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Accessibility to Vaping Products, Vaping, and Use of Cigarettes Among Adolescents

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Abstract

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MSc, Walden University, 2018

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

There has been a continuous increase in the use of e-cigarettes among adolescents. The growth threatens to nullify the years of successfully reducing cigarette smoking among this age demographic. Additionally, the increase has been a concern for public healthcare workers due to the limited research on the effects of long-term use of e-cigarettes on adolescents. I investigated the possible side effects of exposure to e-cigarette advertisements and the use of e-cigarettes. Additionally, the study reviewed the relationship between the age e-cigarette use was initiated and the subsequent use of cigarettes. The conceptual framework was based on the multi-theory model and Bandura's cognitive theory. Data were taken from the 2020 National Youth Tobacco Survey. There were 24,544 students who participated in the survey across 254 schools from around the country. The secondary analysis of the Centers for Disease Control and Prevention National Youth Tobacco Survey dataset was done using binomial and ordinal regression. Ordinal regression analysis revealed an association between the age of e-cigarette initiation and the use of cigarettes, while the analysis revealed no association between the extent of access to vaping products and the frequency of use of e-cigarettes. Additionally, the application of binary logistic regression to the predictor variable (extent of exposure to e-cigarettes ads) and the outcome variable (use of e-cigarettes) showed a significant association between these variables. The findings contribute to the understanding of the accessibility of adolescents to e-cigarettes and how it influences the use of other cigarettes.

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Dedication

This paper is dedicated to my Lord and Savior, Jesus Christ. It is also dedicated to my village; Sunday, Florence, Simisola, Arinola and my Bethel family. Your love and prayers took me through. To God be the glory.

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I would like to acknowledge my chairpersons, Drs. Dunn and Schumaker. Additionally, I want to thank my committee members, Drs Agha and Davis. Thank you for guiding me every step of the way. Their commitment to excellence shines through the quality of the completed work.

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Chapter 1: Introduction to the Study

Introduction

Reports, data, and surveys showed an exponential increase in the use of e-cigarettes among adolescents around the world. However, there is limited information available regarding the health effects of e-cigarettes on this population (Patterson et al., 2020). There is, however, overwhelming evidence that shows there are harmful effects to e-cigarette usage (Fotiou et al., 2015). In a cross-sectional study conducted by Fotiou et al. (2015), over 16.6% of the 1,330 adolescents surveyed confirmed that they use e-cigarettes. Along the same line, Choi and Bernat (2016) discovered an association between hospitalization due to respiratory symptoms and vaping. Furthermore, electronic vaping associated with lung injury (EVALI) is a modern illness formed through e-cigarette use (Patterson et al., 2020). Injury from vaping has resulted in several hospitalizations (Patterson et al., 2020). These discoveries have created challenges for public health practitioners. However, limited data exists regarding the effect of vaping on adolescents. Data showed that between 2007 and 2014, the vaping market has grown globally to over $6 million (Patterson et al., 2020). Patterson et al.'s study explored the influence of the accessibility to vaping products and vaping in adolescents ages 13 to 18 years. Furthermore, it also determined the extent of the relationship between exposure to the advertisement of e-cigarettes and their use by adolescents. The study determined if the early initiation of e-cigarette use is related to the eventual use of cigarettes.

Problem Statement

The tobacco industry introduced vaping or electronic cigarettes ("e-cigarettes") to the market as a healthy option and a tool to assist smokers in quitting smoking (Patterson et al., 2020). In the last five years, e-cigarette use has shifted from its initial purpose as a tool for weaning off cigarettes to a recreational drug, even among adolescents (Patterson et al., 2020). E-cigarette use has become popular among adolescents (Bantug et al., 2020). The study found that 28.6% of U.S. adolescents use e-cigarettes regularly (Ellington et al., 2020; Evan-Polce et al., 2020). Along the same line, in a cross-sectional analysis of 1,330 Greek students, 16.6% used e-cigarettes regularly (Foutui et al., 2018). Furthermore, a 2018 study conducted in the United States showed increased usage from 20.8% to 27.5% among high school students, with an estimated increase in tobacco usage from 59.2 % to 72.2% in the same age group (Patterson et al., 2020). Since much is not known about vaping relating to the health of adolescents, public health officials worry about the unknown negative effect of vaping on this population (Patterson et al., 2020). This includes questions such as: (a) Is there an association between e-cigarette initiation and the later use of tobacco products in adolescents? (b) Is there an association between the accessibility of vaping products and the frequency of e-cigarette use? and (c) Is there an association between exposure to e-cigarette advertisements and the use of e-cigarettes?

In adults, the association between the use of e-cigarettes, worsening asthma symptoms, and lung injury have been established (Choi & Bernat, 2016). Vaping has been associated with increased hospitalization relating to respiratory symptoms, especially asthma and lung injury (Choi & Bernat, 2016). According to Cho and Paik

(2016), the use of electronic cigarettes has been related to the recent lung injuries referred to as EVALI in adults. Limited study or research exists on the consequences of e-cigarette use in adolescents and its long-term effect on lung function (Cho & Paik, 2016). However, there is a need to investigate why adolescents favor e-cigarettes regardless of possible ill effects (Evan-Polce et al., 2020). E-cigarette use has also been linked to heart conditions and addictive behaviors (Evan-Polce et al., 2020). These health-related issues are often more challenging in adolescents than in other age groups. Therefore, it is important to investigate why adolescents use e-cigarettes.

There is a need to explore why adolescents gravitate toward e-cigarettes or start to use e-cigarettes at an early age (Evan-Polce et al., 2020). The increase in usage of e-cigarettes among adolescents from 8.8% in 2014 to 28.6% in 2018 is concerning to healthcare professionals. The study conducted by Evan-Polce et al. attributed the increase in use to the youths' perceptions, understandings, and beliefs regarding e-cigarettes. Ellington et al. (2020) reported an increase in the acquisition of e-cigarettes by teenagers younger than 14 years of age. Rohde et al. (2018) evaluated the attitudes, knowledge, and behaviors of 60 teenagers, indicating that teenagers perceived e-cigarettes as a fun activity. When researchers explored why teenagers and adolescents perceive electronic cigarettes as fun, they found that the perception was linked directly to exposure to ads (Rohde et al., 2018). Stroup and Branstetter (2019) concluded that e- advertisements that intentionally targeted young people significantly influenced the use of e-cigarettes. Exposure to e-cigarette advertisements was seen as a precipitating factor for usage (Stroup & Branstetter, 2019; Rohde et al.,2018). The perception of adolescents toward e-

cigarettes could be the primary reason more adolescents start to use e-cigarettes at an early age. The increased use of e-cigarettes among adolescents has become a public health concern (Evan-Polce et al., 2020).

Public health officials fear that the increase in the use of e-cigarettes among adolescents may transition them to the use of other tobacco products (Evan-Polce et al., 2020). In an analysis of the secondary data of the National Youth Tobacco Survey (NYTS), Evan-Polce et al. discovered the association between e-cigarettes initiation and the later use of tobacco products in adolescents. Another study that supports this idea was conducted in Florida, where 36,085 students were surveyed. Researchers concluded that the consistent use of e-cigarettes in early adolescent years led to early use of cigarettes (Choi &Bernat, 2016). Furthermore, in a recent study by Patterson et al. (2020), the investigators agreed with previous findings that e-cigarettes are associated with the future use of tobacco products. Patterson et al. also connected, in their research, vaping regularly (use of e-cigarettes three times a week) to developing respiratory symptoms. The gateway theory has been applied to addictive behaviors.

Gateway theory has been used to explain the transition from a recreational drug to an addictive one (Etter, 2018). According to Etter, the gateway theory could not explain the transition from e-cigarettes, among teenagers, to traditional cigarettes and other tobacco products. The gateway theory was initially used in the 1970s to describe how the use of marijuana can lead to the use of a more addictive drug like heroin (Ether, 2017). Defining current smoking as 30-day usage of cigarettes, Etter argued against the addictive behavior tendency of e-cigarettes. After acknowledging the addictive tendency of nicotine

and its presence in most e-cigarettes, Etter concluded that e-cigarettes' chronic use could not lead to addiction to a traditional cigarette. Supporting his stand, he highlighted the successful role of e-cigarettes in smoking cessation and pointed out that this benefit outweighs its addictive tendencies (Etter, 2018). However, current researchers have disagreed with these findings. Patterson et al. (2020) showed a high presence of nicotine in most e-cigarettes which creates an addictive influence on its user, adolescents, or adults. Regardless of what side of the argument one believes in, if we agree that nicotine is addictive, nicotine-containing e-cigarettes are equally addictive.

Purpose

This research will address the association between the age of initiation of e-cigarette use in adolescents (ages 13-18 years) and traditional cigarettes (Patterson et al., 2020). Additionally, it will evaluate the association between accessibility to vaping products and the frequency of e-cigarette use. Furthermore, the role of exposure to e-cigarette advertisements and the use of e-cigarettes among adolescents will be explored. For the first research question, the independent variable will be the age of initiation of e-cigarette use, while the dependent variable will be the use of traditional cigarettes. For the second research question, the independent variable is the accessibility to vaping products and the dependent variable is the frequency of use of these products. Finally, the independent variable for the third research question is the exposure to the advertisement, and the dependent variable is the use of e-cigarettes.

Significance

The research will add to the body of knowledge regarding adolescents and the use of e-cigarettes and their effect on their health and future use of tobacco products. There is limited knowledge of the consequences of e-cigarettes on the health of adolescents. I explored any health threats to adolescents who use e-cigarettes and how to mitigate these threats. Furthermore, I investigated the association between the use of e-cigarettes and exposure to e-cigarette advertisements. Furthermore, I examined the association between the age of initiation of e-cigarette use and the transition to cigarettes. Considering the decades of achievement in tobacco cessation in adolescents (Patterson et al., 2020) it is essential to know if the use of e-cigarettes will reverse this success. This point is especially crucial since e-cigarettes were created to assist people in quitting smoking (Patterson et al., 2020). Cross-sectional quantitative research discovered that everyday usage of e-cigarettes among Florida adolescents is related to the aggravation of asthma symptoms and future use of tobacco products (Choi & Bernant, 2016).

Furthermore, Choi and Bernant (2016) pointed out that teenagers diagnosed with asthma have a higher tendency of having been regular e-cigarette users. Finally, this research will fill the literature gap regarding the relationship between early use of e-cigarettes in adolescents, possible traditional cigarette usage, and health challenges. I investigated the extent to which access to vaping products influences use. Focusing on the existing body of knowledge, this study provided evidence-based guidelines for lawmakers to adopt policy and create social change. This social change will be achieved by reducing minors' accessibility to cigarettes introduced by these policies.

Background

Electronic cigarettes, also known as vaping or e-cigarettes, invented to encourage people to quit smoking, have become a public health problem (Evan-Polce et al., 2020; Patterson et al., 2020). E-cigarettes, which contain nicotine, cannabis extract, or other chemicals heated to produce an aerosol, have become popular in adolescents ages 13-17 years (Evan-Polce et al., 2020). According to Evan-Polce et al., 28.6% of 26,662 adolescents surveyed used e-cigarettes regularly. Regular usage in this study refers to vaping 3-5 times a week. In a cross-sectional analysis of self-reported data collected from 1,320 Greek 25 years old, 16.6% were life-long e-cigarette users (Foutiou et al., 2015). The number of adolescents using e-cigarettes has continued to increase (Evan-Polce et al., 2020; Foutiou et al., 2015). Advertisements and social media have been credited with the cause of this increase in e-cigarettes among teenagers. Evans-Polce et al. reported an increase in usage of e-cigarettes among 14 years old or younger, from 8.8% to 28.6% from 2008 to 2018. This rise in the use of e-cigarettes has been attributed to adolescents' perception of e-cigarettes et al., 2020). In a pilot study conducted by Rohde et al. (2018) the knowledge, attitude and behavior of 60 teenagers were evaluated, and the e-cigarette was perceived as a fun activity. The entertaining activity perception has also been connected to early initiation (Rohde et al., 2018).

There is conflicting research on the possible effect of early use of e-cigarettes in adolescents and tobacco products. Etter (2018) disagreed that the gateway theory can be applied to the surge of e-cigarettes use and the future use of tobacco products. In his

assessment of the NYTS, he concluded the responses received did not point to how e-cigarettes can lead to the future use of tobacco products. However, he acknowledged an elevated level of nicotine in these products (Ether, 2018). Evans-Polce et al. (2020) analyzed data collected by NYTS in 2018 and had a different conclusion from Etter. Evans-Polce et al. pointed out the association between e-cigarettes' addictive behavior and the age of initiation of e-cigarette usage in this age group. In another study conducted on 36,085 Florida adolescents, it was established that early initiation and frequency of e-cigarette usage (30 days) is a factor in the eventual use of cigarettes. The study established a connection between regular usage and health challenges (Evans-Polce et al., 2020). As e-cigarettes usage increases among teenagers, public health officials pose a similar concern. Public health officials' interests are related to the possible development of addictive behavior, access to vaping products, and increased lung injury.

Cigarette usage and addiction to cigarette smoking, and asthma exacerbations in adolescents have not been studied extensively (Evan-Polce et al., 2020). However, the author identified a gap in research relating to conducting a longitudinal and qualitative study on this topic. The variables include cigarette use among youth, metropolitan asthma status, and traditional cigarette susceptibility. Examining data collected from 5 Cohort National Youth Tobacco Survey, Evans-Polce et al. (2020) explored the current surge in the use of e-cigarette in adolescents in the United States. It was discovered that there is an increase in adolescents ages 14 years and younger using e-cigarettes. There was a recorded increase in e-cigarette usage in this age group from 8.8% in 2014 to 28.6% in

2018. The variables studied were the age of initiation of e-cigarette and the current use of tobacco products.

Rohde et al. (2018) examined how adolescents' knowledge, attitudes, and behaviors affect their use of e-cigarettes (the "KAB" study). In a pilot study that recruited 60 participants, the KAB study revealed that understanding the risk of e-cigarette is not associated with the behavior. However, the knowledge and attitudes about addiction risk are associated with e-cigarette use variables: Risk belief, knowledge of e-cigarettes, and use of e-cigarettes. Foutiou et al. (2015) examined 1,320 15-year-old Greek adolescents. Using a quantitative approach with logistic regression, the authors analyzed the lifetime smoking of conventional cigarettes (dependent variable) and lifetime use of e-cigarettes. The aim was to determine the dual usage of traditional and e-cigarettes. Focusing on the prevalence of the use of e-cigarettes, it was discovered that 6 in 7 teenagers surveyed had smoked regular cigarettes. Stroup and Branstetter (2019) reviewed the effect of e-cigarette advertisements on adolescents' use of e-cigarettes. The authors explored if exposure to advertising is a precipitating factor in usage. The data (NYTS, *N*= 17, 826) used in this survey was national data like the one used in the proposed research.

Framework

The multi-theory model (MTM) has been widely used in studies relating to behavioral change. According to experts, it is exclusively to predict behavioral change and can be applied to individuals and communities (Sharma, 2015). Furthermore, MTM has been used to predict behavioral change relating to substance abuse (Claros et al., 2020). In another study, the MTM was applied in Mississippi among African American

adult males (Jaelbreiret et al., 2020). The study used the constructs of MTM to explain the ability of African Americans to start healthy behavior (Jaelbreiret et al., 2020). MTM will be used to describe how e-cigarette use may be influenced by the community. Furthermore, MTM will create a platform for understanding how e-cigarette use is initiated and how policies can be applied to curb this epidemic.

Research Question(s)

Research Question 1: What is the association between the age of e-cigarette initiation and the age of cigarette use by adolescents?

$H_0$1: There is no association between the age of initiation of e-cigarettes and the use of cigarettes by adolescents.

H_a1: There is a association between early initiation of e-cigarettes and the use of cigarettes by adolescents.

Research Question 2: What is the association between the accessibility to vaping products and the frequency of e-cigarettes used by adolescents?

$H_0$2: There is no association between the accessibility to vaping products and the frequency of e-cigarettes usage in adolescents.

H_a2: There is an association between accessibility to vaping products and the frequency of e-cigarettes used in adolescents.

Research Question 3: What is the association between the exposure to the advertisement of e-cigarettes and their use by adolescents?

$H_0$3: There is no association between the exposures to the advertisement of e-cigarette and its use by adolescents.

H_a3: There is a association between the exposure to the advertisement of e-cigarette and its use by adolescents.

Nature of the Study

For this study, I evaluated the association between the age of initiation of e-cigarette use and the age of cigarette use by adolescents. Additionally, the study assessed the extent of association between the accessibility to vaping products and the frequency of e-cigarette use by adolescents. Finally, I reviewed the association between exposure to e-cigarette advertisements and their use by adolescents. The study population was adolescents ages 9 to 18 years old, and the data types are nominal, continuous, ordinal, and categorical. Some of the data used includes the following: age of e-cigarette initiation, use of cigarettes, use of e-cigarettes, accessibility to vaping products, and frequency of vaping. Some of the questions from the survey include: (a) How old were you when you first tried using e-cigarettes, even once or twice? (b) Have you ever tried cigarette smoking, even once or twice? (c) During the past 30 days (about four and a half weeks), where did you get the e-cigarette, you used? and (d) During the last 30 days (about 4.5 weeks), how many days did you use e-cigarettes? (Centers for Disease Control and Prevention [CDC], 2020). Correlation and regression analysis were used to determine the independent and dependent variables' association. According to O'Brien and Scott (2012), correlation tests determine the predictive power of variables. After a relationship has been established, the regression test was used to determine the extent of the influence of the independent variable on a particular dependent variable while confounding the other (O'Brien & Scott, 2012).

National Youth Tobacco Survey Data Set

For my research, secondary data analysis was conducted. The data was obtained from CDC's NYTS (CDC, 2020). CDC collects annual data nationally to evaluate the risky behavior of middle and high school students (CDC, 2020). The NYTS data provides national guidelines for various tobacco control programs. The data is designed to be made available to the public platform, and it is easily accessible.

Chapter 2: Literature Review

Introduction

Electronic cigarettes (e-cigarettes) were initially developed to assist addicted smokers in quitting smoking (Patterson et al., 2020). Clinical trials have shown the long-term effect of e-cigarettes on adults' health (Patterson et al., 2020). However, there is limited data on how the use of e-cigarettes affects adolescents' health. (Patterson et al., 2020). E-cigarettes have stunted the growth experienced in the tobacco market as e-cigarettes attract more adolescents (Hansen et al., 2018). Limited research exists on the effect of electronic cigarettes on adolescents and their influence on the future use of tobacco products in this age group (Patterson et al., 2020). The literature on e-cigarettes, vaping, advertisements, adverse health effects, perception of adolescents on cigarette usage, and the use of traditional cigarettes after vaping will be reviewed in this chapter. All the literature reviewed consists of peered-reviewed journals, publications, and studies.

Literature Search Strategies

Peered-reviewed articles from Google Scholars, Medline, and CINAHL were analyzed. The search phrases include vaping, electronic cigarettes, e-cigarettes, JUUL, or e-cigs. The inclusion criteria were articles and journals in English published in the last three years; blogs, newspaper articles, and non-peer-reviewed articles were excluded. The significant sections of the chapter are as follows; background, the prevalence of electronic cigarettes (New York, adults, and in adolescence), media targeting adolescents'

perception of e-cigarette use, an early initiative of e-cigarettes in youth, health concerns, and use of electronic cigarettes (in adult and adolescent). Other sections are the theoretical foundation (multi-theory model), regulation and restriction of e-cigarettes, and addressing e-cigarettes usage in youth (NYTS).

Background

E-cigarettes originated in China in 2006 (Aoyama et al., 2020). By 2008, they were in the United States and widely promoted as a device to help people quit smoking. In 2019, The U.S. Surgeon General declared e-cigarettes an epidemic in the United States (Aoyama et al., 2020; Patterson et al., 2020). In 2008, 8.8% of adolescents vaped regularly in a month; by 2018, the number rose to 28.6% (Patterson et al., 2020). A substantial body of research reveals that adolescent vaping has become a public health emergency (Aoyama et al., 2020; Chadi et al., 2020; Patterson et al., 2020;). Even though previous research has investigated the impact of e-cigarettes on an adult's health, they continued to gain popularity among the youth (Patterson et al., 2020). In the literature review, it was discovered that more research had devoted attention to the effect of vaping on adolescents. E-cigarettes are aerosol devices that form vapor through a heating device (Patterson et al., 2020). E-cigarettes threaten to destroy the several years that public health has successfully combated the use of tobacco products (Chadi et al., 2019). In 2014, e-cigarettes became the most common tobacco product used by middle and high school students (Curran, 2018). The increase in the use of e-cigarettes has created a $6 billion global industry and over $2.5 million in the United States alone (Curran, 2018). There is compounding evidence that adolescents' short- and long-term use of e-cigarettes

is more significant than other illicit drugs (Chadi et al., 2019). E-cigarettes are more dangerous than traditional cigarettes because they are easily accessible to adolescents, often the main target of advertisements.

Prevalence of E-cigarettes in New York

There has been a consistent increase in e-cigarettes among teenagers in the United States and New York. The e-cigarettes were initially conceived in 1965, and it took another 38 years before it was created in China (Patterson et al., 2020). It was marketed as a healthier version of a traditional cigarette, and the popularity of e-cigarettes increased, especially in adolescents (Chadi et al., 2019). According to Chadi et al. (2019), since the product was introduced in 2006, the use of e-cigarettes in adolescents has been three times more common. There has been a global increase in the use of e-cigarettes among teenagers (Patterson et al., 2020). There is a concern in the healthcare profession that this epidemic will lead to over 5 million smoking-related deaths (Patterson et al., 2020). The overwhelming increase in the use of e-cigarettes among adolescents is a concern. E-cigarettes have moved away from their intended purpose as they continued to become popular with this population.

E-cigarettes initially marketed to help with smoking cessation have reversed the years of reducing nicotine usage among adolescents (Chadi et al., 2019). There is a fear among healthcare practitioners that the increasing trend of e-cigarette usage among adolescents could renormalize smoking (Hansen et al., 2020). In effect, they have reversed years of successful tobacco control efforts. The 1964 warning of the Surgeon General successfully curbed traditional cigarettes (Chadi et al., 2019). A 900% increase in

the use of e-cigarettes was reported between 2011 and 2015, making e-cigarettes the most popular type of nicotine product used by adolescents (Chadi et al., 2019). Along the same line, in a self-reported survey of adolescents who vaped in the last 30 days (about four and a half weeks), about 27.5% of high schoolers and 10.5% of middle schoolers use e-cigarettes regularly (Patterson et al., 2020).

Additionally, most adolescents use an e-cigarette with tobacco products in this age group, increasing by 38% in one year (Patterson et al., 2020). The increased use of e-cigarettes among adolescents is of great concern. There has been a global increase in the use of e-cigarettes among teenagers. There are several reasons to investigate how the use of e-cigarettes can lead to the use of tobacco products. There is a concern in the healthcare profession that this epidemic will lead to over 5 million smoking-related deaths (Patterson et al., 2020). The overwhelming increase in the use of e-cigarettes among adolescents is a concern. E-cigarettes have moved away from their intended purpose as they continued to become popular with this population.

Potential Gateway Drug

Several conversations concerning the determination of e-cigarettes as a gateway drug led to other tobacco product use. Experts reviewed the existence of the gateway theory's causality in using e-cigarettes and the future use of other tobacco products (Etter, 2017). Etter argues that her study has no association between using e-cigarettes and tobacco products' future use. In establishing this stand, the article pointed out the increased use of e-cigarettes in communities that reported decreased tobacco products (Etter, 2017). Furthermore, through this study, Etter established that the gateway theory

of e-cigarettes is non-existent and is politically motivated. However, recent studies conducted among teenagers in Florida showed within a year, they had a 38% increase in the use of tobacco products after e-cigarette usage (Patterson et al., 2020).

Several other studies disagree with the conclusion deduced from the investigation conducted by Etter et al. (2017). General trends are apparent in the studies, as cited by Chadi et al. (2020), pointing to the general agreement that using e-cigarettes increases the risk of future service of tobacco products, alcohol, marijuana, and drugs. There are growing concerns raised by scientists and medical practitioners regarding e-cigarettes as a "gateway" drug to new generations of smokers (Hansen et al., 2020). It is imperative to investigate further if there is a gateway effect related to the use of e-cigarettes among adolescents in New York. The number of adolescents using e-cigarettes continues to increase as this population is often the target of various advertisements.

Media Targeting Adolescents

The marketing of e-cigarettes to the youth has been overwhelmingly successful. Experts report an association between the use of e-cigarettes among youth and the amount of money spent on advertising (Chadi et al., 2020). In 2013, the e-cigarette industry represented around a billion dollars, twice the expenditure in 2012 (Hansen et al., 2020). Some of the media used in the advertisement of e-cigarettes include the internet, television, billboard, radio, and point of sale (Hasen et al., 2020). However, countries around the world have embraced article 13 recommendation of the World Health Organization (WHO) Framework Convention on Tobacco Control (FCTC), which stipulates the banning of tobacco advertisement (Hansen et al., 2020). Despite this

recommendation, several loopholes still make e-cigarette advertisements accessible to adolescents.

Role of Advertisement

Advertisements have traditionally influenced the decisions of consumers (Patterson et al., 2020). Experts believe that advertising played a crucial role in the increased use of e-cigarettes among adolescents (Patterson et al., 2020). Studies of the exposure to e-cigarette advertisements and its association with the help of e-cigarettes highlighted a clear exposure-behavior link (Hansen et al., 2020). Researchers surveyed 6,902 German students from six German states; it was concluded that there is a connection between precise exposure to the advertisement and the use of e-cigarettes (Hansen et al., 2020). Chadi et al. (2019) substantiated that youth-focused advertising makes e-cigarettes fashionable and is associated with the increased use of e-cigarettes among teenagers. Advertisements often minimize the risk associated with e-cigarette use, contributing to consumers' misconceptions, especially youth (Chadi et al., 2020). About 80% of the adolescents who use e-cigarettes perceive them as safer than traditional cigarettes (Patterson et al., 2020). In this population, social media like Instagram, Snapchat, Pinterest, and others were instrumental to the popularity of e-cigarettes (Chadi et al., 2020). Adolescents and young adults often share their positive opinions about vaping by posting pictures of themselves and enjoying it (Chadi et al., 2020).

Vaping was trending on social media, and adolescents became intrigued by it (Patterson et al., 2020). The advertisement for e-cigarettes continued to reach the youth without restriction. The lack of universal regulation regarding the advertising of e-

cigarettes has made it accessible to adolescents. Some guidelines restrict the advertisements of tobacco products to adolescents. However, this rule has not been applied to e-cigarettes (Patterson et al., 2020). To appeal to adolescents, the media has used the discreet design of e-cigarettes to promote it. In addition to the free range with which they manufacture e-cigarettes, there is concern that this new "freedom" may destroy the decade of effective campaigning against the use of tobacco products (Hwang & O'Neil, 2020).

Socially Acceptable Image

One of the manufacturers of e-cigarettes, JUUL, has successfully created a socially accepted image for their product through advertisement and technology (Hwang & O'Neil, 2020). Using technology, JUUL launched a version of e-cigarettes acceptable to adolescents because of its small and discreet size (Hwang & O'Neil, 2020). The development of this USB-like e-cigarette has made the JUUL name synonymous with an e-cigarette (Hwang & O'Neil, 2020). Many adolescents prefer vaping as "juuling." This company has been successful in its packaging and advertisements. The small size of the JUUL makes it easier for adolescents to use it in school since they can hide it from school administrators (Chadi et al., 2020; Hansen et al., 2020). Based on these advertisements and superior technology, adolescents associate e-cigarettes with a lower perceived risk than traditional cigarettes.

Perception of Adolescents on E-cigarettes

The adolescent perception of e-cigarettes influences their continuous usage and transition to traditional cigarettes (Evan-Polce et al., 2020). According to Chadi et al.

(2019), several studies' outcomes supported the impact of advertisements on the increased use of e-cigarettes. The availability of candy-like flavors such as "cherry crush" and other types of youth-friendly tastes have been instrumental in attracting the young generation (Hwang & O'Neil, 2020). All these flavors also contain nicotine (Chadi et al., 2019; Hwang & O'Neil, 2020). Along the same line, the perception of invincibility and the idea that they will not be victims often give adolescents the illusion of invincibility (Patterson et al., 2020). According to experts, this feeling of invincibility correlates with high-risk behavior like smoking and alcohol use (Patterson et al., 2020). In addition to invincibility, Patterson et al. (2020) argued that peer pressure plays a significant role in adolescents' perception of e-ding e-cigarettes. The feeling of invincibility coupled with deceptive advertising and peer pressure often leads to the inability of adolescents to come to the negative effect of consistent vaping (Hwang & O'Neil, 2020). In the study conducted among teenagers, it was discovered that the youth who used e-cigarettes later used traditional cigarettes (Patterson et al., 2020).

Early Initiation of E-cigarettes in Youth

Adolescents' perception of e-cigarettes influences their continuous usage and transition to traditional cigarettes (Evan-Polce et al., 2020). According to Chadi et al. (2019), several studies' outcomes supported the impact of advertisements on the increased use of e-cigarettes. The availability of candy-like flavors such as "cherry crush" and other types of youth-friendly tastes have been instrumental in attracting the young generation (Hwang & O'Neil, 2020). All these flavors also contain nicotine (Chadi et al., 2019; Hwang & O'Neil, 2020). Along the same line, the perception of invincibility and the idea

that they will not be victims often give adolescents the illusion of invincibility (Patterson et al., 2020). According to experts, this feeling of invincibility correlates with high-risk behavior like smoking and alcohol use (Patterson et al., 2020). In addition to invincibility, Patterson et al. (2020) argued that peer pressure plays a significant role in adolescents' perception of e-cigarettes. The feeling of invincibility coupled with deceptive advertising and peer pressure often leads to the inability of adolescents to comprehend the negative effect of consistent vaping (Hwang & O'Neil, 2020). The study among teenagers discovered that the youth who used e-cigarettes later used traditional cigarettes (Patterson et al., 2020).

Health Concerns of Use of E-cigarettes in Youth

There is limited information on the effect of e-cigarettes on people, especially adolescents. Even though there are many unanswered questions regarding the impact of e-cigarettes on the health of adolescents, it has raised several health concerns for public health practitioners (Hwang & O'Neil, 2020). According to Patterson et al. (2020), there are several adverse health effects of using an e-cigarette. There is critical brain development that occurs during the adolescence period. Experts discovered that using the e-cigarette, which contains nicotine, has adverse effects on attention, learning, mood, and permanent damage to impulse control (Patterson et al., 2020). Along the same line, Chadi et al. (2019) pointed out that adolescents are more prone to negative health consequences of e-cigarette usage because of their developing brains. In earlier studies conducted on animals, it was discovered that nicotine permanently affects neuronal connectivity in

adolescents. The impact of nicotine neuronal connectivity in adolescents is significant because the brain is still developing (Evan-Polce et al., 2020).

Furthermore, the short-term effect lasts longer in this vulnerable population with developing brains. Moreover, the adolescent brain is more vulnerable to developing addiction, and the addictive properties of nicotine are established. E-cigarettes are related to specific health challenges (Evan-Polce et al., 2020). Several schools of thought seem to purport that e-cigarette use is safer compared to cigarettes (Evan-Polce et al., 2020; Wang et al., 2018). However, deduction from studies and research showed that there is no safe tobacco product (Wang et al., 2018). It is important to note that regardless of the safety of e-cigarettes, a lot is still unclear about the negative health effect on adolescents. The use of e-cigarettes has been associated with various health conditions among adolescents. Some health challenges related to e-cigarette use include asthma, cardiovascular disease, and recently worsening asthma symptoms (Evan-Polce et al., 2020).

E-cigarettes and EVALI

Several research results pointed to the negative impact of e-cigarettes on adolescents (Patterson et al., 2020, Schweitzer et al., 2017; Waligokse & Anand, 2021; Wills et al., 2020). In the summer of 2019, several unexplained lung disease incidents were seen in the emergency room (Evan-Polce, 2020). This national outbreak was tagged as electronic or vaping-associated lung injury (EVALI), and it began to peak in September 2019 (Evan-Polce, 2020). The CDC data revealed that in 2020 there were 2602 hospitalizations relating to EVALI and about 57 confirmed deaths. Furthermore, 37% of those hospitalized were between 18 and 24 years old, and 78% of EVALI

hospitalizations were reported in individuals above 35 years of age (Evan-Polce et al., 2020). 82% of the hospitalized patients claimed to have used e-cigarettes that contained THC before their symptoms developed (Evan-Polce et al., 2020; Patterson et al., 2020, Schweitzer et al., 2017). E-cigarettes and their many additives do not only contain nicotine but other carcinogenic ingredients. Additionally, e-cigarettes have been related to the occurrence and exacerbation of asthma symptoms (Choi &Bernant, 2017).

E-cigarettes and Asthma

The research conducted by Schweitzer et al. (2017) reviewed the relationship between the use of e-cigarettes and the occurrence of asthma while controlling other covariates. E-cigarettes were associated with asthma and other respiratory side effects (Schweitzer et al., 2017). Public health specialists and policymakers need to be at the forefront of the campaign highlighting the negative impact of the use of e-cigarettes on asthma. The connection between the use of e-cigarettes and the development of EVALI has been established. Experts have also studied the association between e-cigarettes and asthma symptoms (Choi & Bernant, 2017; Evan-Polce et al., 2020). A cross-sectional quantitative survey conducted with adolescents in Florida discovered an association between asthma aggravation, the development of asthma symptoms, and the use of e-cigarettes (Choi &Bernant, 2017). In 2015, the study surveyed 6089 students from 33 high schools in Florida, evaluating the connection between the "ever use" and current use (past 30 days—about 4.5 weeks) of e-cigarette asthma, controlling for the benefit of other tobacco products. Researchers concluded that there is an independent association between

using e-cigarettes and developing and worsening asthma symptoms in high school students (Choi &Bernant, 2017).

E-cigarettes and COVID-19

Several studies support the negative effect of vaping on lung function. The association between vaping and lung disease has been established (Evan-Polce et al., 2020). The impact of vaping is felt at the intracellular and cellular levels, creating an immunological response to the pathogen. Furthermore, vaping causes immunological reactions to the pathogen (Waligoske & Anand,2021). Experts believe the increased nicotine level in each vaping pod compounds the negative effect (Waligoske & Anand, 2021). Nicotine is perceived as a "specific priming factor "for SAR-COV-2, the virus that causes COVID-19. For adolescents who have been adversely affected by stress related to the pandemic, the increased stress level has increased the percentage of adolescents who continue to vape. Statistics show a 15% reduction in motivation to stop vaping since the pandemic (Waligoske & Anand, 2021). Vaping has an adverse effect on the severity of the COVID-19 infection.

Theoretical Foundation

This section focuses on the study's theoretical foundation, Bandura's Social-Cognitive Theory (SCT), highlighting how they relate to adolescent e-cigarette usage and the research questions. Bandura's social-cognitive theory deals with how human behavior may be underdeveloped and may be cultivated (Bandura, 2019). For this study, the MTM was the primary research used, and the various literature on this theory was reviewed in this section. Additionally, I provided the literature review for these two theories (BPM

and the SCT). This study drew from previous research to which these theories have been applied.

Multi-Theory Model

The MTM is often used to initiate and sustain new behavior (Brown et al., 2019; Williams et al., 2020). It was developed from the health behavior models that existed before it. MTM is often used in behavioral modification intervention in the community, promoting long-term and short-term behavioral changes (Williams et al., 2020). Additionally, it can be applied to individuals and groups alike. The MTM construct of emotional transformation is to be considered to develop policies that will lead to lasting change in behavior (Brown et al., 2019; Williams et al., 2020). MTM can be used to determine the role of the environment in the initiation of smoking and the transition to cigarettes. Furthermore, this theory explained the part of the environment (advertisement and accessibility to vaping products) on vaping in adolescents and how manipulating the same domain will produce the results of E-cigarette use cessation.

A cross-sectional study conducted in a barbershop in 2019 with African American men as the targeted population reached an exciting conclusion (Williams et al., 2020). The participants' eating habits were evaluated to determine the role; men who do not eat fruits and vegetables were selected for this study of the environment and social construct in the initiation and sustenance of fruits and vegetables (Williams et al., 2020). The study concluded that the social and environmental construct of the MTM was discovered that influences the ability of the men to initiate and sustain eating fruits and vegetables (Williams et al., 2020). A similar study used MTM to assess the behavioral health change

among African American women in Mississippi. Surveying 116 total participants, ranging from the ages of 21 to 84 years old, the study used the following constructs: participatory dialogue, behavioral confidence, emotional transformation, and environmental changes (Brown et al., 2019). The study provided credible support and demonstrated the effectiveness of using MTM in a behavioral modification approach. Furthermore, the study gave credence to the MTM framework and should be considered in developing programs geared towards encouraging increased consumption of fruits and vegetables among African Americans (Brown et al., 2019). MTM has also been applied to curb waterpipe smoking among Iranian youth (Brown et al., 2019).

In a randomized controlled trial involving 94 adolescent students in 10th and 11th grades, the authors reviewed the 94 students in a problem where half were in the intervention group, and the other half were in the control group (Abasi et al., 2019). All the students selected were from Iran; some smoked water pipes (W.P.) recently or in the past month (Abasi et al., 2019). MTM constructs were used to frame the questions in the questionnaire. The experts concluded that the developed education intervention was effective (Abasi et al., 2019). MTM has been used as a behavioral approach modification and to explain the environmental influence on the actions of an individual (Abasi et al., 2019). Over the years, several attempts have been made by the federal government to reduce smoking in the general population by controlling the labeling of tobacco products (Graham et al., 2020). These attempts have not been highly effective because of the effective tactics of the tobacco lobby (Graham et al., 2020). By 1995, the Food and Drug Administration (FDA) began to regulate tobacco and tobacco products after tobacco and

tobacco products were classified as drug and drug devices. With the increased use of tobacco products, especially e-cigarettes, it was essential to restrict these products. By Dec 2019, the Federal Food, Drug, and Cosmetic Act (FDCA) raised the minimum age for purchasing tobacco products, including e-cigarettes, from 18 to 21. This short-lived victory was overturned in 2000 when the U.S. Supreme Court ruled that the FDA does not have the authority to uphold Congress's regulatory scheme. It was not until 2012 that the FDA gained some level of control. In 2016, the "deeming rule" was created that prohibited e-cigarette product sales to persons under 18 years with no restriction in flavor, unlike tobacco products. Like the overall lack of success of the Tobacco law, the age restriction did not change adolescents' e-cigarette usage trend.

Socio-Cognitive Theory

Bandura's social-cognitive theory (SCT) is multifaceted in its application and explanation of how human behavior is cultivated or underdeveloped (Bandura, 1986). The SCT focuses on the importance of observing and modeling the attitudes, behavior, and emotional reaction of others. The three primary constructs of this theory are environmental, behavior, and personality. How do these three elements influence the behavior we develop, nurture, resist or adopt? SCT addresses self-regulation, self-management, and self-efficacy (Bandura, 2019). The theory supports the notion that human beings are not merely influenced by their environment but by the active participants of the event based on their various cognitive experiences (Bandura, 2019). In postulating this theory, Bandura argues that humans can make informed decisions to do right or wrong. However, these decision-making abilities may be influenced by

environmental factors (Bandura, 1986). Several experts have used the SCT to explain why adolescents smoke cigarettes and how the psychological effect of the pressure "peer smoking" has on this population.

Bandura's self-efficacy construct was applied in the meta-analysis study (Tan et al., 2021). Tan et al. (2021) reviewed over 100 journals to identify an association between self-efficacy and self-care in patients with essential hypertension. Self-efficacy is defined as the faith of an individual in the ability to carry out with a plan that has been decided upon, and hypertension self-care is defined as doing the needful to maintain and regulate one's blood pressure- being involved in actions that leads to a change in lifestyle (Tan et al., 2021). After reviewing the articles, the authors concluded that there is some evidence of the relationship between self-efficacy and self-care. It is therefore essential to build on this knowledge and promote lifestyle medicine which promotes self-efficacy.

In relating Bandura's socio-cognitive theory to the study, emphasis will be placed on creating interventions that will promote self-efficacy in adolescents, as self-efficacy will drive self-care (cessation of the use of e-cigarette). According to Bandura's SCT, the environment has limited influence on an individual (Bandura, 1986). However, it is essential to note that this slight influence can significantly affect a growing adolescent. Therefore, it is necessary to consider the environment (advertisement, accessibility to vaping products) in promoting vaping in this age group.

National Policies and Regulation

Over the years, several attempts have been made by the federal government to reduce smoking in the general population by controlling the labeling of tobacco products

(Graham et al., 2020). These attempts have not been highly effective because of the effective tactics of the tobacco lobby (Graham et al., 2020). By 1995, the Food and Drug Administration (FDA) began to regulate tobacco and tobacco products after tobacco and tobacco products were classified as drug and drug devices. With the increased use of tobacco products, especially e-cigarettes, it was essential to restrict these products. By Dec 2019, the Federal Food, Drug, and Cosmetic Act (FDCA) raised the minimum age for purchasing tobacco products, including e-cigarettes, from 18 to 21. This short-lived victory was overturned in 2000 when the U.S. Supreme Court ruled that the FDA does not have the authority to uphold Congress's regulatory scheme. It was not until 2012 that the FDA gained some level of control, and in 2016, the "deeming rule" was created that prohibited e-cigarette product sales to persons under 18 years with no restriction in flavor, unlike tobacco products. Like the overall lack of success of the s of Tobacco law, the age restriction did not change the trend of e-cigarette usage in adolescents.

Adolescents can still buy e-cigarettes online, at the corner store, and at vape shops around the country (Hwang & O'Neil, 2020). There must be a more stringent law to guide the manufacture, advertisement, and sale of e-cigarettes and their paraphilias. Recently, an ultimatum, which expired in 2020, was set for large vaping-producing companies to stop selling their products to minors (Graham et al., 2020; Hwang & O'Neil, 2020). Additionally, there is a public health intervention proposal by several researchers to institute federal policies that limit exposure to e-cigarettes via advertisement. (Chadi et al., 2020; Hansen et al., 2020). The increase in unexplained health-related issues in adolescents linked to e-cigarettes has been alarming. The FDA was prompted to take

action when a lawsuit was filed against them by various health organizations (Graham et al., 2020; Patterson et al., 2020). Adding to the law making it illegal to sell e-cigarettes to minors, the U.S. Food and Drug Administration (FDA) mandated all e-cigarette companies not to manufacture or distribute products with mint and fruit flavors that appeal to kids. Mint and flavored e-cigarettes had effectively masked the potential dangers of using poses to adolescents.

Other experts advocate implementing voluntary compliance (AVC) between the retail chains that sell tobacco. The guidelines that govern the AVC are created with retailers' input and designed to change how cigarette products are marketed among minors. Furthermore, it aims to characterize the sale of potentially addictive or addictive substances to minors (Henriksen et al., 2020). The implementation of AVC has received mixed reviews from public health advocates. Some advocates support its potential effectiveness, while others are focused on the limited evidence supporting such a claim. According to public data obtained from Federal Drug and Agriculture (FDA) archives, AVC was more effective in some tobacco sales points than others. AVC is reported to reduce tobacco products in the supermarket and convenience stores effectively, but not gas stations and pharmacies (Henriksen et al., 2020). The strategies of AVC-like limitations of tobacco adverts, brand names, prices, logos, and restrictions on the area of sale should not be ignored. Even though these guidelines are often difficult to follow universally, especially in pharmaceutical companies and gas stations because of the various owners and franchises, they have shown some success. On the other hand, some healthcare practitioners believe that federal policies and AVC are not enough to curb the

epidemic. Experts advocate for the states to adopt the 21-age limit sale of e-cigarette products instituted and passed by Congress and signed by President Trump in 2019 (Printz, 2020).

Furthermore, experts believe that taxation worked to reduce traditional cigarette usage, and it should be implemented to reduce the use of e-cigarettes (Chadi et al., 2019). Individual states like New York have implemented e-cigarette excise taxes (Chadi et al., 2019). Other intervention methods to consider include revenue from the tax to sponsor adverts and campaign efforts that focus on the youth. The campaign and community awareness will increase the knowledge of adolescents. Higher education is associated with increased awareness of the dangers related to the use of e-cigarettes (Balan et al., 2017). Experts believed that the effectiveness of these campaigns would be dependent on the involvement of youth. Insight should be obtained from the child regarding their perspective and things that influence them (Rohde et al., 2018). These health promotion campaigns should focus on correcting wrong perceptions and creating a change in thinking. Regardless of the intense desire of the FDA to gain complete control of the sales and marketing of e-cigarettes, as of Jan 2021, there is no legislation for online sales age verification–the deadline for application approval has been extended to 2022. The implication is alarming, especially as it relates to the health of adolescents. The public health practitioner must figure out how to help the community.

Policies and Regulation in New York

Policies influence social behaviors and interactions. Guidelines to deter adolescents from using e-cigarettes vary from state to state. There is an effort to reduce

the use of e-cigarettes in adolescents. In 2019, Eight states created a temporary order preventing the sale of flavored cigarettes (Hwang et al., 2017). Despite several legal challenges to this policy, several states moved forward. In New York, the New York State Health Department restrictions were extended to a specific location like the pharmacy. In 2018, a little after the state recorded five deaths relating to COVID-19, the state banned the sale of flavored cigarettes to our youth. The New York State government renewed the ban in 2019 (Vaping Flavorless in New York after Statewide Ban, 2019). To protect children from flavored e-cigarette advertisements that intentionally target the youth, the New York State Health Department turned the temporary ban into law (NYSDH, 2021). The law prohibits the sale of flavored e-cigarettes, like bubble gum, cherry cola, and mint chocolate (NYSDH, 2021). These flavored products are sold under the false claim of not being harmful. In a recent survey conducted by the State Department, the access to flavored e-cigarettes was why 19% of adolescents started e-cigarette use and the reason why 27% of them continued to vape.

Additionally, over 75% of middle and high school students have been exposed to vaping product advertisements. The medical and nursing community plays a significant role in combatting this by educating the youth. Their task will be to make the child aware of this unhealthy trend of the use of e-cigarettes among the population. They must develop ways to reduce the threat posed by e-cigarette use.

Summary

E-cigarettes have been widely used among adolescents (Patterson et al., 2020). Limited information on the health implications of vaping in this population (Patterson et

al., 2020). Experts have indicated that adolescent perceptions of e-cigarettes and peer pressure are responsible for the exponential increase in the use of e-cigarettes. Some experts (Etter, 2020) do not perceive e-cigarettes as a gateway drug, while others support how e-cigarettes may lead to e-cigarettes (Patterson et al., 2020). Advertisement and socially accepted images have intentionally targeted adolescents (Evan-Polce et al., 2020). Advertisements and social media have been deemed responsible for the early age of initiation in the use of e-cigarettes in adolescents (Evan-Polce et al., 2020). MTM and Bandura's theory are the two theories that will be applied to the behaviors of adolescents towards e-cigarettes. Furthermore, federal policies need to be initiated to combat the free range of sales of e-cigarettes and their advertisement.

Chapter 3 states the research methodology that was used in this study. This chapter reviews the targeted population, sampling and sampling procedure, recruitment process, data collection and process, instrument operational, and the questionnaire. Additionally, I evaluated the layout and the summary of the elements included in the questionnaire and discussed the threat to validity.

Chapter 3: Research Method

Introduction

My research was conducted using data collected by the CDC's NYTS. I analyzed the survey results to determine the association between the age of e-cigarette initiation and the future use of tobacco products. There are limited studies on the possible effect of exposure to advertisements and subsequent use of e-cigarettes (Evan-Polce et al., 2020). Additionally, the analysis of the second dataset from NYTS explored if the accessibility to vaping products affected the frequency of use of e-cigarettes. The use of e-cigarettes has been attributed to various health-related complications like EVALI, COVID-19, and cardiovascular complications in adults (Patterson et al., 2020). There is limited research or data that reveals the effect of e-cigarettes on the health of adolescents (Evan-Polce et al., 2020). The potential adverse effects of e-cigarettes on adolescents are alarming and have raised concerns in public health (Evan-Polce et al., 2020; Patterson et al., 2020). These concerns are compounded by the fact that the adolescent brain is still developing (Patterson et al., 2020).

The uncontrolled increase in the use of e-cigarettes has threatened several years of effective tobacco control (Chadi et al., 2019; Patterson et al., 2020). Therefore, it is crucial to examine the time adolescents start to use e-cigarettes and if this can influence the use of cigarettes. The instrument discussed in this chapter measured the association between exposure to advertisements for e-cigarettes and the use of e-cigarettes in adolescents. The last research question that this instrument explored is the association between the exposure to ads for e-cigarettes and their use by New York adolescents.

CDC'S NYTS

The NYTS has collected data used in various tobacco prevention and control programs (TCPs), evaluation of youth access to tobacco products, support state, national and global initiatives like the Healthy People 2020 objectives (CDC, 2020a). The data has been collected annually since 1999,2007, 2008 and 2010 being the exception (CDC, 2020a). NYTS data focuses on various tobacco uses- cigarettes, cigars, smokeless tobacco, hookahs, roll-your-own cigarettes, pipes, snus, dissolvable tobacco, bidis, and heated tobacco products (CDC, 2020). Furthermore, the data collected by the NYTS have been used to promote 6 (TU-2, TU-3, TU-7, TU-11, TU-18, and TU-19) of the 20 Healthy People 2020 objectives (CDC, 2020a). Future data promises to cover more objectives on the Health People 2020 initiatives (CDC, 2020a).

Until 2011, the survey was conducted solely by CDC when they collaborated with the FDA (CDC, 2020a). Participants were recruited from 50 states and the District of Columbia. Furthermore, the survey was done on paper up until digitization in 2019. Students were recruited from all around the United States to ensure adequate representation of the population. It is essential for the survey group to reflect the population that they represent. Students, locations, and race/ethnicity were strategically selected to reflect the population. For this study, the NYTS 2020 dataset will be analyzed to answer the research questions.

Research Design and Rationale

The association between accessibility to vaping products and use of e-cigarettes in adolescents; and the extent of association between the age of vaping and the future use of e-cigarettes was determined through the application of quantitative analysis. The quantitative design method was used to evaluate how exposure to e-cigarette advertisements influenced their use among adolescents. A cross-sectional study was done on the original data from NYTS. Ordinal logistic regression {OLR) and binary regressions analysis were conducted to determine if the independent (predictive) variables influenced the dependent (outcome variables).

Methodology

Population

Participation in the study was voluntary; participants were randomly selected to participate (CDC, 2020a). The process ensured that the surveyed population represented the national population through ethnic consideration, background, and socioeconomic status (CDC, 2020a). The study participants were male and female students from public and non-public schools in grades 6 to 12 (CDC, 2020a). The study design focused on a 95% confidence level based on school (middle to high school), grades (9-12), Sex (female and male), and race/ethnicity (non-Hispanic white, non-Hispanic black, and Hispanic) (CDC, 2020a). Some students in this class were excluded from the survey. Exclusion criteria included students who attend vocational schools that serve only pull-out populations, special education schools, Bureau of Indian Affairs schools, Department of Defense-operated schools, and vocational schools that serve the only pull-out population.

Students enrolled in regular schools who could not independently complete the questionnaire were also excluded (CDC, 2020a).

Sampling and Sampling Procedures

There were 3 sample units identified with sampling done in 3 stages (CDC, 2020a). The sampling units are as follows: PSU (counties, portions of counties, or groups of counties) (CDC, 2020a). Stratified as urban vs non-urban (2 strata), and minority concentration (8 strata) (CDC, 2020a). The second sampling level is the level of medium, small, and large schools: High school vs. middle school. The third sample includes the classes (CDC, 2020a). The PSU included 100 counties; the SSU included 320 schools (240 large, 50 medium and 30 small schools) (CDC, 2020a). The participants for the survey were selected randomly from all the sampling levels.

Projected Sampling Size

In deciding the sample size, the research design focused on the historical average responses of the participants (CDC, 2020a). Based on the past 15 surveys, an average of 89.7% of the students surveyed responded to the study (CDC, 2020a). Additionally, to facilitate the close to the average variance of various estimations, the arrangement strata were slightly modified (CDC, 2020a). Race and ethnicity were recorded in the original data to reflect race ethnicity/ no multi-group and race and ethnicity/no multi-group. The recording was done to categorize all respondents into a single race (CDC, 2020). The categories of race are as follows: American Indian or Alaska, Asian, Black African American, Native Hawaiian or Pacific Islander, and White (CDC, 2020a). The districts and school information were validated to ensure the validity of each entity collected.

Some elements included in the school validation are as follows: school with unique location, student body, school address with overnight delivery to the district validation operational name, address for overnight delivery, name, and title of the superintendent.

Recruitment Process, Data Collection, and Processing

The recruitment process began in September 2019 for the 2020 NYTS survey (CDC, 2020). The recruitment effort started by reaching out to o state departments of education and health of the targeted states. The notification proceeded from the state level, district, and school level. Thirty-four states were at the end of the project (CDC, 2020). The survey had 117 questions administered electronically (CDC, 2020). In 2020, the survey was collected electronically for the second time after the first collection in 2019 (CDC, 2020a). Compared to the paper-and-pencil (PAPI) used for the past eleven years, students were surveyed using tablets (CDC, 2020a). The surveys were implemented by investigators hired locally to ensure easy accessibility to the locations (CDC, 2020a). The data collector conducted the survey using a tablet, and each student, class, and school were given unique, random five digits codes (CDC,2020). According to CDC (2020), on the backend, the special code for each school and class allowed the researcher to track the result. These results were encrypted and transferred. Students who were absent on the day of the survey had their test administered via a web-based version (CDC, 2020a). The privacy of each student was maintained throughout the process. Likewise, parents were made aware of the involvement of their students (CDC, 2020a). The average length of the interview (LOI) was determined by calculating the average

time it took to interview the students that were interviewed via tablets and those interviewed with the web-based version (CDC, 2020a).

Additionally, to accommodate the outliers, they were removed. Of the 361 schools in 254 districts and 34 states, 49.9 % of the selected schools participated in the survey (CDC, 2020a). The decrease in the percentage of participation from previous years compared to this year was attributed to the pandemic (CDC, 2020a). When most cities closed on March 16th, 2020, due to the pandemic, the scheduled surveys to 74 schools were canceled. To accommodate the people who did not respond, the weights of the response and non-response weights were calculated to determine the average (CDC, 2020a). The non-response adjustment is important to obtain a result representing the population while eliminating bias (CDC, 2020a)

Parental Consent

Parental consent was required to participate. Some of the students need active consent, while others need passive consent. For passive consent, the parents who do not want their children to participate must return the form and indicate as such (CDC, 2020a). Other students whose parents do not return the form and indicate as such and students whose parents do not return the active consent will be deemed consenting (CDC, 2020a). Students who require active consent need to have approval or non-approval on file status on file (CDC, 2020a).

Instrument and Operationalization Constructs

The 2020 NYTS provided data on three leading indicators – short, intermediate, and long-term. These indicators provided input to key policy and social change initiatives

(CDC, 2020a). The 117 questions asked in 2020 targeted the following: tobacco relates beliefs, attitudes, and behavioral exposure to pro and anti-tobacco influences, with the target population being middle and high school students. The format of the questionnaire will be evaluated.

The NYTS 2020 Questionnaire

The questionnaire started with basic instructions regarding how to complete the survey. It also indicated that the entire process is voluntary and confidential. The first five questions were on demographics, and the instrument covered many variables, with sessions dedicated to various tobacco products. The questions explored tobacco products and devices used to smoke them: e-cigarettes, cigarettes, cigars, cigarillos, cigars, chewing tobacco, snuff, or dip, smoked tobacco in a hookah, and heated tobacco products or "heat-not-burn" tobacco products (CDC, 2020a). This last group produces vapor from tobacco sticks or capsules (CDC, 2020a). Some brands in this category include iQOS, glo, and Eclipse.

Data Collection

For this study, I analyzed the 2020 CDC NYTS dataset obtained from the IRB (Institutional Review Board) at Walden University, which granted permission to conduct this study (09-08-21-0427375). I obtained the dataset, which is publicly available from the CDC NYTS website (https://www.cdc.gov/tobacco/data_statistics/surveys/nyts/index.htm) to answer my research questions. The primary investigator has de-identified and weighted the dataset to ensure that the responses represented the community (CDC, 2020a). Responses for the

questions needed for the research questions were retained, while irrelevant questions were removed. The CDC NYTS dataset included a nationwide representative sample of middle school, junior high, and high school tobacco use.

Definition of Variables

Definition of Variables

Several variables were examined in the study, including sex, age, grade, ethnicity, and other variables in the form of questions. Some of the questions in this survey were used to answer the research questions. The following were used in answering the research questions. See Table 1 for the operational variables by original survey questions.

Dependent Variable

The dependent variables used for this study are as follows: Age of cigarettes initiation, Frequency of e-cigarette usage, E-cigarette usage,

Independent Variable

The independent variables for the study are as follows: Age of e-cigarette initiation, Access to vaping products, Exposure to advertisements.

Demographic Variables

Age of participants, sex, race, and grade are the demographic variables.

Table 1

Operational Variable by Survey Questions, Coding and Variable for 2020 National Youth Tobacco Survey

Demographics	**Survey Questions**	**Data Code**	**Variable type**
Age of participants	How old are you?	1= 9 years old	Confounding, scale
Age of e-cigarettes initiation	How old were you when you first used e-cigarettes, even once or twice	2=10 years old 3=11 years old 4=12 years old 5=12 years old 6=13 years old 7=14 years old	Independent scale
Age of cigarette initiation	How old were you when you first used a cigarette, even once or twice	8=15 years old 9=17 years old 10=18 years old 11=19 years old	Dependent scale
Sex of participants		1=Male 2=Female	Confounding, categorical
Grade		1=6th grade 2=7th grade 3=8th grade 4=9th grade 5=10th grade 6=11th grade 7=12th grade	Confounding ordinal
Race		American Indian or Alaska Asian Black African American Native Hawaiian or another Pacific Islander White	Confounding Nominal

Measurement and Scale of Variables

The independent and dependent variables were categorical and ordinal variables. The age of e-cigarettes initiation, an independent variable, ranges from ages 8 years to 18 years old. The age was converted from scale variable to ordinal through grouping. 8-12 years = 1 (younger adolescents), 13-15 years old-2 (mid-aged adolescents) and 16 plus= 3 (older adolescents). The age of e-cigarettes initiation, an independent variable, and the age of cigarette initiation, a dependent variable was also grouped as stated above and named AGegroupecig and AGEGroupCigarette, respectively. Thee-cigarettes users, a dependent variable dichotomous various, a nominal variable was coded "1" for Yes and "2 "for No. This is the same coding as the NYTS questionnaire.

The frequency of e-cigarettes uses a dependent variable and was formatted to a different variable of 5 ordinal categories: 1-5. The code "1" represented 1- 5 times, "2" represented the group of 6-10 times, "3" represented the group of 11-15 times, "4" represented the group 16-20 times and "5" represented the group of 21-30 times. Access to vaping products, an independent variable, was converted to become cumulative which will express the extent of access to vaping products. Each type of access was represented as "1". The highest score for access was 10 and the lowest was 1. Table 2 shows the original variables, the survey questions, original coding, and the types of variables.

Table 2

Operational Variable by Survey Questions, Coding and Variable for 2020 National Youth Tobacco Survey

Variables	Survey Questions	Coding	Types of variables
E-cigarettes users	Have you ever used an e-cigarettes, even once or twice?	0 = No 1 = Yes	Dependent Nominal
Frequency of e-cigarettes usage	During the past 30 days, on how many days did you use e-cigarettes?		Dependent Scale
Access to vaping products	During the past 30 days, where did you get or buy the e-cigarettes that used.	1-A gas station or convenience store 1-A grocery store 1-A drug store 1-A mall of shopping center kiosk/stand 1-On the internet 1-A vape store or other stores 1-Some other places other than those listed here 1-From a family member 1-From a friend 1-From other person that is not family or friend	Independent Nominal
Exposure to e-cigarettes Ad.	How often do you see The Ad of e-cigarettes	1- When you use the internet 1-When you read a newspaper or magazine, 1-When you go to the convenience store or supermarket, or gas station, 1-When you watch TV or streaming services 1-When you go on social media (such as YouTube, Instagram, Snapchat, Twitter or Facebook)	Independent

*1-one occurrence

Analysis of Data

The data was downloaded using excel format and PDF format. The excel format was converted to SPSS. The SPSS was used to analyze the data after it was re-coded. Ordinal and linear logistic regression will be used to utilize for data analysis. The research variables involve nominal dependent, categorical ordinal variables, and independent variables with more than two outcomes (Pampel, 2000). Research Question 1 was analyzed using two different variables created from two survey questions from NYTS –Q7 (How old were you when you first used e-cigarettes, even once or twice?) and Q23 (How old were you when you first smoked a cigarette, even one or two puffs?). AGEGroupCigarette is the variable for Q23 and AGegroupecig is the new variable for Q7. AGegroupecig is the independent, ordinal variable representing the age at which the age of e-cigarettes initiation. AGEGroupCigarette is a dependent variable representing the age of cigarette initiation. Research Question 1 was analyzed using ordinal logistic regression.

In analyzing Research Question 2, The Q15 and Q9 of the CDC NYTS dataset will be used.

Independent variable- "accessibility to vaping products," was assessed using the Survey the Q15-During the past 30 days (about 4.5 weeks), where did you get or buy the e-cigarettes that you have used? A. A gas station or convenience store; B. A grocery store; C. A drugstore; D. A mall or shopping center kiosk/stand E. On the Internet F. A vape shop or other store that only sells e-cigarettes, G. Some other place not listed here (Specify: _____); H. From a family member I. From a friend J.

From some other person that is not a family member or a friend (CDC, 2020b). Q15 has ten variables (15QA to 15QJ) based on the location where the participants obtained the e-cigarettes. These 10 variables were computed into a new variable "access". "Access," an ordinal variable, represented the extent of access, and the total number of various locations where the participant may obtain vaping products. Additionally, to effectively analyze the data, variables 15a-15j were recoded to same variable, while designating "0" for the participants who did not use e-cigarettes at all. The frequency of e-cigarettes was assessed using Survey Q9. During the past 30 days (about 4.5 weeks), how many days did you use e-cigarettes? Specify: |__|__| (Range 0 – 30) (CDC, 2020b). The variable Q9 was computed to another group variable "Freqgrp". 1-5 = "1", 6-10 = "2", 11-15 = 3, 16-20 = "4" and 21-30 = "5". The variable was converted to groups for effective analysis. The new variable categorical, ordinal variables, and Freqgrp" and "Access" will be analyzed using Ordinal regression.

Research Question 3: What is the association between the exposure to ads of e-cigarettes and the of e-cigarettes use by adolescents? For Research Questions 3 the independent variable is "the exposure to ads". This independent variable will be represented by combining the outcome of Qs 102, 103, 104,105, and 106 surveys on SPSS to a a new variable, "Ad exposure"

Q102-When you are using the Internet, how often do you see ads or promotions for e-cigarettes? (CDC, 2020b). Q103. When you read newspapers or magazines, how often do you see ads or promotions for e-cigarettes? (CDC, 2020b). Q104. When you go to a convenience store, supermarket, or gas station, how often do you see ads or promotions

for e-cigarettes? (CDC, 2020b). Q105- When you watch T.V. or streaming services (such as Netflix, Hulu, or Amazon Prime), or go to the movies, how often do you see ads or promotions for e-cigarettes? (CDC, 2020b). The options for questions 100 to 106 are as follows: (a)I do not use the Internet, (b). Never (c) Rarely (d) Sometimes (e) Most of the time, (f) Always (CDC, 2020b). The dependent variable for Research Question 3 is "The use of e-cigarettes" It will be answered by Q6. Have you ever used e-cigarettes, even once or twice? (a)Yes, (b). No (CDC, 2020b). For research question 3, the independent variable, "Adexposure", categorical variables, while the dependent variable is a dichotomous variable with a "*Yes*" or "*No"* response. Binary logistic regression was used to analyze this question. To prepare for the analyses, the variables were assigned labels and values as indicated in the code book and as stated above.

Table3 indicated below shows independent and dependent variables and their value.

According to Frey (2018), logistic regression is used to analyze the association between one dependent variable and one or several independent or predictor variables. The analysis determined if the age of initiation of e-cigarettes (predictor) can be associated with the age when adolescents from New York first smoked a cigarette (outcome) (CDC, 2020b). Table 4 shows the re-coding for independent and dependent variables. The ages from 8 to 19 years were re-coded as stated in Table 4. The ages of the participants ranged from 9 years old to 19 years old. In the original datasets, the ages were represented with 1-11. For this study, the ages were grouped into 3 categories- younger adolescents, mid-aged adolescents, and older adolescents. To obtain an accurate analysis, the variable of access was treated as a cumulative number as shown in Table 4.

Table 3

Research Questions, Independent and Dependent variables

Research Questions	Label	Variables combined	Variable Type
Research Question 1 What is the association between the age of initiation of the use of e-cigarettes and the age when adolescents from New York adolescents first smoked a cigarette?	Grouped age e-cigarettes initiation	1- younger adolescents (9 - 12 years old) 2- mid-aged adolescents (13- 15 years old) 3- older adolescents (16 plus years)	Independent variable, Ordinal
	Grouped age of cigarette initiation	1- younger adolescents (9 - 12 years old) 2- mid-aged adolescents (13- 15 years old) 3- older adolescents (16 plus years)	Dependent variable, Ordinal
Research Question 2 What is the association between the accessibility to vaping products and the frequency of e-cigarettes used by adolescents?	Cumulative Access to vaping product	Q15A to Q15J	Independent Variable, Scale
	Frequency of e-cigarettes usage	During the past 30 days, on how many days did you use e-cigarettes?	Dependent Scale
Research Question 2 What is the association between the exposure to ads of e-cigarettes and their use by adolescents?	Extent of Exposure to Ad	Q102 - Q106	Independent variable, scale
	E-cigarettes users	Have you ever used an e-cigarettes, even once or twice?	Dependent variable, Categorical

The data relating to age were re-coded as reflected in Table 4.

Table 4

List of Variables that were Recoded

Variables	
Original Variable	Recoded variables
Age of cigarettes initiation (Dependent Variable)	
1= 9 years old 2=10 years old 3=11 years old 4=12 years old 5=12 years old 6=13 years old 7=14 years old 8=15 years old 9=17 years old 10=18 years old 11=19 years old	1 = 8 - 12 (younger adolescents) 2 = 13 - 15(mid-age adolescent) 3 = 16+ (older adolescent)
Frequency of e-cigarettes use (Dependent Variable)	
1-30 occurrences	1 = 1 – 5 2 = 6-10 3= 11- 15 4= 16- 20 5= 21- 30
Exposure of e-cigarettes ads (Independent variable)	
1. When you read a newspaper or magazine, 1-Do you often see ads or promotions for e-cigarettes? 1-When you go to the convenience store or supermarket, or gas station, how often do you see ads or promotions for e- cigarettes? 1-When you watch TV or streaming services 1-How often do you see posts related to e-cigarettes 1-When you go on social media (such as YouTube, Instagram, Twitter, Snapchat or Facebook	1 exposure 2 exposures 3 exposures 4 exposures 5 exposures 6 exposures

Table 4

Lists of Variables that were re-coded

Variables	
During the past 30 days, where did you get e-cigarettes that you used? Access to vaping products	
Original Variable	Recoded variables
1-A grocery store	1 access point
1-A drug store	2 access point 3 access points
1-A mall of shopping center kiosk	4 access points
1-On the internet	5 access points
1-A vape store or other stores	6 access points
1-Some other places other than those listed here	7 access points
1-From a family member	8 access points
1-From a friend	9 access points
1-From other person that is not family or friend	10 access points
1-From other person that is not family or friend	
Demographic Variable	
Age	
1= 9 years old 2=10 years old 3=11 years old 4=12 years old 5=12 years old 6=13 years old 7=14 years old 8=15 years old 9=17 years old 10=18 years old 11=19 years old	1 = 8 - 12 (younger adolescents) 2 = 13 - 15(mid-age adolescent) 3 = 16+ (older adolescent)
1- White 2 = Black/African American 3 = Asian 4 = Hispanic/Latino 5 = American Indian/Alaska Native 6 = Native Hawaiian/ Pacific Islander	1 = White 2 = Black/African American 3 = Others

Threat of Validity

The survey was self-directed, and this may affect the validity of results. In addition to the self-directed nature of the survey, the reduced number of respondents from 89.4% in 2019 (CDC, 2019) to 49.7 % in 2020 due to the pandemic was a threat to the validity of the survey (CDC, 2020b). Some of the communities in the schools or classes opted out. The reduction in the number of participants had a negative effect on the ability of the survey to represent the population of interest (CDC, 2020b). To reduce the possibility of the participants falling into a socially acceptable response, participants were made aware that the record of their personnel information will not be kept (CDC, 2020b). Furthermore, to ensure that the sample of the participants is a true representation of the population, the participants were randomly selected from the school and the community sample size was weighted (CDC, 2020b)

Summary

In Chapter 3, I described the proposed methodology and research design for the 2020 NYTS data collected and publicly owned by CDC. I conducted a non-experimental, cross-sectional study using the NYTS data. The inquiry is guided by sample size and the recruitment process of the original data collection. I used the study analysis to answer the research question, which will provide information that will impact social change through policy making. In chapter 4, I analyzed the dataset based on each research question and presented the results.

Chapter 4: Results

There is an increase in the use of e-cigarettes among adolescents in the United States of America and specifically in New York. This increase has been attributed to aggressive marketing by the vaping industry (Evan-Polce et al., 2020). Furthermore, little is known regarding the effect of vaping on adolescents. In addition, the increased rate of usage and early initiation of e-cigarette use among adolescents is threatening several decades of success against tobacco use. This quantitative study assessed the association between the age of initiation of e-cigarettes use and the use of cigarettes in adolescents. Furthermore, the quantitative study explored the extent of the association between the accessibility of vaping products and the frequency of their usage. I performed a secondary quantitative analysis study to address the research questions and hypotheses, using the CDC TS 2020 dataset.

Research Question(s)

Research Question 1: What is the association between the age of initiation of e-cigarette use and the age of use of cigarettes by adolescents?

$H_0$1: There is no association between the age of initiation of e-cigarettes and the use of cigarettes by adolescents.

H_a1: There is a association between early initiation of e-cigarettes and the use of cigarettes by adolescents.

Research Question 2: What is the association between the accessibility to vaping products and the frequency of e-cigarettes used by adolescents?

$H_0$2: There is no association between the accessibility to vaping products and the frequency of e-cigarettes usage in adolescents.

H_a2: There is an association between accessibility to vaping products and the frequency of e-cigarettes used in adolescents.

Research Question 3: What is the association between the exposure to the advertisement of e-cigarettes and their use by adolescents?

$H_0$3: There is no association between the exposure to the advertisement of e-cigarette and its use by adolescents.

H_a3: There is a association between the exposure to the advertisement of e-cigarette and its use by adolescents.

Data Collection

A total of 14,531 adolescents completed the CDC NYTS in 2020. Out of 14,531 responses, it was noted that some participants omitted some questions. Thirty-nine participants did not provide an answer for sex; 25 participants did not answer the question, of whether they have ever smoked e-cigarettes. Recruitment was done through the department of education nationwide. The notification process moved from state to district and city levels, while targeting students in middle and high schools (Grades 6 to 12). There were 34 schools selected across the country, but only 49% of the schools selected participated. Each student participated in person at their school with the assigned investigator. A total of 117 questions were answered by each student. Chapter 3 details the steps involved in the data collection. The targeted population consisted of 14,561 students from ages 9-19 from 34 states across the United States.

Data Cleaning

The data were entered into IBM SPSS 27 to be analyzed. The data were screened for missing data and outliers. The data were then screened for any missing data and outliers using a frequency distribution procedure. While screening the data, it was discovered that among the 14531 participants only 25.6% responded as using e-cigarettes. The data was then reviewed to ensure it was coded correctly.

Descriptive Statistics

Tables 5 show demographic data of participants. The total number of participants included in the study was 14,531 adolescents with 50.5 % being female (see Table 5).

Table 5

Sex of Participants from 2020 NYTS

	Sex	Frequency of participants	Percentage
	Male	7,153	49.2
	Female	7,339	50.5
Total		14,531	100.0

The races were as follows; White- 9,391 (64.63%), Black Africans/Americans -2,472 (17.01%), others which included American Indians and Alaska, Asian, Native Hawaiian or other Islanders were 18.93% of the population surveyed (See Table 6).

Table 6

Descriptive Statistics of Race NYTS

Race	Number	Percentage
White	9,391	64.63
Black African American	2,472	17.01
others	2,668	18.36
Total	14,531	100

Table 7 shows the descriptive statistics of the age group: young adolescents, mid-age adolescents, and older adolescents, 24.1 % were younger adolescents, 43.6 % were mid-age adolescents, and 32.3 % were older- adolescents. There were more adolescents between the ages of 13 and 15 that participated in the survey. Table 8 shows the original ages of the participants and their frequency and percentages. The ages of the participants range from 9 years old to 19 years. The highest number of participants was 13 years old (Table 8).

Table 7

Descriptive Statistics of Group- Age of participants

	Age Group	Frequency	Percent
	young adolescents	3,495	24.1
	mid-age adolescents	6,329	43.6
	older adolescents	4,677	32.2
Total		14,531	100.0

Table 8

Demographic Age by percentage of Participants

	Age	Frequency	Percent (%)
	9 years old	25	0.2
	10 years old	17	0.1
	11 years old	1,146	7.9
	12 years old	2,307	15.9
	13 years old	2,346	16.1
	14 years old	2,101	14.5
	15 years old	1,882	13.0
	16 years old	1,920	13.2
	17 years old	1,781	12.3
	18 years old	913	6.3
	19 years old	63	0.4
Total		14,531	100.0

Table 9 shows the grade of the participants, the largest number of the participants were in 6th and 7th grades. Participants were from grades 6 to grade 12.

Table 9

Demographic Grades of Participants by Percentage

	Grades	Frequency	Percent
	6th grade	2,352	16.2
	7th grade	2,354	16.2
	8th grade	2,336	16.1
	9th grade	1,966	13.5
	10th grade	1,882	13.0
	11th grade	1,799	12.4
	12th grade	1,806	12.4
	Ungraded or other grades	20	0.1
Total		14,531	100.0

Table 10 presents the descriptive statistics of ages in groups of when participants initiated the use of cigarettes and e-cigarettes. 37% of participants started the use of cigarettes when they were mid-aged adolescents, and 44.9 % of the same age group initiated the use of e-cigarettes. The descriptive data showed that the mid-aged adolescents (13-15) used more e-cigarettes and cigarettes at that age than other categories of adolescents. Out of the young adolescents, 10% answered that they use e-cigarettes at that age, while 28.9% of the same age group use cigarettes. Table 11 presents the response regarding e-cigarette use. It showed that 25.6 713) of the participants responded to having used e-cigarettes while 74.3% responded to never using e-cigarettes.

Table 10

Descriptive Statistics of Age and Cigarette Initiation and the Age of E-cigarettes Initiation

Variables	Age group	Frequency	Percentage
Age of cigarettes initiation	Young adolescents	477	28.9
	mid-aged adolescents	622	37.7
	older adolescents	550	33.3
		1,649	100.0
Age of e-cigarettes initiation	Young adolescents	366	9.9
	mid-aged adolescents	1,657	45.1
	older adolescents	1,647	44.8
Total		3,670	100

Table 11

Descriptive Statistics of E-cigarettes Users

		Frequency	Percent
	Yes, use e-cigarettes	3,713	25.6
	No, never use e-cigarettes	10,793	74.3
Total		14,531	100

Table 12 showed the extent to which the participants have access to vaping products. Most participants have 1 to 3 occurrences. Table 13 showed the extent of e-cigarette advertisement exposure to adolescents. There was a minimum of 5 exposure expressed and a maximum of 30 exposure to e-cigarettes ad.

Table 12

Descriptive Statistics of Extent of Access to vaping products

Number of Occurrence	Frequency	Percent
1.00	151	1.0
2.00	96	0.7
3.00	50	0.3
4.00	22	0.2
5.00	15	0.1
6.00	7	0.0
7.00	3	0.0
8.00	2	0.0
9.00	2	0.0
10.00	6	0.0

Table 13

Descriptive Statistics of Participant's Exposure to E-cigarettes Advertisement

Extent of exposure (Occurrence)	Frequency	Percent
5.00	84	0.6
6.00	14	0.1
7.00	37	0.3
8.00	178	1.2
9.00	453	3.1
10.00	1,073	7.4
11.00	873	6.0
12.00	950	6.5
13.00	1,110	7.6
14.00	1,193	8.2
15.00	1,424	9.8
16.00	1,183	8.1
17.00	979	6.7
18.00	915	6.3
19.00	785	5.4
20.00	765	5.3
21.00	480	3.3
22.00	317	2.2
23.00	243	1.7

Table 13

Descriptive Statistics of Participant's Exposure to E-cigarettes Advertisement

Extent of exposure (Occurrence)	Frequency	Percent
24.00	166	1.1
25.00	156	1.1
26.00	83	0.6
27.00	56	0.4
28.00	28	0.2
29.00	21	0.1
30.00	134	0.9

Bivariate Analysis

A bivariate analysis was conducted between the demographic variable and the independent variables and newly created variable grouped age. See table 15

The output showed that there is a significant difference between the grouped age of participants and the age of e-cigarette initiation ($p<.001$). Further analysis will be needed through regression analysis to determine where the significance lies within the age categories. Table 15 shows the Pearson Chi-Square test between the grouped age of e-cigarettes and cigarette initiation; access and frequency to e-cigarette; Exposure to advertisement and e-cigarettes users. There was a significant association between the grouped age and the e-cigarettes users ($p <.001$). There is also a significant association between access to e-cigarettes and frequency of e-cigarettes usage; exposure to advertisement and e-cigarettes users with $p < .001$.

Table 14

*Pearson Chi- Square Test Between Age of e-cigarettes and cigarette initiation; access and frequency to e-cigarette; Exposure to advertisement * E-cigarettes users*

	X^2	df	Asymptotic Significance(2-sided)
Group (Age of e-cigarettes initiation) * Group (Age of cigarette initiation)	623.477a	4	<.001
Access to e-cigarettes * Frequency of e-cigarettes usage	158.154a	225	<.001
Exposure to advertisement * E-cigarettes users	543.171a	25	<.001

Table 15

Pearson Chi- Square Test between Grouped Aged, E-cigarettes users, Exposure to Advertisements, Access to E-cigarettes and Grouped Age of E-cigarettes Initiation.

	X^2	df	Asymptotic Significance (2-sided)
Group -Age of participants * E-cigarettes users	1,663.890 a	2	<.001
Group -Age of participants * Exposure to advertisement	668.523a	2	<.001
Group -Age of participants * Access to e-cigarettes	51.103a	18	<.001
Group -Age of participants * Group (Age of cigarette initiation)	639.041a	4	<.001
Group- Age of participants * Group (Age of e-cigarettes initiation)	1,939.520 a	4	<.001

Table 16 showed the Chi-test between sex and grouped age, e-cigarettes users, exposure to advertisements, access to a-cigarettes, and grouped age of e-cigarettes initiation. There was no significant association between sex and the use of e-cigarettes (p = 0.431), while there was a significant association between sex and exposure to advertisement and age of e-cigarette initiation and age of cigarette initiation (p< .001). Additionally, there was an association between sex and access to e-cigarettes (p=0.045), and there was no significant association between sex and grouped age of participants (p = 0.235).

Table 16

Pearson Chi- Square Test Between Sex, Grouped Aged, E-cigarettes users, Exposure to Advertisements, Access to E-cigarettes and Grouped Age of E-cigarettes Initiation.

	X^2	df	Asymptotic Significance (2-sided)
Sex * E-cigarettes users	.620a	1	0.431
Sex * Exposure to advertisement	210.247a	25	<.001
Sex * Access to e-cigarettes	17.228a	9	0.045
Sex * Group (Age of cigarette initiation)	12.388a	12888	<.001
Sex * Group (Age of e-cigarettes initiation)	17.903a	2	0.002
Sex * Group -Age of participants	2.893a	2	0.235

Table 17 showed the association between race, Pearson Chi-Square Test between race, e-cigarettes users, exposure to advertisements, Access to e-cigarettes, Group age of participants, Group-Aged of cigarette initiation, and e-cigarette users. There was a significant association between race and all these variables with p <.001The variables need to be further analyzed to determine the level of the association.

Table 17

Pearson Chi- Square Test between dependent and independent variables (Race, e-cigarettes users, Exposure to Advertisement, Access to e-cigarettes, Group age of participants, Group-Aged of Cigarettes Initiation and E-cigarettes users).

	X^2	df	Asymptotic Significance (2-sided)	Percent
Race * E-cigarettes users	307.723a	31	<.001	100.0%
Race * Exposure to advertisement	1,536.621a	750	<.001	100.0%
Race * Access to e-cigarettes	243.366a	126	<.001	100.0%
Race * Group -Age of participants	354.796a	62	<.001	100.0%
Race * Group (Age of cigarette initiation)	135.674a	48	<.001	100.0%
Race * Group (Age of e-cigarettes initiation)	136.525a	56	<.001	100.0%
Race * E-cigarettes users	1,663.890a	2	<.001	

Assumptions

Ordinal Regression-

The other analysis used for this study was ordinal regression. For ordinal regression, the assumption to be met is as follows:

1. Ordinal regression has a major assumption of proportional odds.

2. The effect of any explanatory variable is consistent or proportional across the different thresholds or the explanatory variables have the same effects on the odds regardless of the threshold.

Binary Regression -

According to Saida-Fatah and Ali-Alkaki (2021), binary regression is the appropriate tool to use to determine statistically significant predictor variables such as age and sex. The model analyzed nominal dependent variables and group of independent variables (continuous or categorical variables) In my research, the extent to which accessibility e-cigarettes can influence the use of cigarettes. Binary regression measures the association between a binary response with 2 categories and a set of predictors' variables. In the analysis of binary data (dichotomous) researchers often use binary logistic regression (Saida-Fatah & Ali-Alkaki (2021). In Research Question 3, the dependent variables represent (the use of e-cigarettes) and the non-usage of e-cigarettes.

Statistical Analysis

Research Question 1-Ordinal Regression

The first research question examined the association between the age of initiation of e-cigarettes use and the age of use of cigarettes by adolescents. The independent variable for this test was the age of initiation of e-cigarettes products, and the dependent variable was the age of initiation of cigarettes. Table 18 shows the statistical frequency of distribution of predictor and outcome. The outcome and the predictor variables are in 3 groups: young adolescents, mid-aged adolescents, and older adolescents. Table 18 indicated that the outcome variable, age of cigarette initiation, had the following: 24.7%

of the adolescents were young adolescents (9 to 11 years old), 37.6% were mid-aged adolescents (12 to 15 years old, and older adolescents were 37.7%. Additionally, Table 18 showed the outcome variables that young adolescents at 15.2%, mid-aged adolescents 45.9% and older adolescents at 38.9%). Both predictor and outcome variables are ordinal-ages ranging from 8 years old to 18 years old. The dataset was analyzed using Ordinal Logistic Regression (OLR). Table 18 shows the correlation between the dependent variables and the independent variables. The case summary table indicated that more adolescents initiated using e-cigarettes than mid-aged adolescents (45.9%) compared to 15.2% of young adolescents and 38.9 % of older adolescents initiating the use of e-cigarettes. However, this major difference in the percentage of the age of e-cigarettes initiation is not reflected in the outcome variable, the use of cigarette use.

Table 18

Ordinal Regression Case Processing Summary Group age of Cigarette Initiation and Group Age of E-cigarettes Initiation

		N	Marginal Percentage
Group (Age of cigarette initiation)	young adolescents	305	24.7%
	mid-aged adolescents	463	37.6%
	older adolescents	465	37.7%
Group (Age of e-cigarettes initiation)	young adolescents	187	15.2%
	mid-aged adolescents	566	45.9%
	older adolescents	480	38.9%
Total		14,531	

Table 19 presented the model comparison between the group age of e-cigarette (predictor) initiation and group age of cigarette initiation (outcome). A significant

improvement was observed from the final model compared to the null model with no predictor variable. This means that there is a significant association (p =<.001) between the predictor variable (age of e-cigarette initiation) and the outcome variable (age of cigarettes initiation)- $X^2(2)$, 554.406.

Table 19

Ordinal Regression Model of Fitting Information Summary Group Age of Cigarette Initiation and Group Age of E-cigarettes Initiation

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	613.855			
Final	59.449	554.406	2	<.001

Link function: Logit.

Table 20 indicates the fit of the overall model, showing whether the independent variable fits the dependent variable. In Table 20, the result of statistical significance indicated the possibility that there were other variables that were not considered that may have affected the outcome. The goodness of fitness would have been insignificant (more than .05) if the outcome (age of cigarette initiation) occurred only because of the predictor variable – the age of e-cigarette initiation. The Pseudo R square as presented in Table 21 shows the amount of the variance in the age of cigarette initiation and how it is explained by the age of e-cigarettes. The measure of Nagelkerke indicates that 40.9 % of the variance in the outcome variable (grouped age of cigarette initiation) can be explained by the predictor variable (group age of e-cigarette initiation) (Table 21)

Table 20

Ordinal Regression -Goodness-of -fit for Group age of Cigarette Initiation and Group Age of E-cigarettes Initiation

	Chi-Square	df	Sig.
Pearson	29.060	2	001
Deviance	26.048	2	<.001

Table 21

Pseudo R square Summary Group age of Cigarette Initiation and Group Age of E-cigarettes Initiation

Cox and Snell	0.362	
Nagelkerke	0.409	
McFadden		0.20

Link function: Logit.

Table 22 shows the parameter estimate between Group age of cigarette initiation and group age of e-cigarettes initiation. It was found that there was a significant association based on the age at which the student initiated the use of e-cigarettes and when they first used cigarettes. The significance was evident in all age groups 1 to 3 (younger adolescents, mid-aged adolescents, and older adolescents) with $p< 0.01$. The threshold estimates of –3.129 in young adolescents (group 1) indicated a lesser influence compared to middle–aged (group 2) adolescents with a threshold of – 0.824. One can

reject the null hypothesis that there is no association between the age of initiation of e-cigarettes and the use of cigarettes by adolescents.

Table 22

Parameters of Estimate Group age of Cigarette Initiation and Group Age of E-cigarettes Initiation

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[AGEGroupCigarette = 1.00]	-3.129	0.136	532.602	1	<.001	-3.395	-2.864
	[AGEGroupCigarette = 2.00]	-0.824	0.099	69.920	1	<.001	-1.017	-0.631
Location	[AGegroupecig=1.00]	-4.373	0.220	395.710	1	<.001	-4.803	-3.942
	[AGegroupecig=2.00]	-2.000	0.134	221.610	1	<.001	-2.263	-1.737
	[AGegroupecig=3.00]	0a			0			

Link function: Logit.

Research Question 2- Applying Ordinal Regression

Research question 2 explored the extent of the association between accessibility to vaping products and the frequency of e-cigarettes used by adolescents. Ordinal regression was used to analyze the association between the dependent variables frequency of e-cigarette use and the covariate access to vaping products. The frequency of the use of e-cigarettes within the past 30 days was grouped into 5 categories. Group 1(1-5 times

within 30 days), Group 2 (6-10 times within 30 days), Group 3 (11-15 times within 30 days), Group 4 (16-20 times 30 days), and Group 5 (21-30 times within 30 days)

Table 23 indicates the case processing summary of the predictor and the outcome variables. The cumulative frequency adolescents access vaping products is categorized into groups in Table 23. Access to vaping products is the access points and various locations at which they get these products. Group 1 indicates the category that uses e-cigarettes 1-5 times within 30 days (about 4.5 weeks). This group of adolescents accounted for 26.0 % of the targeted population. Group 2 indicates the category that uses e-cigarettes 6 –10 times within 30 days (about 4.5 weeks). This group of adolescents accounted for 9.9% of the targeted population. Group 3 indicates the category that uses e-cigarettes 11 - 15 times within 30 days. This group of adolescents accounted for 7.9% of the targeted population. Group 4 indicates the category that uses e-cigarettes 16 - 20 times within 30 days. This group of adolescents accounted for 6.8% of the targeted population. Group 5 represented the category 21 - 30 times within a 30-day period. This group of adolescents accounted for 49.4% of the targeted population.

The access to vaping products was expressed based on the locations where vaping products can be obtained, as displayed in Table 23. Among the adolescents surveyed, 42.7% of them had one (1) access point to buy vaping products, 27.1% of the targeted population had two access-point to buy vaping products. There were 14.1% of the

Table 23

Ordinal Regression Case Processing Summary of Frequency Group and Access to vaping Products

		N	Percentage
Frequency group	Group 1(1-5)	92	26.0%
	Group 2 (6-10)	35	9.9%
	Group 3(11-15)	28	7.9%
	Group 4 (16-20)	24	6.8%
	Group 5 (21-30)	175	49.4%
Access to vaping products	1.00	151	42.7%
	2.00	96	27.1%
	3.00	50	14.1%
	4.00	22	6.2%
	5.00	15	4.2%
	6.00	7	2.0%
	7.00	3	0.8%
	8.00	2	0.6%
	9.00	2	0.6%
	10.00	6	1.7%
Missing		14,177	
Total		14,531	

The targeted population had three access points to buy vaping products, and 6.2% of the targeted population had four access points to buy vaping products. 42% and 2.0% had 5 and 6 access points, respectively. The percentages for adolescents that had 7, 8, 9 and 10 access points were as follows: 0.8%, 0.6%, 0.6% and 1.7%. The increase in access points provided more opportunity to buy vaping products.

Table 24 presented the ordinal regression goodness of fit summary. There is no significant improvement observed from the final model compared to the null model with no predictor variable. This means that there is no significant association ($p = 0.142$) between

predictor variables (the access to e-vaping product) and the outcome variable (the frequency of e-cigarettes use). Looking at Table 25, the Nagelkerke, $R^{2=}$ 0.040, indicated that 0.4% of the result of the frequency of e-cigarettes use is influenced by the access to vaping products. Indicating that there may be another factor that is influencing the outcome.

Table 24

Ordinal Regression -Goodness of Fit Summary of Frequency Group and Access to vaping Products

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	101.182			
Final	87.694	13.488	9	0.142
Link function: Logit.				

.

Table 25

Pseudo square for of Frequency Group and Access to vaping Products

Model	Results
Cox and Snell	0.037
Nagelkerke	0.040
McFadden	0.015

The parameters of estimates, as indicated in Table 26 show the interaction between the frequency of e-cigarettes usage and access to vaping products. In group 1 (1-5 times in 30 days), there is a significant association of p=0.037. Indicating an association between access to vaping products and the adolescents that vape 1 to 5 times in a 30-day period. In groups 2, group 3, and group 4, adolescents who vape 6-10 times, 11-15 times, 16- 20 times, and 21 – 30 times in 30 days respectfully did not show any significant

association to access to vaping products. Therefore, the null hypothesis stands that there is no association between the accessibility to vaping products and the frequency of e-cigarettes usage in adolescents.

Table 26

Ordinal Regression: Parameters of Estimate of Frequency of use and Access to Vaping Products

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[Freqgrp = 1.00]	-1.759	0.845	4.329	1	0.037	-3.415	-0.102
	[Freqgrp = 2.00]	-1.284	0.843	2.321	1	0.128	-2.936	0.368
	[Freqgrp = 3.00]	-0.946	0.842	1.264	1	0.261	-2.596	0.704
	[Freqgrp = 4.00]	-0.667	0.841	0.629	1	0.428	-2.315	0.981
Location	[Access =1.00]	-0.781	0.854	0.835	1	0.361	-2.455	0.894
	[Access =2.00]	-0.914	0.862	1.124	1	0.289	-2.603	0.775
	[Access =3.00]	-0.585	0.882	0.439	1	0.507	-2.314	1.144
	[Access =4.00]	-0.405	0.936	0.188	1	0.665	-2.239	1.429
	[Access =5.00]	-0.334	0.979	0.116	1	0.733	-2.253	1.585
	[Access =6.00]	-0.822	1.093	0.566	1	0.452	-2.966	1.321
	[Access =7.00]	19.322	<.001		1		19.322	19.322
	[Access =8.00]	19.322	<.001		1		19.322	19.322
	[Access =9.00]	19.322	<.001		1		19.322	19.322
	[Access =10.00]	0a			0			

RESEARCH QUESTION3- Binary Logistic Regression

Research question 3 focused on the association between the exposure to ads of e-cigarettes and its use by adolescents. The predictor variable is the exposure to ads and the outcome is the use of e-cigarettes, a dichotomous variable. Binary logistic regression was applied to analyze the variables. Table 27 shows statistical significance, and it indicates that model fits properly. Therefore, the null hypothesis that states that there is no association between the exposure to the advertisement of e-cigarettes and its use by adolescents can be rejected. The logistic regression model was statistically significant, $\chi 2$ (1) = 406.664, $p < 0.01$. So, our new model is significantly better than the model without predictor variables. The model in Table 28 explained 4.0% (Nagelkerke R^2) of the variance in exposure to ad of vaping products. The specificity of 1.6% and the sensitivity of 99.0%.

Table 27

Binary Logistic Regression -Omnibus Test of Model Coefficient for E-cigarette users and Exposure to E-cigarettes Ad.

		Chi-square	df	Sig.
Step 1	Step	406.664	1	<.001
	Block	406.664	1	<.001
	Model	406.664	1	<.001

Table 28

Binary Logistic Regression Model Summary for E-cigarette users and Exposure to E-cigarettes Ad.

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	14809.538a	0.029	0.044

Table 29

Classification Table

Observed			Predicted		
			E-cigarettes users		Percentage Correct
			Yes, use e-cigarettes	No, never use e-cigarettes	
Step 1	E-cigarettes users	Yes, use e-cigarettes	53	3,289	1.6
		No, never use e-cigarettes	102	10,244	99.0
	Overall Percentage				75.2

Overall, adolescents who have increased exposure to ads of e-cigarettes were 0.914 more likely to use e-cigarettes. There is a 0.914 change in the odds of an individual using e-cigarettes for every one-unit increment of exposure to ad. The more types of ad exposure that an adolescent has the higher the possibility of using e-cigarettes.

Table 30

Binary Regression Variable of Equation for E-cigarette users and Exposure to E-cigarettes Ad.

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1a	Exposure to ads	-0.090	0.004	398.823	1	<.001	0.914
	Constant	2.559	0.076	1132.200	1	<.001	12.928

Summary

Regression analysis was used to analyze the three research questions. For Research Questions 1, and 2, ordinal logistic regression was used, and binary logistic regression was used for Research Question 3. Research Question 1 was answered by 8.4% of the participants and it showed an association between the age of e-cigarettes initiation and the future use of e-cigarettes, p=<.001. The age at which an adolescent starts to use e-cigarettes affects the age at which they use cigarettes. E-cigarette initiations increased with age and the earlier an adolescent starts to use e-cigarettes the earlier they were found to use cigarettes. Therefore, the null hypothesis can be rejected that says there is no association between the age of initiation of e-cigarettes and the use of cigarettes by adolescents. The analysis of the data in Research Question 2 revealed no statistical significance or association between accessibility to vaping products and the frequency of e-cigarettes usage in adolescents. Therefore, the null hypothesis that states "there is no association between the accessibility to vaping products and the frequency of e-cigarettes usage in adolescents was accepted. The data in Research Question 3 were analyzed using binary logistic regression. The result revealed an association between the exposures to e-cigarettes. Therefore, the null hypothesis that states "There is no significant association between the exposure to e-cigarettes advert and its use in adolescents" was rejected. Furthermore, the bivariate analysis revealed no statistical significance between the age of e-cigarettes initiation and exposure to e-cigarettes adverts. The age of an adolescent did not determine whether the ne e-cigarettes. Additionally, the frequency of e-cigarettes use is not associated with exposure to e-cigarettes ads.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

This study aimed to examine the use of e-cigarettes in adolescents ages 9 to 18 years old in grades 6 to 12. A quantitative analysis of data from NYTS was conducted to get a clearer understanding of what influenced the increase in e-cigarettes usage among adolescents. Regression analysis was applied to determine the statistical relationship between the predictor variable and the outcome. Three research questions were used to explore the topics. Research Question 1 focused on the association between the age of e-cigarettes initiation and cigarette initiation. Research Question 2 focused on the association of exposure to ads and the frequency of the use of e-cigarettes in adolescents within the last 30 days. Research Question 3 dealt with the association between access to vaping products and the use of e-cigarettes in adolescents. The result found compelling evidence that there is a connection between the age at which adolescents start to vape and the age at which they use cigarettes. The findings revealed a strong association adolescent who vape and early initiation of cigarettes, which raises questions and concerns within this population.

Research Question 1 focuses on the association between the age of e-cigarettes initiation and cigarette initiation. The analysis showed statistically significant findings in all age groups with $p = .001$. The case summary revealed only 1,233 adolescents out of 14,531 participants answered the question. Among the adolescents that responded to the questions, the largest population that admitted to early initiation of e-cigarettes were the mid-age adolescents. They accounted for 45.9% of adolescents who responded to the

questions. However, 37.7% of older adolescents-initiated e-cigarettes at that age, while 37.6% of older adolescents who smoked e-cigarettes used cigarettes later.

Interpretation of Findings

Access to Vaping Products

The analysis of the variables in Research Question 2 revealed no significant association between access to vaping products and the frequency of adolescent e-cigarettes usage. Seven access points were evaluated in the survey questions. Any adolescent with access to a location recorded one point for each access. There was a minimum of 5 access points and a total of 30, revealing that most adolescents have more than one means of accessing vaping products. Regardless of the number of access points or the extent of the access, there was no significant association between the ability of the teenager to access vaping products and how often they vape within a 30 days period. In evaluating the association between access to vaping products and the frequency at which an adolescent vapes within 30 days (about 4.5 weeks), I discovered no statistical significance. However, there is a progression in the threshold pattern (Table 22) when the predictors interact with the outcome. The group 4 adolescents (21-30) displayed the highest threshold at 0.667. The other groups are as follows; groups 3, 2, 1 were –1.0, -1.284, and –1.759, respectively. Adolescents who vape more frequently have a higher threshold than those who do not.

Exposure to E-cigarettes Ads

The adolescent spent countless hours on social media and online platforms. The lack of federal regulations that can restrict the use of e-cigarettes is of great concern.

After analyzing the data using Binary logistic regression, it was discovered that there is a significant association between the e-cigarette's usage within 30 days and the exposure to e-cigarettes ad. The exposure to e-cigarettes ads was evaluated by asking adolescents if they were exposed to advertisements of e-cigarettes at the following locations: When you read a newspaper or magazine, when you go to the convenience store or supermarket, gas station, and when you watch TV or streaming services. Each exposure was counted as one encounter, and the extent of exposure was added as a cumulative point. The analysis revealed no association between how much exposure each adolescent had and their use of e-cigarettes. The exposure to e-cigarettes ads affects the use of e-cigarettes. The logistic regression model was statistically significant, $\chi 2\ (1) = 406.664$, $p < 0.001$.

Use of E-cigarettes

There was a statistically significant association between the age of e-cigarettes initiation and the use of e-cigarettes. However, this association explains only 40.9% of the occurrences. Other factors that are responsible for 59.1% were not considered in my analysis. Future research questions should explore these areas. The age at which adolescents start to use e-cigarettes influences their future cigarette use. The study revealed that a strong association occurs between e-cigarettes and cigarettes. Still, it also showed how this association is related to the age at which an adolescent starts to use e-cigarettes. The mid-aged adolescents (group 2) showed a lower threshold at 0.824 (Table 18), which showed a stronger association compared to the younger adolescents with a threshold of –3.129.

Use of E-cigarettes and Demographic Variables

The findings revealed a significant association between sex and age of e-cigarettes initiation, age of cigarette initiation, frequency of e-cigarettes usage, and exposure to ads. However, there is no significant association between sex and access to vaping products. Regardless of the sex of an adolescent, they have equal access to vaping products. It is an important message that can curb the use of e-cigarettes to be directed for both sex equality. Future research should look closer into sex-specific messaging. The race of participants was correlated with the independent and dependent variables. There is a correlation between the race of adolescents and the age of e-cigarettes initiation, the age of cigarette initiation, frequency of usage, the extent of exposure to ads. However, no correlation was established between the race of adolescents and access to vaping products. The race of an adolescent is not related to access to vaping products. Race and sex as major demographic do not correlate with access to the vaping product. However, it is associated with other variables.

Multi Theory Model and Bandura Theories

The result pointed out how the early initiation of e-cigarettes has contrary effects on helping participants quit smoking, as alluded to by some manufacturers (Evan-Polce et al., 2020). The findings point to the association of early e-cigarettes use with earlier use of cigarettes. In addition to the influence of e-cigarettes usage or cigarettes, the MTM points to the role of environment and social media in influencing behavior. The study discovered that exposure to ads significantly affects the use of e-cigarettes. MTM alludes to how behavioral modification through environmental modification, access, and exposure in this

case (Abasi et al., 2019) can influence behavior. Behavioral development due to e-cigarettes ads exposure, including false claiming ads. In addition, Bandura's theory pointed out the influence of the environment on behavioral modification. For this study, I leaned heavily on the influence of environment or behavior, leading to self-management and self-regulation (Bandura, 2019)

Limitation of Study

There were several limitations of this study. Some of the limitations include age; the study was limited to middle school and high school students between 9 and 18 years old. The study was self-directed and conducted by CDC. Individual participants may withhold information or may not be truthful in their responses. There were other limitations of the investigation relating to size. Fear of repercussion may also influence withholding information. In the previous NYTS CDC survey, over 89% of participants who completed the survey from the original population showed interest. Only 49% of the participants completed the survey in the 2020 survey. The limited participants may lead to the people being underrepresented. In addition, in the survey itself, only 8.6% of the people responded to whether they used e-cigarettes or not. The inadequate response may create a false result. The other limitation relates to recall bias. The participants may not recall accurately the interaction in their experience. Furthermore, the ability of the student to recall when they started to use e-cigarettes may not be accurate or the ability to recall the number of location/ access points they had relating to vaping products. The issue with recall may also influence the number of exposures they had to e-cigarettes ads, especially participants with multiple access.

The fourth limitation is related to the data. The data used was previously collected by CDC. The use of these previously collected data created a limitation to the available variables. The questions asked were specifically for the purpose of the researcher. The research question used in this study had to be adapted to fit the available data. There were some questions I could not explore because of limited data.

Implications

The study aimed to determine some of the factors that feed into the early e-cigarettes initiation in adolescents and determine if the usage of these early e-cigarettes is a threat to the several decades of curbing cigarette use in adolescents. The result can also guide the policy change in exposing the youth to e-cigarettes. There is the need to institute federal policies that cross state lines and limit the accessibility and exposure of adolescents to vaping products. Furthermore, the influence of the environment model, MTM, and Bandura's theory will be a great foundation. The study will have implications for future research, practice, and social change.

Implication for Future Research

Future research can be generated from survey questions that target a large population of students who vape. There will be the need for longitudinal studies investigating the long-term implication of vaping in this age group. As stated in the literature reviews, data has begun to emerge that strongly suggests the adverse effects of vaping in adolescents. Other research should also focus on the impact of addictive components of these vaping products on the developing brain of an adolescent. These questions can only be effectively answered through a longitudinal study. Following a

large group of students in their natural environment will assist in developing results and real-time answers to these pertinent questions. Furthermore, future research should explore the connection between exposure to e-cigarettes ad and the use of e-cigarettes.

Additionally, future research should focus on the other factors that may influence the connection between e-cigarettes initiation and the age of cigarette use. Based on the study I conducted, the significance finding explained only 40.9% of the occurrences. Other factors could have influenced the outcomes not explored in this study. These factors could be explored through targeted survey questions that will address other possible variables like location and family structure. Furthermore, the access points and the exposure to advertisements were inexhaustible. The scope of my research did not allow for this possible access or disclosure to be collected or analyzed.

Implication for Practice

My research highlighted and validated healthcare practitioners' concerns regarding vaping and adolescents. There is a need to make a distinct distinction between politics and science. My research pointed out a connection between early initiation of vaping and e-cigarettes in adolescents. To prevent the reversal of the years of success in curbing the use of tobacco products in adolescents, there must be an ongoing campaign that will outmatch the campaign promoting the use of e-cigarettes. Language across all public health and public education areas should be strong to be impactful. Pediatricians, school personnel, parents, and community stakeholders must work together to combat this uprising epidemic in our youth.

Collaboration between Healthcare Practitioners and School Administration

Students spend many hours awake at school. There is a need for healthcare practitioners to collaborate with a school administrator in the move to curb the use of e-cigarettes. It has been pointed out that the age at which the youth initiate using e of e-cigarettes continued to be younger. The factors leading to early initiation have been established. School administrations need to be aware of the danger posed by the early initiation of e-cigarettes. Additionally, there must be an increased knowledge of school personnel on the features and the make-up of these e-cigarettes. Allies like pediatricians, school personnel, and faith-based and community leaders must be established for these vulnerable teenagers. The outcome of this study can support efforts toward positive social change. .

Positive Social Change

The significance of social change was reflected in some of the literature studied and the findings of this study. It has been established that the use of e-cigarettes is associated with the use of cigarettes. The negative effects of cigarettes have been established over the years. Nicotine, a prominent ingredient in e-cigarettes, has also been attributed to several negative effects. These negative effects include but are not limited to cardiovascular disease, respiratory problems, and cancer (Patterson et al., 2020). The possible negative effects of e-cigarette use in adolescents are not fully known, raising concerns among healthcare workers and policymakers. This study has spoken about the negative effect of e-cigarettes on adolescents and using Banda MTM has highlighted the need for behavioral modification through environmental manipulation. Public health

practitioners have collaborated with policymakers to develop a federal restriction on accessibility to vaping products and exposure to e-cigarettese ads. This restriction must apply to ads and physical locations but virtual ads and various online platforms. We do not have the full effect or knowledge of the effects of numerous chemicals being heated in the body, especially in adolescents. There is the need to move swiftly and create policies that will enhance social and behavioral change.

Furthermore, the invisibility felt by adolescents in the use of e-cigarettes should be debunked by ads that share facts relating to their usage. The ads must target these populations, be culturally sensitive, and be displayed on platforms like Snapchat, TikTok, and Instagram frequented by these age groups. Adolescents should be engaged in the creation of these culturally age-appropriate campaigns. There is also statistical significance between the exposure to e-cigarettes ads and the use of e-cigarettes. Previous studies have highlighted an association between the use of e-cigarettes and other tobacco products (Evan-Polce et al, 2020).

I concluded that the age at which adolescents began to use e-cigarettes influenced their future use of cigarettes. E-cigarette's ads exposure also influenced whether an adolescent used e-cigarettes or not. The misinformation regarding e-cigarettes-adolescent tailored marketing has led to the increased use of e-cigarettes in this population. There is a need for healthcare professionals, public health practitioners, policymakers to collaborate in creating policies that will influence behavioral change. Furthermore, creating ads that will debunk the misinformation regarding e-cigarettes and their potential

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