

The independent variables were marketing exposure from social media, radio, TV ADs, and vaping products. The measured level was nominal, and age and ethnicity were

available to adolescents in Colorado. The inferential analysis defined these variables, age, and race.

Dependent Variables

The dependent variable was e-cigarette usage. This nominal variable was defined in the inferential analysis.

Age. Age was a continuous variable. Respondents had the option of entering their exact age.

Ethnicity. Ethnicity was a nominal variable. Students were asked whether they were Hispanic or Latino and were requested to select not Hispanic or Latino; Mexican, Mexican American, or Chicano; other Hispanic or Latino to assess ethnicity. This variable was recoded to Hispanic or not Hispanic.

Gender. Gender was a dichotomous variable with the response option of male or female.

Race. Race was a nominal variable. To assess race, students could select one of the following categories: American Indian or Alaska Native; Asian; Black or African American; Native Hawaiian or another Pacific Islander; White; more than one race.

Data Analysis

HKCS uses data files from middle and high schools around the region and state. All the HKCS data use procedures for complex sampling designs that helped obtain unbiased estimates and error terms. SPSS, Stata, and SAS helped declare statement variables that identified clusters, weights, and primary sampling units (HKCS Data, 2019). For this quantitative study, I used secondary data sourced by HKCS to meet the

inclusion criteria through a structured questionnaire. The datasets were downloaded and analyzed using SPSS version 27.0.

I employed the following quantitative data analysis methodology (i.e., binary logistic regression, Pearson Correlation, and linear regression data analysis) to test for significant trends in the prevalence of select behaviors surveyed in 2019.

Research Question (RQ1): Is there a relationship between e-cigarette usage, marketing exposure from social media, radio stations, TV ADs, and vaping products available to adolescent-aged individuals (11–19 years) in Colorado?

Null Hypothesis (H01): There is no relationship between e-cigarette usage, marketing exposure from social media, radio stations, TV ADs, and vaping products available to adolescent-aged individuals (11–19 years) in Colorado.

Alternative Hypothesis (Ha1): There is a relationship between e-cigarette usage, marketing exposure from social media, radio stations, TV ADs, and vaping products available to adolescent-aged individuals (11–19 years) in Colorado.

Research Question (RQ2): To what extent, if any, does age (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and social media platforms) predict e-cigarette usage in Colorado?

Null Hypothesis (H03): There is no extent to which adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and social media platforms) predict e-cigarette usage in Colorado.

Alternative Hypothesis (Ha3): There is an extent to which adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and social media platforms) predict e-cigarette usage in Colorado.

Research Question (RQ3): To what extent, if any, do race/ethnicity of adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station, and social media platforms) predict e-cigarette usage in Colorado?

Null Hypothesis (H03): There is no extent to the race/ethnicity of adolescent individuals (13–19 years) and e-cigarette marketing exposure (TV ADs, radio stations, and social media platforms) to predict e-cigarette usage in Colorado.

Alternative Hypothesis (Ha3): There is an extent to which the race/ethnicity of adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio stations, and social media platforms) predict e-cigarette usage in Colorado.

Statistical Test and Results Interpretation

Linear and logistical regressions were implemented to assess possible relationships between variables. I will utilize ratio and nominal variables for each research question.

Research Question 1 Data Analysis

Pearson correlation helped determine if there was a relationship between e-cigarette usage (nominal, and marketing exposure (nominal) from social media, radio stations, TV ADs, and vaping products available to adolescent (ratio) individuals (11–19 years) in Colorado using a ratio level measurement.

Research Question 2 Data Analysis

Linear regression helped determine the level of influence, if any, that age (11–19 years; ratio) and e-cigarette marketing exposure (nominal; TV ADs, radio station ADs, and social media platforms) predict e-cigarette usage (nominal) in Colorado. Linear regression results indicated the strength of the relationship between adolescents watching an endorsed celebrity vaping on TV and mimicking those actions. The degree of measurement was ratio.

Research Question 3 Data Analysis

Logistic regression analysis helped determine the level of influence, if any, that the race/ethnicity (nominal) of adolescent individuals (13-19 years) and e-cigarette marketing exposure (nominal; TV ADs, radio stations, and social media platforms) predict e-cigarette usage (nominal) in Colorado. The level of measurement was nominal. Table 3 presents descriptions of the datasets.

Table 3

Dataset Descriptions

Name of dataset	Description	Analytic level
hkcs2017_hs_public.sasb7dat	High school data	State
Hstot_strata_public.sasb7dat	High school finite population	State
Hstot_region_public.sasb7dat	High school finite population	Region
hkcs2017_ms_public.sasb7dat	(Middle secondary school dataset) (secondary school data	State

High school variables were evaluated using a data dictionary to determine the variables' interest using both modules A and B. Module A and Module B only had corresponding weights, and the analytic variables are listed in Table 4.

Table 4

Weighting and Analytic Variables Included in HKCS Datasets

Variable	Description
Region	Colorado Health Statistics Region for regional estimates
Strata	Strata (including combined regions) for state estimates
School ID	Masked school I.D. – (typically the CLUSTER or P.S.U. variable)
FWTST	Final state weight, used for state-level analysis of high school core variables and all middle school variables
FWTSTA	Final state weight Module A, used for the state-level analysis of high school variables on Module A only
FWTSTB	Final state weight Module B, used for the state-level analysis of high school variables on Module B only
FWTRGN	Final region weight, used for regional-level analysis of high school core variables
FWTRGNA	Final region weight Module A, use for regional-level analysis of high school variables on Module A only
FWTRGNB	Final region weight Module B, use for regional-level analysis of high school variables on Module B only

The finite population correction was applied to the formula used to compute the standard error to sample the population without replacing the test sample size. The middle school sampling fraction size was 33 middle schools out of a frame of 562. The sampling for high schools was expanded due to the 21 health regions being used. See Table 5.

Table 5

Total Participation, Including Opt-In Schools

Variable	Total schools	Total students
Opt-in high school participation	63	7,680
Opt-in middle school participation	149	20,152
Total high school participation (opt-in and sampled)	236	59,625
Total middle school participation (opt-in and sampled)	182	26,856
Total middle and high school participation	418	86,481

Threats to Validity

External Validity

There were several threats to external validity in this study. The questionnaire was self-administered, and respondents may not have provided accurate, honest answers. Schools targeted for participation who declined might have threatened the study's validity, reflecting the general population. There was a possibility of social desirability bias where respondents who chose to participate may have felt the need to provide socially acceptable responses. Reassuring respondents minimized these concerns; no personal information such as respondent name, school, school district, city, or province was identified in result reports. Schools and individual school rooms were randomly selected for participation. The sample size was weighted to ensure that responses adequately represented the population's state. Concerns about the secondary use of data revolved around potential harm to individual subjects and the issue of consent. I

mitigated these concerns to protect participants' privacy and the confidentiality of the data.

Internal Validity

There was no threat to internal validity.

Construct Validity

The interpretation of the dependent variable, e-cigarette usage, was not be asked during the survey. Multiple methods of measuring e-cigarette usage, students were asked how dangerous they considered using e-cigarettes. Students then self-reported their response as very dangerous, somewhat risky, not very dangerous, or dangerous.

Ethical Consideration

Ethical issues are present in any form of research. Many of the ethical challenges faced during this study involved obtaining parental consent from parents. Some ethical considerations that came into play during this data collection were assessed for specific criteria such as accuracy, data collection period, the purpose for which it were collected, and the data's content. The dataset offered by the HKCS shall be kept for no longer than is necessary for 1 year. It must also be kept safe from unauthorized access or accidental loss; the HKCS data in the form of datasets are available for download from the Healthy Kids Colorado database. The local and state schools within Colorado ensured that parents of the adolescents asked to participate in the study gave consent while understanding the study's purpose.

Summary and Transition

Chapter 3 provided the plan and rationale for using a quantitative approach as the methodology in this research study. The research explored adolescent behaviors regarding the usage of vaping through the SLT theory. The objective was to encourage an intervention that could understand how promotion and marketing techniques used by big tobacco companies through platforms such as social media outlets and celebrity endorsements can cause adolescents to develop behavior in such a dangerous way. Vaping can cause serious health risks without the realization of adolescents knowing it. This chapter described (a) the research methodology, (b) the target population and research setting, (c) the method of collecting data, the ethical expectation that complies with the process set in place by Walden University's Institutional Review Board, and (g) a summary. Chapter 4 begins with an introduction and a brief review. The purpose and research questions will be highlighted. The study's setting, demographics, description of the number of study participants, and any factors that created difficulties in interpreting the results will be presented in the chapter.

Chapter 4: Results

Chapter 4 describes the results of this quantitative study using secondary data. The purpose of this quantitative study was to determine the possible relationship between vaping products advertised via endorsements and their use by Colorado adolescents. The risk factors of vaping among adolescents remain concentrated on the amount of exposure to TV ADs, celebrity endorsements, and social media posts regarding the popularity of vaping and using e-cigarettes. The results of this study, which used secondary data analysis, are contained in this chapter. Data were gathered from the 2019 HKCS. Three research questions guided the study:

RQ1: Is there a relationship between e-cigarette marketing exposure from social media, radio stations, TV ADs, and vaping products available to adolescent-aged individuals (11–19 years) in Colorado?

$H_0$1: There is no relationship between e-cigarette usage, marketing exposure from social media, radio stations, TV ADs, and vaping products available to adolescent-aged individuals (11–19 years) in Colorado.

H_a1: There is e-cigarette usage, marketing exposure from social media, radio stations, TV ADs, and vaping products available to adolescent-aged individuals (11–19 years) in Colorado.

RQ2: To what extent, if any, do age (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and social media platforms) predict e-cigarette usage in Colorado?

$H_0$2: There is no extent to which adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and social media platforms) predict e-cigarette usage in Colorado.

H_a2: There is an extent to which adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and social media platforms) predict e-cigarette usage in Colorado.

RQ3: To what extent, if any, do race/ethnicity of adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station, and social media platforms) predict e-cigarette usage in Colorado

$H_0$3: There is no extent to the race/ethnicity of adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio stations, and social media platforms) predict e-cigarette usage in Colorado.

H_a3: There is an extent that the race/ethnicity of adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio stations, and social media platforms) predict e-cigarette usage in Colorado.

In this chapter, I describe the data-coding and analysis process. The chapter includes sections on how I gained access to the secondary data, followed by a discussion of results, which include inferential statistics of the variables evaluated in this study. I answered RQ1 using a Pearson correlation model. I answered RQ2 using a quantitative analytic method through linear regression. For the RQ3, I answered it using a binary logistic regression model. The results of this study may provide much-needed insights into how vaping products are marketed via social media platforms such as Facebook,

Instagram, Twitter, radio broadcasting platforms, and TV platforms exposing adolescents aged 11–19 years old to e-cigarette use in the state of Colorado.

Data Access

Upon Walden University IRB approval access to the data, the HKCS secondary dataset was accessed. The dataset was downloaded from the Colorado Department of Public Health & Environment (n.d.) and analyzed in SPSS. The Walden University's IRB approval number for the study is 04-02-2021-0732088. I formatted the data to ensure consistency and participant confidentiality using codes to label respondent information as described in Chapter 3.

Study Results

HKCS uses data files from middle and high schools around the region and state. All the HKCS data use procedures for complex sampling designs that helped obtain unbiased estimates and error terms. SPSS helped identify weights and primary sampling units. I employed the following quantitative data analysis methodology: binary logistic regression, Pearson correlation, and linear regression data analysis to test for significant trends in the prevalence of select behaviors surveyed within the 2019 HKCS. Tables 6, 7, and 8 presents data regarding the age, race, and type of e-cigarette use of respondents respectively.

Table 6

Age

	Age in years	Frequency	Percentage
Valid	11	93	13.2
	12	104	14.8
	13	115	16.4
	14	120	17.1
	15	97	13.8
	16	64	9.1
	17	106	15.1
	18	2	0.3
	19	701	99.7
	Total	2	0.3
Missing total	system	703	100.0

Table 7

Race

Valid	Race	Frequency	Percent
	African American	82	11.7
	Hispanic	75	10.7
	White	372	52.9
	Asian	74	10.5
	Hawaiian	29	4.1
	American Indian	69	9.8
	Total	701	99.7
Missing	System	2	0.3
Total	703	100.0	Total

Table 8

ECig

		Frequency	Percent
Valid	JUUL	464	66.0
	BLU	109	15.5
	Vaporesso	128	18.2
	Total	701	99.7
Missing	System	2	0.3
Total		703	100.0

Tables 9–11 present data on how Ads were viewed by respondents during a 30-day period.

Table 9

Students Who Saw ADs on the Internet in the Past 30 Days

		Frequency	Percent
Valid	Facebook	280	39.8
	Instagram	298	42.4
	Twitter	123	17.5
	Total	701	99.7
Missing	System	2	0.3
Total	703	100.0	

Table 10

Students Who Saw ADs on TV in the Past 30 Days

		Frequency	Percent
Valid	yes	434	61.7
	no	267	38.0
	Total	701	99.7
Missing	System	2	.3
Total	703	100.0	

Table 11

Students Who Heard ADs on the Radio in the Past 30 Days

		Frequency	Percent
Valid	Yes	439	62.4
	No	262	37.3
	Total	701	99.7
Missing	System	2	0.3
Total	703	100.0	

In this cross-sectional study, I defined the sample size as the total number of students that participated (703), and I removed two participants for not answering the questions asked. The demographics range in ages 11–19 years old, students of African American, Asian, White, Hispanic, Hawaiian, and American Indian descent. Participants ranged from Grades six through 12. See Table 12.

Table 12

Pearson Correlations

		ECig	Age	Students who heard ADs for electronic vapor products on the radio in the past 30 days	Students who saw ADs for electronic vapor products on the Internet in the past 30 days	Students who saw ADs for electronic vapor products on TV in the past30 days
ECig	Pearson Correlation	1	.146**	.010	-.119**	-.038
	Sig. (2-tailed)		.000	.798	.002	.321
	N	701	701	701	701	701
Age	Pearson Correlation	.146**	1	-.010	-.070	.014
	Sig. (2-tailed)	.000		.783	.065	.709
	N	701	701	701	701	701
Students who heard ADs for electronic vapor products on the radio over the past 30 days	Pearson Correlation	.010	-.010	1	-.030	.080*
	Sig. (2-tailed)	.798	.783		.431	.034
	N	701	701	701	701	701
Students who saw ADs for electronic vapor products on the Internet in the past 30 days	Pearson Correlation	-.119**	-.070	-.030	1	.003
	Sig. (2-tailed)	.002	.065	.431		.932
	N	701	701	701	701	701
Students who saw ADs for electronic vapor products on TV in the past 30 days	Pearson Correlation	-.038	.014	.080*	.003	1
	Sig. (2-tailed)	.321	.709	.034	.932	
	N	701	701	701	701	701

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

A Pearson correlation was conducted to determine the relationship between e-cigarette usage, marketing exposure from social media, radio stations, TV ADs, and vaping products available to adolescent-aged individuals (11–19 years) in Colorado and answer RQ1. There was also a positive significant correlation between e-cigarette usage and age with a (r =.146, p=<.001). There was a positive correlation between e-cigarette usage and social media platforms such as (Facebook, Instagram, and Twitter; r=.119, p = .002.) There was also no correlation between TV ADs (p in.321) and radio ADs (p = .798) with e-cigarette usage in Colorado.

Linear Regression

I conducted a linear regression to determine whether age whether19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and social media platforms) predict e-cigarette usage in Colorado to answer RQ2. The results are shown in Tables 13–15.

Table 13

Linear Regression Analysis of Variance

Model		Sum of squares	*df*	Mean square	*F*	Sig.
1	Regression	14.996	4	3.749	6.273	.000[b]
	Residual	415.954	696	.598		
	Total	430.950	700			

Note. a. Dependent Variable: ECig

b. Predictors: (Constant), Age, students who heard ADs for electronic vapor products on the radio in the past 30 days, students who saw ADs for electronic vapor products on the internet in the past 30 days, students who saw ADs for electronic vapor products on TV in the past 30 days

Table 14

Linear Regression Analysis of Variance Cont.

Model		Sum of squares	*df*	Mean square	*F*	Sig.
1	Regression	14.996	4	3.749	6.273	.000[b]
	Residual	415.954	696	.598		
	Total	430.950	700			

Note. a. Dependent variable: ECig.
b. Predictors: (Constant) age, students who heard ADs for electronic vapor products on the radio in the past 30 days, students who saw ADs for electronic vapor products on the internet in the past 30 days, students who saw ADs for electronic vapor products on TV in the past 30 days.

Table 15

Coefficients

		Unstandardized coefficients		Standardized coefficients		
Model		B	Std. Error	Beta	*t*	Sig.
1	(Constant)	1.576	.152		10.379	.000
	students who heard ADs for electronic vapor products on the radio in the past 30 days	.018	.061	.0the 11	.298	.766
	students who saw ADs for electronic vapor products on the Internet in the past 30 days	-.117	.040	-.109	-2.906	.004
	students who saw ADs for electronic vapor products on TV in the past 30 days	-.065	.060	-.040	-1.072	.284
	Age	.056	.015	.139	3.725	.000

a. Dependent Variable: ECig

Linear regression was conducted to determine age (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and social media platforms) to predict e-cigarette usage in Colorado. The results from the data show that the dependent variable (e-cigarettes) and the independent variables (age, students who saw ADs for electronic

vapor products on the internet via social media in the past 30 days), were determined to have a significant value.

Analyzing the analysis of variance model, the results show that students who saw ADs for electronic vapor products on the Internet (p= .040) in the past 30 days can use e-cigarettes more due to their age (p = .004), was below the (p= .05) threshold. The model explained that 3.5% of the variance of e-cigarettes could correctly classify that 35% of cases for students who saw ADs for electronic vaping products on the Internet had a higher of being exposed to experimenting with electronic cigarettes. The odds ratio was -.109, which revealed the probability that students who saw ADs for electronic vaping products online would increase by 10.9%. There was also no relationship between the amount of marketing exposure to e-cigarettes and e-cigarette usage, with ADs being heard on the radio (p =.766) among students aged 11–19 in Colorado. No significant relationship existed between the number of TV ADs (p= .06) shown for e-cigs and e-cigarette usage and the number of students aged 11–19 in Colorado.

RQ3: To what extent, if any, do race/ethnicity of adolescent individuals (11–19 years) and e-cigarette marketing exposure (TV ADs, radio stations, and social media platforms) predict e-cigarette usage in Colorado?

Logistic regression was conducted to assess the relationship between race/ethnicity, e-cigarette marketing exposure, and e-cigarette usage. The results show that race with a (p=.013) and e-cigarette usage are significant in determining if students will use e-cigarettes in the future. The model (see Table 16) explained 15% (Nagelkerke R Square) of the variance of e-cigarettes and correctly classified 76.3% of the cases (see

Table 17). The odds ratio is 1.181, which tells us that the probability that students will use e-cigarettes in the future based on ethnicity, as they are exposed to marketing ADs for e-cigarettes, increases by 18.1%. The results (see Table 18) also show that there was no significance in determining if students will use e-cigarettes due to ADs exposed on social media platforms such as Facebook, Instagram, and Twitter (p=.545) exposure to ADs seen on TV (p=.865) or exposure to ADs heard on the radio (p=.766).

Table 16

Model Summary

Step	-2 log-likelihood	Cox & Snell R square	Nagelkerke R square
1	760.614[a]	.010	.015

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 17

Classification Table

			Predicted		
			JUUL, Blu, Vaporesso		Percentage
	Observed		yes	no	correct
Step 1	JUUL, Blu, Vaporesso	yes	535	0	100.0
		no	166	0	.0
	Overall percentage				76.3

a. The cut value is .500

Table 18

Variables in the Equation

							95% CI for EXP(B)	
		B	*SE*	Wald	*df*	Sig.	Exp(B)	Lower	Upper
	Race	.167	.067	6.238	1	.013	1.181	1.037	1.347
Step 1a	Students who heard ADs for electronic vapor products on the radio in the past 30 days	-.055	.186	.088	1	.766	.946	.657	1.362
	Students who saw ADs for electronic vapor products on the internet in the past 30 days	-.075	.124	.367	1	.545	.927	.727	1.184
	Students who saw ADs for electronic vapor products on TV in the past 30 days	-.031	.185	.029	1	.865	.969	.674	1.392
	Constant	1.455	.476	9.337	1	.002	.234		

Note. a. Variable(s) entered on step 1: Race, students who heard ADs for electronic vapor products on the radio in the past 30 days, students who saw ADs for electronic vapor products on the internet in the past 30 days, students who saw ADs for electronic vapor products on TV in the past 30 days.

Summary

In this chapter, I reported the results of the study. I presented the results in tables while also describing them in the results. I investigated how e-cigarette marketing exposure predicts the exposure of students aged 11–19 years old being willing to vape more. I also examined the relationship between race and age in comparison to e-cigarette usage. In Chapter 5, I will discuss the results and compare them to the literature in greater detail. Chapter 5 will include a discussion of the study of limitations, the study of implications, the recommendation for future studies, and the study's conclusion.

Chapter 5: Discussion, Conclusions, and Recommendations

This research study was driven by the need to investigate the effect of exposure to e-cigarette marketing on adolescents aged 11–19 years old in Colorado. The limited research available has shown that the marketing of e-cigarettes among adolescents has caused Colorado to be in an epidemic crisis (Vogel et al., 2020). Adolescents aged 11–19 years old are prone to experience higher rates of illness, including respiratory diseases, hospitalizations, and extended hospital stays, among other stressors that affect their health and well-being (Vogel et al., 2020).

I used a data set from the HKCS, a study that represented 703 students from both middle and high schools in Colorado. I collected data from the state of Colorado's website and placed the data into SPSS for data analysis. In this study, I used Pearson correlation statistics to determine the relationship between e-cigarette usage, marketing exposure from social media, radio stations, TV ADs, and vaping products available to adolescent-aged individuals (11–19 years) in Colorado. Additionally, I used a linear regression model to determine to what extent, if any, age (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and social media platforms) predict e-cigarette usage in Colorado. Lastly, I conducted a logistics regression to test whether the race/ethnicity of adolescent individuals (11–19 years) e-cigarette marketing exposure (TV ADs, radio stations, and social media platforms) predict e-cigarette usage in Colorado.

Interpretation of Findings

The study's first purpose was to investigate the relationship between e-cigarette usage, marketing exposure from social media, radio stations, TV ADs, vaping products, and access to health education/prevention programs available to adolescent-aged individuals (11–19 years) in Colorado. Based on the survey of 701 students, it was found that more adolescents began vaping after being exposed to e-cigarette marketing ADs on social media platforms such as Facebook, Instagram, and Twitter.

A Pearson correlation was conducted to determine the relationship between e-cigarette use, marketing exposure from social media, radio stations, TV ADs, and vaping products available to teenagers aged 11–19 in Colorado. There was a correlation between e-cigarette usage and age. There was a strong positive correlation between e-cigarette usage and social media platforms such as Facebook, Instagram, and Twitter (Vogel et al. 2020) stated that even a very short viewing of Instagram posts affected teens. More significant usage of social media by an adolescent resulted in greater exposure to e-cigarette advertising and a more positive attitude toward the use of e-cigarettes. Adolescents have heavy exposure to e-cigarettes while having a lower perceived danger of the harmful use of e-cigarettes (Vogel et al., 2020). I found no relationship between TV or radio ADs about e-cigarette usage in Colorado and adolescent use. Greater social media use and heavier exposure to advertising and e-cigarette content in social media posts are associated with a higher risk of e-cigarette use among teenagers.

Linear regression was conducted to answer the RQ2, which examined whether age (11–19 years) and e-cigarette marketing exposure (TV ADs, radio station ADs, and

social media platforms) predict e-cigarette usage in Colorado. In the linear regression results, I found that students who saw ADs for electronic vapor products on the Internet in the past 30 days were more likely to vape e-cigarettes based on their age. Students between the ages of 11–19 saw more ADs about e-cigarette products JUUL, Blu, and Vaporesso more times on social media platforms such as Facebook, Instagram, and Twitter. These findings describe the finding that social media advertisements for e-cigarettes persuaded adolescent students to try e-cigarettes more due to celebrity endorsements implying e-cigarette use is safe for students.

Seven in 10 adolescents are exposed to e-cigarette advertising (Wood & Allan, 2021). Celebrity endorsers often use their unique and distinct personalities to endorse brands, influencing attitudes and the perception that certain traits and things are cool (Wood & Allan, 2021). Bandura (1973) noted that individuals learn through observations of others around them, whether cognitive, environmental, or behavioral. Compared to my study, Wood and Allen (2021) conducted a quantitative study involving 414 undergraduate students from a U.S. university. The study results showed that celebrities who endorse e-cigarette brands have a substantial effect on the attitudes and behaviors of adolescents and young adults.

Celebrity endorsers significantly increased favorable attitudes and behaviors mimicked by adolescents towards e-cigarettes and smoking intentions than non-celebrities or products only (Wood & Allan, 2021). Celebrity endorsers are highly looked upon, which creates higher trustworthiness, expertise, goodwill, and attractiveness towards adolescents willing to mimic celebrity behavior to wanting to vape than non-

celebrities like an adolescent's parents or teacher (Wood & Allan, 2021). Celebrity endorsers significantly increased adolescents' favorable attitudes, allowing them to mimic others' actions towards e-cigarettes and the smoking intentions of their favorite celebrities.

Identification, social comparison, and health consciousness were key dependent measures used by social networking sites to influence the use of e-cigarettes among adolescents (Wood & Allan, 2021). In contrast to my study, these findings also showed a relationship surrounding the amount of marketing exposure of radio ADs for e-cigarettes by students aged 11–19 in Colorado. There was no relationship surrounding the number of TV ADs shown for e-cigarette usage towards students ages 11–19 years old in Colorado.

Logistic regression was carried out to answer RQ3. The findings showed that race and e-cigarette usage play a factor in determining if students will use e-cigarettes in the future. Among the Hispanic community, vape shops are more likely to have ethnic-specific marketing material for adolescents in comparison to other ethnic communities (Garcia et al., 2016). Garcia et al. (2016) noted that all the shops in their study provided customers with free samples; adolescents in Asian, non-Hispanic White, and African American communities had higher exposure to free sample tries of vaping products compared to Caucasian communities. The results also showed no relationship in determining if students will use e-cigarettes due to ADs on social media platforms such as Facebook, Instagram, and Twitter, exposure to ADs seen on TV, or exposure to ADs heard on the radio.

Limitations of the Study

I observed limitations in my study, which may have affected the investigation's results. The first limitation of the study was using a cross-sectional study design. The second limitation of the study was the use of the sample. In this study, I estimated a sample size of 703 students. However, since the secondary data were captured from the HKCS, the limited geographical distribution in the selected survey for middle and high school caused students to affect the results adversely.

Additionally, attitude changes over time helped guide the influence needed for adolescents to experiment with vaping. The data on the long-term health effects of e-cigarettes for adolescents and young adult users are minimal, owing to the limited time frame these devices have been on the market (Auf, 2017). Potential long-term effects may include cancers, nicotine dependence, and chronic lung conditions (Auf, 2017). The neoplastic risk may be associated with any of the components of e-cigarettes (i.e., nicotine, carrier agents, or flavorings). Nicotine exposure is not necessarily associated with tumor development, but it has been shown to promote tumor growth and metastasis (Auf, 2017). Long-term use of e-cigarettes might increase the risk of malignancy among users with an underlying predisposition for tumor development or those who also smoke conventional cigarettes.

Secondary data and categorization of the exposure to marketing e-cigarettes among adolescents aged 11–19 years old who saw ADs on TV and social media platforms and adolescents who heard about e-cigarettes on the radio limit the generalization of the study findings to adolescents because the study was limited as to

what time students saw the ADs. For example, the research is limited to not knowing what time students heard radio advertisements regarding e-cigarette advertisements and what e-cigarette advertisements' time frame slots showed when students were watching TV.

Recommendations

As an emerging inhalational exposure, e-cigarettes have rapidly gained public awareness, increasing use among adolescents and adults, leading to increased primary use by adolescents. This implies the potential for long-term lung injury and altered neurocognitive development in children with nicotine-containing aerosols. Adolescent users of e-cigarettes may be more likely to use other substances, including marijuana, blunts, hookahs, and alcohol, but these associations may not always be consistent in different populations. Health risks such as chronic bronchitis symptoms (i.e., chronic cough, phlegm, or bronchitis) are reported to be twice as common among teenage e-cigarette users as ever users (Auf, 2017).

In addition, e-cigarette use among adolescents may be associated with an increased prevalence of physician-diagnosed asthma and school absences secondary to asthma symptoms, even after adjusting for conventional cigarette use (Pu & Zhang, 2017). Self-reported oral symptoms such as cracked/broken teeth, tongue/cheek pain, and broken mandibles have been reported among adolescents aged 11–18 years old with daily usage of e-cigarettes, along with mental illness development including hallucinations, adolescents hearing voices, manic episodes, and neurological brain disorders (Pu & Zhang, 2017).

The exposure of e-cigarette marketing remains an understudied topic in the United States. Previous researchers found, in comparison to what I have seen, that it is evident that there is a need to explore the issue in the future (Pu & Zhang, 2017).

Exploration of this study further helps to identify more predictors of how marketing exposure of e-cigarettes among adolescents who are exposed via radio ADs, TV ADs, and social media platforms causes more health risks to adolescents. I believe that it would be necessary to explore more studies on how the relationships of celebrity endorsements of tobacco products such as vaping have such an influence on adolescents who stay in the hospital with severe health risks (see Pu & Zhang, 2017). More quantitative and qualitative research is needed to understand the differences and similarities of how e-cigarette marketing exposure is putting adolescent's health at risk.

Additionally, I recommend future primary research on youth engagement in other known e-cigarette use behaviors that lead to greater exposure. For example, naive and experienced users may have different systemic directions due to inhalation and exhalation patterns. Further research is needed to determine the scope of health effects associated with primary and secondhand e-cigarette exposure. Finally, public policy organizations and legislators have taken steps to restrict sales to youth younger than 18 and smaller steps to limit children's exposure to secondhand emissions in the general area.

Implications

Adolescents who use social media intensely may be at a higher risk for e-cigarette use. Even brief exposure to e-cigarette content on social media was associated with greater intention to use and more positive attitudes toward e-cigarettes. Regulatory

measures should be taken to ban promoted e-cigarette content on social media used by young people, including posts by influence-peddling who appeal to young people. In 2019, 2.4 million middle and high school students aged 11–18 years old in the United States admitted to administrators using e-cigarettes seven times or more within a month time. Health professionals know that e-cigarettes contain nicotine, which causes addiction. Some of the more harmful effects of vaping e-cigarettes are harmful to brain development, underlying mental illness, severe respiratory illness, and death (Dai & Hao, 2016). The average spending on advertisements alone on e-cigarettes enhanced the curiosity of adolescents about using them. Since 2011, $6.5 billion has been spent on e-cigarette advertisements. Eighty-four percent of middle and high school students aged 11–18 years old were exposed to e-cigarette advertisements in retail stores, saw ADs on the TV, saw ADs on the Internet, in newspapers/magazines, and movies in 2016. In 2019, the percentage of middle and high school students aged 11–18 exposed to e-cigarette advertisements reached 92% (Dai & Hao, 2016). Efforts by state legislators and community leaders could help reduce this exposure by taking a stand against tobacco companies and their marketing tactics toward adolescents.

Social Change

While there are numerous ways to implement social change in the state of Colorado, one of the most meaningful ways to implement social change for adolescents who are suffering from vaping would be to implement interventions. Protesting the dangers of vaping helps spread the word to adolescents; however, the state of Colorado needs laws to protect adolescents from tobacco companies and their marketing agencies.

Colorado currently has the Children and Youth Mental Treatment Act, also known as House Bill 18-1094 (Davis, n.d.). This bill focuses on adolescents' mental health.

Colorado lawmakers are working on a bill known as House Bill 22-1064. This bill would ban the sale of all flavored tobacco and nicotine products starting July 1st, 2022. It includes vapes, e-cigarettes, menthol cigarettes, hookah, chewing tobacco, and cigars for adolescents. Bringing awareness of the dangers of vaping through lawmakers making new laws would cut down the sales of vaping among adolescents in the state.

Creating mandatory intervention programs as part of a graduation curriculum in middle and high schools across the state of Colorado would allow all adolescents to take a drug prevention course. By making it a graduation requirement, all students would need to pass it to graduate. Doing this allows the information to be brought to light that marketing agencies target youth for profit gain (Davis, n.d.).

Lastly, as parents, teachers, and adults, effort must be executed to make time for children. It takes a village to raise children and protect them. I never understood that statement as a kid until now as an adult. I teach, and I had a few incidents in the classroom where I caught my sixth graders vaping when I was not looking. I stopped my math lesson, walked up to the children, and took their vape pens. Even at that moment, as a teaching professional, I had to remember these are just children; they pick up on things they see and think are cool. I took the last 30 minutes to have an intense conversation about what vaping does to the mind and the body. At that moment, I was not just a math teacher but a parent talking to children and gave them an important life lesson. I called

the parents and made the school aware of the situation, and those kids got in trouble. Getting the adults involved to help bring awareness is critical.

Adults can all create a positive environment for our adolescents. Adults can be the world they need, so being involved in their daily lives and taking the extra time to spend with adolescents can go a long way in creating positive, safe social changes and social environments for the growth and development of adolescents. Adults must be the change that the children want to see.

Conclusion

E-cigarette marketing advertisement tactics have caused a massive epidemic in the state of Colorado. Colorado adolescents aged 11–18 years old are pruned to vaping frequently (Navarro, 2020). According to Attorney General Phil Weiser, adolescents are three times more likely to vape in school classrooms. Weiser stated in a news conference that "Addiction to e-cigarettes poses major health risks to Colorado youth" (Navarro, 2020 pg 5).

Alerting as it seems, the attorney general and other lawmakers across the state are suing one of the biggest brands that cause such an epidemic in Colorado. Alongside the attorney general, the City and County of Denver filed a 207-page lawsuit in U.S. district court stating that the manufacturers of e-cigarette and vaping products seeking damages and relief, including abatement of the public health crisis caused by their wrongful, deceptive conduct (Navarro, 2020). Data show Colorado leads the nation in youth vaping. In 2013, only 11% of high school students in the Denver area *had ever tried e-cigarettes.

By 2017, that number had jumped to 85% of high school and middle school students (“Denver Sues E-cig Companies,” n.d.).

In understanding the lawsuits filed among the state against vaping companies like JUUL, Bandura’s (1973) SLT helps officials understand how adolescents who vape in the first 30 days of trying vaping experience several behavioral changes, especially among Gen Z adolescents (Holmes et al., 2022). Much like an adolescent who becomes addicted to their screen time on their phone, when an adolescent loses a vape pen, adolescents often become irate until it is back in their possession. For reasons like these, states started filing lawsuits against companies that manufacture vaping products. Not only does this want to shed light on the dangers that marketing vaping products had on adolescents aged 11–19 years, but the lawsuit also sheds light on what vaping has caused to adolescents’ mental and behavioral health (Holmes et al., 2022).

According to Dr. Heather De Keyser, the children’s hospital continues to see an increase among adolescents who started vaping in the pandemic, which simply cannot stop vaping, causing many adolescents to have mental health crises now (Holmes et al., 2022). According to Holmes et al. (2022), 49.9% of Colorado middle school students continued vaping in 2024. Another 22.3% of those students tried vaping before they were 15 years old during the pandemic (Holmes et al., 2022). Due to the addictiveness of vaping, many students in middle and high school reported experiencing suicide, bullying, depression, and anxiety (Holmes et al., 2022). Three hundred eighty students experienced suicide; another 322 students experienced bullying (Holmes et al., 2022).

To help reduce the number of youth from continuing to vape, Colorado's Law Department of Education, alongside the Attorney General's Office, won a $31.7 million settlement after the courts determined that the e-cigarette manufacturer JUUL Labs had targeted adolescents in the marketing misrepresentation of the health risk that their products have to offer (Willard, 2024). In 2021, 49.9% of middle and high school adolescents stated that they have vaped, with another 22.3% saying that they started vaping before the age of 13 years old (Willard, 2024). Among counties like Clear Creek, Gilpin, and Teller, those numbers increased to 69.8% of middle and high school adolescents who have stated that they started vaping before the age of 13 years of age (Willard, 2024).

Due to the number of cases among adolescents who vape also experiencing mental health crisis increasing, the State of Colorado decided to use $11.4 million of the $31.7 million to start a grant program used across the state of Colorado to help develop programs within the state to combat youth vaping, the addiction to vaping, a behavioral health crisis that youth aged 11–19 face ("Colorado Is Allocating $11.4M to Combat Youth Vaping Crisis," 2024). The Vaping Prevention Grant program will help more schools address the dangers of vaping through strategic educational practices and treatment programs that include mental and behavioral services starting in the school year of 2024–2025 for school groups K-12 and will continue the intervention program in helping bring awareness to the dangers of vaping among adolescence in Colorado.

The purpose of this study was to examine the role of marketing and promoting e-cigarette products among adolescents aged 11–19, which had a significant influence on

adolescents' choice of vaping. Adolescents mimicked celebrities who tried the product, realizing that vaping was the new popular thing to do in society without realizing the harmful effects vaping caused on adolescent's health. Big tobacco companies such as JUUL used marketing loopholes through advertisement agencies to help influence adolescents' decisions by pushing more ADs to talk about their product. The more vaping ADs were seen on social media platforms such as Facebook, Twitter, and Instagram, the more adolescents were exposed to the content. The more vaping ADs were shown on TV and heard on the radio, the more adolescents became influenced to try the product ("Denver Sues E-cig Companies," n.d.).

Key findings were identified in the study, including opportunities to increase vaping awareness activities among adolescents. Based on findings in the study, recommendations were made to address prevention programs in the state of Colorado to help adolescents, including providing mental health assessments and treatment programs for adolescents that will help adolescents understand the health risks that vaping causes mentally and physically on the mind and the body.

Marketing and advertisement tactics have been around since the first cigarette was introduced. However, marketing agencies are hired by big tobacco companies as a resort to make their product popular at any cost to boost sales. Many around the world are not shown the effects of what harmful products can do to adolescents. My mission and vision are to illuminate how marketing and advertisement ADs are just as responsible for the health risks of adolescents at popular brands e-cigarette brands such as JUUL are responsible for.

References

Alzahrani, T., Pena, I., Temesgen, N., & Glantz, S. A. (2018). Association between electronic cigarette use and myocardial infarction. *American Journal of Preventive Medicine*, *55*(4), 455–461. https://doi.org/10.1016/j.amepre.2018.05.004

Auf, R. (2017). *Risk associated with e-cigarette use and marketing messages on other tobacco product and dependence symptoms among adolescents* [Doctoral dissertation, Florida International University]. FIU Electronic Theses and Dissertations. https://doi.org/10.25148/etd.fidc004022

Balingit, M. (2019, October 15). *More than 150 teens have fallen ill from vaping. Is it enough to make their peers stop?* The Washington Post. https://www.washingtonpost.com/local/education/more-than-150-teens-have-fallen-ill-from-vaping-is-it-enough-to-make-their-peers-stop/2019/10/14/a79b158e-e47b-11e9-a6e8-8759c5c7f608_story.html

Bandura, A. (1973). *Social learning theory*. General Learning Press.

Barnhart, B. (2019, August 13). *How to rise above social media algorithms*. Sprout Social. https://sproutsocial.com/insights/social-media-algorithms/

Barrington-Trimis, J. L., & Leventhal, A. M. (2018). Adolescents' use of "pod mod" e-cigarettes — Urgent concerns. *New England Journal of Medicine*, *379*(12), 1099–1102. https://doi.org/10.1056/nejmp1805758

Boykan, R., Goniewicz, M. L., & Messina, C. R. (2019). Evidence of nicotine dependence in adolescents who use Juul and similar pod devices. *International*

Journal of Environmental Research and Public Health, *16*(12), Article 2135. https://doi.org/10.3390/ijerph16122135

Buckell, J., & Sindelar, J. L. (2019). The impact of flavors, health risks, secondhand smoke and prices on young adults' cigarette and e-cigarette choices: A discrete choice experiment. *Addiction*, *114*(8), 1427–1435. https://doi.org/10.1111/add.14610

Centers for Disease Control and Prevention. (2020a). *Data and statistics*. https://www.cdc.gov/tobacco/data_statistics/index.htm

Centers for Disease Control and Prevention. (2020b). *Fast facts*. https://www.cdc.gov/tobacco/data_statistics/fact_sheets/fast_facts/index.htm

Centers for Disease Control and Prevention. (2020c). *Outbreak of lung injury associated with the use of e-cigarette, or vaping, products.* https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html

Centers for Disease Control and Prevention. (2021, October 29). *Health effects of cigarette smoking*. https://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/index.htm#:~:text=1%2C2-,Smoking%20and%20Death,death%20in%20the%20United%20States.&text=Cigarette%20smoking%20causes%20more%20than,nearly%20one%20in%20five%20deaths

Chadi, N., Vyver, E., & Belanger, R. E. (2021). Protecting children and adolescents

against the risks of vaping. *Paediatrics & Child Health*, *26*(6), 358–365. https://doi.org/10.1093/pch/pxab037

Chaffee, B. W., Couch, E. T., & Gansky, S. A. (2017). Trends in characteristics and multi-product use among adolescents who use electronic cigarettes, United States 2011-2015. *Plos One*, *12*(5), Article e0177073. https://doi.org/10.1371/journal.pone.0177073

Chu, K.-H., Colditz, J. B., Primack, B. A., Shensa, A., Allem, J.-P., Miller, E., Unger, J. B., & Cruz, T. (2018). Juul: Spreading online and offline. *Journal of Adolescent Health*, *63*(5), 582–586. https://doi.org/10.1016/j.jadohealth.2018.08.002

Colorado Department of Public Health & Environment. (n.d.). *Home*. https://cdphe.colorado.gov/

Cooper, M., Harrell, M. B., Pérez, A., Delk, J., & Perry, C. L. (2016). Flavorings and perceived harm and addictiveness of e-cigarettes among youth. *Tobacco Regulatory Science*, *2*(3), 278–289. https://doi.org/10.18001/trs.2.3.7

Crawford, C. (2018, August 6). Rise of 'juuling' among youth sparks sharp response. *American Academy of Family Physicians.* https://www.aafp.org/news/health-of-the-public/20180806juul.html

Dai, H., & Hao, J. (2016). Exposure to advertisements and susceptibility to electronic cigarette use among youth. *Journal of Adolescent Health*, *59*(6), 620–626. https://doi.org/10.1016/j.jadohealth.2016.06.013

Denver sues e-cig companies as Colorado leads nation in vaping epidemic among youth.

(2020, April 2). City and County of Denver. https://www.denvergov.org/content/denvergov/en/city-attorneys-office/news/2020/denver-sues-e-cig-companies-as-colorado-leADs-nation-in-vaping-e.html

Dinardo, P., & Rome, E. S. (2019). Vaping: The new wave of nicotine addiction. *Cleveland Clinic Journal of Medicine*, *86*(12), 789–798. https://doi.org/10.3949/ccjm.86a.19118

Douglass, B. L., & Solecki, S. (2017). Teen vaping: time to clear the air. *Contemporary Pediatrics*, *34*(8), Article 24. https://www.contemporarypediatrics.com/view/teen-vaping-time-clear-air

East, K., Hitchman, S. C., Bakolis, I., Williams, S., Cheeseman, H., Arnott, D., & McNeill, A. (2018). The association between smoking and electronic cigarette use in a cohort of young people. *Journal of Adolescent Health*, *62*(5), 539–547. https://doi.org/10.1016/j.jadohealth.2017.11.301

Farzal, Z., Perry, M. F., Yarbrough, W. G., & Kimple, A. J. (2019). The adolescent vaping epidemic in the United States—how it happened and where we go from here. *JAMA Otolaryngology–Head & Neck Surgery*, *145*(10), Article 885. https://doi.org/10.1001/jamaoto.2019.2410

4 marketing tactics e-cigarette companies use to target youth. (2018, August 9). Truth Initiative. https://truthinitiative.org/research-resources/tobacco-industry-marketing/4-marketing-tactics-e-cigarette-companies-use-target

Fraga, J.-A., & National Center for Health Research. (n.d.). *The dangers of juuling.*

National Center for Health Research. https://www.center4research.org/the-dangers-of-juuling/

García, R., Sidhu, A., Allem, J. P., Baezconde-Garbanati, L., Unger, J. B., & Sussman, S. (2016). Marketing activities of vape shops across racial/ethnic communities. *Tobacco Prevention & Cessation*, *2*(Suppl), Article 12. https://doi.org/10.18332/tpc/76398

Gibson-Young, L., & Martinasek, M. (2018). JUULING: What kids don't know will hurt them. *Contemporary Pediatrics Journal*, *35*(6). https://www.contemporarypediatrics.com/view/juuling-what-kids-dont-know-will-hurt-them

Golan, R., Muthigi, A., Ghomeshi, A., White, J., Saltzman, R. G., Diaz, P., & Ramasamy, R. (2023). Misconceptions of vaping among young adults. *Cureus*, *15*(4), Article e38202. https://doi.org/10.7759/cureus.38202

Goldenson, N. I., Leventhal, A. M., Stone, M. D., McConnell, R. S., & Barrington-Trimis, J. L. (2017). Associations of electronic cigarette nicotine concentration with subsequent cigarette smoking and vaping levels in adolescents. *JAMA Pediatrics*, *171*(12), 1192–1199. https://doi.org/10.1001/jamapediatrics.2017.3209

Heydari, G., Ahmady, A., Chamyani, F., Masjedi, M., & Fadaizadeh, L. (2017). Electronic cigarette, effective or harmful for quitting smoking and respiratory health: A quantitative review papers. *Lung India*, *34*(1), 25–28. https://doi.org/10.4103/0970-2113.197119

Jenco, M. (2019, August 26). *Study: Teens more likely to vape after seeing store ADs*. American Academy of Pediatrics. https://www.aappublications.org/news/2019/08/26/ecigarettemarketing082619

Jenssen, B. P., & Boykan, R. (2019). Electronic cigarettes and youth in the United States: A call to action (at the local, national and global levels). *Children*, *6*(2), Article 30. https://doi.org/10.3390/children6020030

Jeong, M. (2018). Sharing tobacco and e-cigarette information: Predicting its occurrence and valence among youth and young adults. *Health Communication*, *33*(9), 1114–1123. https://doi.org/10.1080/10410236.2017.1331310

Jones, K., & Salzman, G. A. (2020). The vaping epidemic in adolescents. *Missouri Medicine*, *117*(1), 56–58. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7023954/

Kanyadan, V., & Ganti, L. (2019). E-cigarette awareness among young adults: A pilot survey study. *Cureus*, *11*(7), Article e5234. https://doi.org/10.7759/cureus.5234

King, B. A., Gammon, D. G., Marynak, K. L., & Rogers, T. (2018). Electronic cigarette sales in the United States, 2013-2017. *JAMA*, *320*(13), 1379–1380. https://doi.org/10.1001/jama.2018.10488

Lichtenberg, K. (2017). E-cigarettes: Current evidence and policy. *Missouri Medicine*, *114*(5), 335–338. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6140188/

McLeod, S. (2016). *Albert Bandura's social learning theory*. SimplyPsychology. https://www.simplypsychology.org/bandura.html

Navarro, N. V. (2020, July 7). *Colorado sues JUUL, says the E-cigarette company*

targeted children. Colorado Public Radio. https://www.cpr.org/2020/07/07/colorado-sues-juul-says-the-e-cigarette-company-targeted-children/

Pepper, J. K., Farrelly, M. C., & Watson, K. A. (2018). Adolescents' understanding and use of nicotine in e-cigarettes. *Addictive Behaviors*, *82*, 109–113. https://doi.org/10.1016/j.addbeh.2018.02.015

Phua, J., Jin, S. V., & Hahm, J. M. (2018). Celebrity-endorsed e-cigarette brand Instagram advertisements: Effects on young adults' attitudes towards e-cigarettes and smoking intentions. *Journal of Health Psychology*, *23*(4), 550–560. https://doi.org/10.1016/j.bpsc.2019.01.003

Prokhorov, A. V., Khalil, G. E., Foster, D. W., Marani, S. K., Guindani, M., Espada, J. P., Gonzálvez, M. T., Idrisov, B., Galimov, A., Arora, M., Tewari, A., Isralowitz, R., Lapvongwatana, P., Chansatitporn, N., Chen, X., Zheng, H., & Sussman, S. (2017). Testing the nicotine dependence measure mftq for adolescent smokers: A multinational investigation. *American Journal on Addictions*, *26*(7), 689–696. https://doi.org/10.1111/ajad.12583

Public Health Institute. (n.d.). *Teen vaping in denver.* Denver Public Helath. http://www.denverpublichealth.org/community-health-promotion/tobacco-prevention-education/ecigarette-facts/teen-vaping

Rapaport, L. (2019, August 13). *Teen vaping tied to marijuana use*. Reuters. https://www.reuters.com/article/business/healthcare-pharmaceuticals/teen-vaping-

tied-to-marijuana-use-idUSKCN1V324S/

Sanginiti, D. (2020). JUUL's efforts to recruit influencers. National Law Review, 29(189). https://natlawreview.com/article/juul-s-efforts-to-recruit-influencers

State of Delaware. (n.d.). *DE outbreak of lung injury associated with e-cigarette use, or vaping*. Delaware Health and Social Services. https://www.dhss.delaware.gov/dph/lunginjury.html#:~:text=16%25%20reported%20acquiring%20products%20only,online%2C%20or%20other%20sources).

Stewart, J. L. (2019). A computational modeling approach supports negative reinforcement theories of addiction. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, *4*(3), 218–219. https://doi.org/10.1016/j.bpsc.2019.01.003

Tsai, M., Byun, M. K., Shin, J., & Crotty Alexander, L. E. (2020). Effects of e-cigarettes and vaping devices on cardiac and pulmonary physiology. *The Journal of Physiology*, *598*(22), 5039–5062. https://doi.org/10.1113/JP279754

Urban Dictionary. (n.d.). *Juul*. https://www.urbandictionary.com/define.php?term=Juul

U.S. Food & Drug Administration. (n.d.). *Youth and tobacco*. http://www.fda.gov/tobacco-products/public-health-education/youth-and-tobacco

U.S. Department of Health and Human Services. (2016). *E-cigarette use among youth and young adults: A report of the surgeon general*. https://e-cigarettes.surgeongeneral.gov/documents/2016_SGR_Full_Report_non-508.pdf

U.S. Department of Health and Human Services. (2020, January). *Vaping devices (electronic cigarettes) drugfacts*. National Institutes of Health.

https://nida.nih.gov/publications/drugfacts/vaping-devices-electronic-cigarettes#:~:text=The%20nicotine%20in%20e%2Dliquids,the%20hormone%20epinephrine%20(adrenaline).

Vogel, E. A., Ramo, D. E., Rubinstein, M. L., Delucchi, K. L., Darrow, S. M., Costello, C., & Prochaska, J. J. (2020). Effects of social media on adolescents' willingness and intention to use e-cigarettes: An experimental investigation. *Nicotine & Tobacco Research*, *23*(4), 694-701. https://doi.org/10.1093/ntr/ntaa003

Willard, H. (2024, March 27). *Colorado is allocating $11.4m to combat youth vaping crisis*. FOX31 Denver. https://kdvr.com/news/local/colorado-is-allocating-11-4m-to-combat-youth-vaping-crisis/

Wood, N., & Allan, D. (2021). #Nico-teens: JUUL, social media, and the teen vaping epidemic. *SAGE Business Cases.* https://doi.org/10.4135/9781529753288

Appendix: Interview Questionnaire

DEMOGRAPHICS

1. **What do you consider your gender to be?**

    - Male
    - Female

2. **What is your race/ethnicity?**

    - Caucasian/White
    - Black or African American
    - Native Hawaiian or Pacific Islander
    - Hispanic
    - Asian
    - American Indian

3. **What age did you first start vaping?**

    - 11 years old
    - 12 years old
    - 13 years old
    - 14 years old
    - 15 years old
    - 16 years old
    - 17 years old
    - 18 years old
    - 19 years old

4. **Have you ever vaped before?**

    - Yes
    - No

5. **What grade did you first start vaping?**

    - 6^{th} grade
    - 7^{th} grade
    - 8^{th} grade
    - 9^{th} grade
    - 10^{th} grade
    - 11^{th} grade

- 12th grade

6. ***Have you been exposed to electronic vaping marketing ADs on social media platforms such as Facebook, Instagram, or Twitter in the last 30 days?***

    - Yes
    - No

7. ***Have you been exposed to electronic vaping marketing ADs while listening to the radio in the past 30 days?***

    - Yes
    - No

8. ***Have you been exposed to electronic vaping marketing ADs on television in the past 30 days?***

    - Yes
    - No