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SMOKE AND MIRRORS: POLICY SOLUTIONS FOR DETERING ADOLESCENT
USE OF NICOTINE ELECTRONIC CIGARETTES

by

Austin D. Fiala

A thesis submitted to the faculty of the University of Mississippi in partial fulfillment of
the requirements of the Sally McDonnell Barksdale Honors College.

Oxford, Mississippi, USA

May 2020

Approved by

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ACKNOWLEDGEMENTS

First, I would like to thank my parents, Dr. Martin and Anneliese Fiala, for always believing in me and supporting me throughout all of my endeavours and struggles. It is only because of my parents that I ever even considered the University of Mississippi; and, I cannot imagine having had my University experience anywhere else. I am forever grateful for their passion for my education as well as their enduring love; and, I know that I would not be the man I am today without their guidance.

Next, I would like to thank my thesis advisor Dr. Joseph H. Holland. From the first days of PPL 101, your passion for policymaking was infectious; you charged your students to seek out and make effective policies while never losing sight of the people that they affect most. Throughout the many of your classes that I have taken, you consistently instilled excitement in your students, like me, for the work that we do. Thank you for agreeing to take on my thesis project and for putting up with the occasional missed deadline. Dr. Holland, has left an indelible mark on my professional life; and, for that, I am forever grateful.

Thank you to Dr. Melissa Bass and Dr. John Winkle III for agreeing to serve as my second and third readers, respectively. While I did not have the opportunity to be a student in either of your courses, I am thankful for your expertise and your willingness to help in the creation of this research product.

Finally, thank you to the Trent Lott Leadership Institute and the PPL program for making my four years at Ole Miss more memorable than I could ever have imagined. I am so grateful that I have had the opportunity to learn from leading policymakers in our field and to grow as a future public servant. Specifically, thank you to the PPL faculty and staff members that continuously drive our program and our institution forward.

ABSTRACT

AUSTIN DAVIS FIALA: Smoke and Mirrors: Policy Solutions for Deterring Adolescent use of Nicotine Electronic Cigarettes
(Under the direction of Dr. Joseph H. Holland)

In recent years, there has been a dramatic spike in the number of adolescents that regularly use nicotine electronic cigarettes. As recently as 2019, a large outbreak of e-cigarette, or vaping, product use-associated lung injuries was observed in adolescents, leading many to question the safety of these devices, particularly when use by adolescents. By way of a literature review, this thesis will examine the history of nicotine and electronic cigarettes in the United States, as well as existing data on the nature of nicotine electronic cigarettes and the ways in which they are marketed.

From these findings, it is clear that adolescents are particularly susceptible to beginning nicotine use, due to the questionable marketing practices of nicotine electronic cigarette firms, as well as social and peer influences to try nicotine electronic cigarettes. It is clear that while nicotine electronic cigarettes have not proven to be uniquely harmful to a user, some of the chemical components used to produce vapour in these devices can be harmful and carcinogenic. Nevertheless, it was found that the recent outbreak of e-cigarette related lung injury cases was not directly associated with nicotine electronic cigarettes that are presently available on the market; rather, these injuries were a result of bootlegged vaping products.

In order to analyse the findings of this thesis, an evaluative policy framework was used so as to create a policy solution that deters adolescent use of nicotine electronic cigarettes. This thesis proposes the use of regulation, education, and repeal of certain legislative actions in order to address this public issue.

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List of Abbreviations

CDC – Centers for Disease Control and Prevention
THR – Tobacco Harm Reduction
NEC – Nicotine Electronic Cigarette
VG – Vegetable Glycerin
PG – Propylene Glycol
TIRC – Tobacco Industry Research Committee
JAMA – Journal of the American Medical Association
AJN – American Journal of Nursing
FAMRI – Flight Attendant Medical Research Institute
HHS – United States Department of Health and Human Services
DOJ – United States Department of Justice
RICO – Racketeer Influenced and Corrupt Organizations Act
NMRS – Nuclear magnetic resonance spectroscopy
MOE – Margin of Exposure
VOC – Volatile Organic Compound
TSNAS – Tobacco specific nitrosamines
mg – Milligrams
FDA – U.S. Food and Drug Administration
FSPTCA – Family Smoking Prevention and Tobacco Control Act of 2009
FFDCA – Federal Food Drug and Cosmetic Act of 1938
MLSA – Minimum legal sale age
FTC – Federal Trade Commission
EVALI – E-cigarette, or vaping, product use-associated lung injury
18-20s – a demographic of individuals, ages eighteen to twenty

CHAPTER I

Introduction

The use of products containing nicotine has been prevalent throughout history in ritualistic, social, and perfunctory circumstances--with the latter two circumstances more or less defining its use in the United States (Goodman, 2005). Historically, many states relied on tobacco crop production as a means of income. At this time, the use of nicotine laden products was not thought cause any adverse health risks. At the beginning of the twentieth century, America began a dramatic shift towards incorporating cigarettes into the average individual's daily life. In the early 1900s, when tobacco products were thought safe, the tobacco industry sought to capitalize on the vices of the American people by instituting a rigorous messaging and advertising campaign. Tobacco companies advertised in a plethora of newspapers and journals; and, by the early 1900s, they had even expanded their advertisements to be included in the Journal of the American Medical Association and the American Journal of Nursing--targeting the healthcare providers with misinformation that would plague the medical profession for decades to come.

According to the U.S. Centers for Disease Control and Prevention (CDC), approximately 480,000 individuals die in the United States every year due to smoking cigarettes. Moreover, an additional 41,000 individuals die from exposure to second-hand tobacco smoke (CDC, 2019). While tobacco has been around in the United States for many years, it was not popularized in modern culture until the late twentieth century--

through the use of product placement in TV shows and movies. Due to the prevalence of tobacco usage, and the lack of medical understanding as to the effects that tobacco usage could have on the human body in the long-term, America became, more than ever, hooked on tobacco. As advancements in medicine clarified the previously murky risks of tobacco, even the advertisement of its associated risks was not enough to abate an addicted America.

Beginning in the 1950s, true scientific research relating to the use of tobacco products was finally coming to the public's attention; however, the tobacco industry would take strides to establish a messaging campaign that would highlight the uncertainty in the tobacco science and in science in general. In doing so, the tobacco industry continued to maintain that there were no proven health consequences that could occur due to the use of tobacco. As many advocacy groups, including the U.S. Surgeon's General, made great efforts to bring to light the truth of tobacco use during the latter half of the twentieth century, this ignorance of public health concerns continued until the 1960s, at which time widespread publicity and warnings on the health risks of smoking (tobacco) began to be issued (Kozlowski, 2018). Although the public tide of opinion had begun to shift, many misconceptions about tobacco and its harmful effects were still unknown, or unreported.

The tobacco industry would hold strong to these talking points until the 1990s, when a leak of more than 13 million internal, confidential memoranda and documents occurred (Daynard, 2012). These leaked documents, now available in their entirety on the internet, not only showed that the tobacco industry had much more information on the negative health effects of tobacco use than previously thought; but also, they proved the

fears of many to be true in that tobacco companies were, in fact, targeting youth in the mid to late 1900s for no reason other than to increase profits and sales overall (Daynard, 2012). Through this document leak, it was realized that there was significant evidence to prove that tobacco companies were fully aware of the risks that tobacco use posed as well as its highly-addictive quality, and, instead, continued to push the substance on the American public. With the tobacco industry left somewhat exposed from this document leak, many individuals, groups, and even U.S. State Attorneys General filed suit against the tobacco industry in the years following 1990 (Daynard, 2012). While many of the suits resulted in settlement, the fact remains that through these lawsuits, the tobacco industry was successfully held accountable for the first time by being forced to legally state that they (tobacco firms) were aware of the health consequences of tobacco use—as in the Master Settlement Agreement of 1998—and even that second-hand smoke was objectively known to be harmful—as in *Broin v. Phillip Morris* (Daynard, 2012) (Daynard, 2004).

For as long as the medical community has been warning against the dangers of smoking tobacco cigarettes, many have sought to develop methods of tobacco harm reduction (THR) (Adriaens, 2014). These methods would be marketed as tools that a tobacco user could use to stop smoking cigarettes. Although nicotine infused chewing gum and drinks were, and have been, used, somewhat, by individuals attempting to kick their smoking habit, no THR method, to date, has seen as much success as the nicotine electronic cigarette (NEC) (Adriaens, 2014). First released in 2007, NEC devices served as a means for traditional cigarette smokers to switch to another nicotine delivery system—one that does not have as many harmful chemicals or health risks compared to those of

tobacco cigarettes. NECs are effective methods of THR due to the fact that a user can still partake in the sensory and motor cues associated with tobacco smoking—inhalation through mouth, immediate nicotine buzz, and exhalation through mouth—just as they would feel as if they were smoking traditional tobacco cigarettes (Adriaens, 2014). Moreover, as NECs allow for a great deal of flavour variety, compared to other methods of THR, adult aged smokers—and even youth, as will be later discussed—are more likely to continue using an NEC as opposed to other flavourless methods of THR. Studies have proved the efficacy of NECs as a viable form of THR as evidenced by the dramatic rise in their use and the decrease in traditional tobacco cigarette smoking, and, that THR methods, in general, are proven to be more effective in abating long-term nicotine use compared to complete cessation or abstinence from nicotine (Adriaens, 2014; Phillips, 2009).

While the definition of NECs can be broad, for the purposes of this study, an NEC is a battery-operated device that is used to vaporize a liquid solution that is dissolved with nicotine (Capponnetto, 2013). The components of an NEC include an electrical heating element and a replaceable, refillable, or built in cartridge that contains nicotine laden e-juice. When activated, the heating mechanism vaporizes the liquid e-juice into a visible aerosol that can be inhaled and subsequently exhaled to achieve not only nicotine delivery, but also smoke production--which serves to complete the sensory-motor cues associated with NEC use that allow its use to mimic that of a traditional cigarette (Adriaens, 2014).

When NECs were first introduced, many were styled as Cigalike NECs, that used cartomizers--liquid-soaked foam cartridges--as their heating element. These cartomizer

NECs would become known as first generation NECs and saw minimal success compared to the present-day successes of the NEC industry. Second generation NECs would later be released to include clearomizers--or heating elements that used e-juice that was stored in a reserve, often transparent, refillable tank (Adriaens, 2014). This second generation of NECs would skyrocket in popularity compared to their first-generation ancestors, as the use of a clearomizer enabled individuals to produce a denser smoke that more closely resembled the inhalation of an ignited cigarette. Further, allowing NEC users the option of purchasing their own e-juice flavours and refilling their NEC devices, themselves, made second generation NECs even more enticing to the average smoker.

While adult-aged smokers primarily use NECs to either stop or curb their use of tobacco cigarettes, the prevalence of NECs, and their appetizing flavours, have led to a dramatic increase in their use among teenagers. In 2011, just 4 years after the emergence of NECs, only 1.5% of high school students reported that they were currently (at the time) using NECs. Meanwhile, in 2016, that number was shown to have jumped almost tenfold to 11.3%, with evidence to indicate a substantially higher jump having occurred since then (Krishnan-Sarin, 2019). Although the unique flavour offerings of NECs are cited by many adult-aged smokers as a reason they originally tried to quit smoking tobacco cigarettes, it can be presumed that these unique, sometimes fruity, flavours have also contributed to the tempting of teens to try and use NECs (Farsalinos, 2013).

In order to combat this dramatic rise in teen use of NECs, the U.S. Food and Drug Administration (FDA) has established regulations that limit the sale of mint, and some fruit, flavourings in NEC products; however, as teen use of NEC's continues to rise, even with parental and societal warnings, policymakers must evaluate what course of action, if

any, could be used to allay teenage NEC use (Office of the FDA Commissioner, 2020). While some policymakers, including President Trump, have concurred with banning all flavoured NEC products, I will demonstrate that this strategy, which would affect NEC users of all ages, is not the most effective way to curb NEC use in youth as it would unduly effect to adult-aged NECs users who have made the switch from tobacco cigarettes solely because of the unique flavourings offered by this method of THR (Farsalinos, 2013). Through this study, I will attempt to both inform the reader about NEC devices and establish new and improved regulatory policies for the use of NECs that seeks to allay the epidemic of teen NEC use while providing ease of access to NEC products for adult-aged individuals who previously used tobacco cigarettes.

In light of a multitude of recent news reports indicating possible harms that could come from the use of NEC devices, paired with a dramatic rise in underage use of NECs, many have begun to question whether NEC devices serve as an effective and safe method of THR. While proponents argue that NEC devices are relatively very benign compared to the use of cigarettes, opponents argue that there is too little research for the device to be considered 'safe.' Further, concerns regarding the advertising and marketing practices of NECs have recently come into question with NEC firms being accused of the same type of deceit regarding the potential harm of their devices as the tobacco industry had done in the twentieth century: one that inadvertently--or not--targets youth and adolescents by making the use of NECs appear to be the 'cool' thing to do. In recent years, NEC use has appeared to plague the underage youth of America, with the prevalence of NEC use *in schools* increasing by tenfold just between the years of 2011 and 2015 (Krishnan-Sarin, 2019). This increase in nicotine use among youth is likely due

to the innocuous way in which many youth view nicotine; while proper education regarding the use of nicotine has yet to be made standard across education systems.

In order to evaluate all of the relevant factors associated with abating NEC use among youth, this thesis will examine adolescent NEC use, the safety of NEC devices, and regulatory measures that have either been approved or recommended. While the federal government recently took regulatory steps to address not only NECs, but also tobacco, by increasing the minimum legal purchase age of nicotine products to twenty-one nationwide, this regulation should be immediately repealed and replaced with a different policy solution, due to the current policy's highly prejudicial nature towards nicotine users ages eighteen to twenty-one, who can no longer legally use NEC devices as a method of THR (American Lung Association, 2020). Through this research, I will attempt to craft a policy solution for the regulation for NEC devices that prevents the use of NEC devices by youth under the age of eighteen, while still allowing NEC devices to serve as a preferable THR method in substitute of tobacco use for adult nicotine users. The intention of this study is to answer my research question: What is the most effective policy to deter adolescent use of NEC devices? Through the findings of this thesis, I will demonstrate that there are effective policy solutions such as, but not limited to, youth nicotine use education and NEC marketing regulations.

First, this thesis will highlight the background and evolution of tobacco products, the introduction of NECs, and adolescent use of NEC devices. Next, this thesis will discuss the methodology used to conduct a literature review of relevant sources. Third, this thesis will examine the current state of NECs in the United States, the various factors associated with its use among adolescents, and recent public concerns regarding the

safety of NEC devices—in order to evaluate policy proposals and alternatives that have been put forward for consideration. Finally, this thesis will offer a succinct policy recommendation to address the rise of NEC use among youth.

CHAPTER II

Background

The Rise of Tobacco

Throughout the course of recorded history, tobacco has played an important cultural and spiritual role in human civilizations. While popularized as a cash crop for export and domestic consumption during the early colonial period, tobacco products were not widely bought and used by the average person until the twentieth-century. For much of this time, tobacco was viewed as an innocuous substance that happened to contain nicotine--a chemical that conveniently offers a stimulating effect when used, followed by a sedative effect. To market tobacco, cigarette companies, in particular, employed joint strategies of public relations marketing and advertising. By the 1950s, the widely shared view regarding the harmless nature of tobacco would shift from one of unquestioning acceptance to one of more serious caution. During this time in the United States, various scientific and medical studies and reports were conducted and created in order to inform the public of the real health concerns relating to tobacco use. These health concerns included respiratory disease, lung cancer, oral/esophageal cancer, among others (Brandt, 2012).

As more and more of these medical findings were shared with the American people, public interest in the substance slightly waned; however, to save their failing industry, tobacco-market leaders turned to more aggressive advertising strategies in order to retain their clientele. With stronger and more plentiful radio and television

advertisements, the main goal of the tobacco industry at this time was, from an outsider's perspective, “to erode, confuse, and condemn the very science that now threatened to destroy [the industry’s] prized, highly popular, and exclusive product” (Brandt, 2012).

Between 1920 and 1950, cigarette smoking was still viewed as benign, even in light of a Nazi-study that linked cigarette use with possible lung cancer and other respiratory problems. It wasn’t until the Allies were able to somewhat replicate these results in the early 1950s that the public began to question the safety of cigarettes (Tyrrell, 2008). One marketing technique employed by tobacco companies was to contradict the multitude of anti-tobacco medical studies with a medically-oriented-marketing campaign of their own.

The Tobacco Industry Research Committee. In response to negative medical reviews of their product, the cigarette industry turned to an even bolder and aggressive marketing and advertising strategy. In order to demonstrate a level of concern to the public at large, the large players in the tobacco industry came together to form the Tobacco Industry Research Committee (TIRC) in 1954. While many exterior players would view the TIRC as a sign of progress, the TIRC’s main goals were to dispute epidemiological studies and to delay legislative action in light of scientific uncertainty (Tyrrell, 2008).

The TIRC, funded jointly by industry leaders through the imposition of a \$0.0025 tax per every 1,000 cigarettes sold, would go on to hire ‘Hill & Knowlton’ one of the most prominent public relations firms of the era, creating a “smoothly run disinformation machine” (Courtwright, 2005). In addition to the continual feeding of disinformation to

the public at large, the TIRC also had the final editorial decision on all public information and booklets that were released relating to cigarettes. In one such case, relying on the tactic of confusion, the TIRC dramatically edited a soon to be released informational pamphlet entitled *Cigarette Smoking and Lung Cancer*; and, by the time the TIRC had completed its revisions, the pamphlet needed to be retitled as *Cigarettes=Lung Cancer?*, indicating that other factors, such as automotive and industrial pollutants, could just as likely be the cause of lung cancer as cigarette use could be (Courtwright, 2005). From changes such as these, the motives and aims of the TIRC become even more crystalized. By failing to rely on medical research in their pamphlets--due to their subjective opinion that the science was still up for debate--the TIRC fueled the public with misinformation presented as fact.

The TIRC also funded their own epidemiological research, to give the perception to the public that the industry was taking these health concerns seriously, and not callously disregarding them (Courtwright, 2005). In all of their publications, the TIRC would seek to rebut scientific studies based on a lack of certainty. As Courtwright puts it: “Rebuttal raised doubt, doubt permitted rationalisation, and rationalisation led to continued cigarette consumption” (Courtwright, 2005).

Medically-Oriented Tobacco Advertisements

Beginning at the start of the twentieth century, tobacco companies attempted to combat developing scientific studies that indicated possible links between tobacco use and medical issues or illnesses. As previously discussed, this was largely done by questioning the reported findings and highlighting the uncertainty existent in science. The

tobacco industry soon found a perfect conduit for their counter-science information campaign: medical professionals. Doctors and nurses alike were, *prima facie*, viewed by the public at large to be the foremost authority on all matters relating to an individual's health, and the tobacco industry capitalized on and abused this trust by enticing doctors and nurses into the fold of tobacco use; and, thus, the industry could point to their use of the product as evidence of its health safety.

Doctors and The Journal of the American Medical Association. Once again relying on their tactic to confuse, the tobacco industry of the early 1900s portrayed doctors as users and proponents of cigarettes. In order to truthfully advertise their product's approval by doctors, industry representatives would attend medical conventions, offering free cartons of cigarettes in exchange for positive survey responses or even endorsements (Jackler, 2018).

In a study examining the types of messaging used by 519 doctor-involved cigarette advertisements during the first half of the twentieth century, it was found that the most popular and utilized portrayals of doctors and cigarettes were those that purported to offer the 'science' of tobacco. While it is understandable that this marketing strategy would prove to be effective, the cigarette industry did not stop there, also publishing cigarette advertisements in which doctors were flattered and the safety of tobacco cigarettes was lauded (Jackler, 2018). *The Journal of the American Medical Association* (JAMA) would also go on to play a key role in the advertising efforts of the tobacco industry during the first half of the twentieth century.

Morris Fishbein served as editor-in-chief of the JAMA from 1924 to 1949 and was originally critical of cigarette advertisements, decrying those of Lucky Strike Cigarettes, in particular. However, by the 1930s, Fishbein had transitioned from skeptic to accomplice by offering editorial advice and support to the tobacco industry in the notably ironic goal of creating advertisements that met the standards of the JAMA (Jackler, 2018). While Fishbein had long maintained that the advertisements included in JAMA, and accompanying data to prove their claims, were vetted by various committees to ensure medical accuracy, it became increasingly obvious that Fishbein was entangled too closely with the tobacco industry. In 1948, in an effort to save face, Fishbein penned an editorial in the JAMA stating that advertising was single-handedly responsible for the increase in annual tobacco cigarette use from 10 billion cigarettes per year as of 1910 to 350 billion per year as of 1946. His editorial also posited that there were no appreciable or measurable harms that could come from tobacco use; thus, Fishbein argued that the problems with tobacco advertisements could be easily solved through the self-policing of the tobacco industry regarding their ads (Jackler, 2018).

From editorials like these, and the continued permission of advertising to tobacco companies, the JAMA became an inadvertent political and messaging ally of the tobacco industry, damaging the public's confidence in the advertising standards of medical journals for years to come.

Nurses and The American Journal of Nursing. At the beginning of the twentieth century, women in general were viewed as bulwarks of Victorian femininity whose medical expertise was valued and respected in a way similar, but not identical, to that of doctors (Soine, 2018). Many nurses, like many other women, did not use tobacco

products in the time before and during World War I as it was seen to be contrary to the idealized embodiment of womanhood; however, as the war struck followed by the era of prohibition, many women were persuaded to try cigarettes due to a lack of medical research suggesting otherwise, the abundance of the plant's popularity among other members of society, the lack of other intoxicating substances available, and the constant push of early tobacco industry advertisements (Soine, 2018).

The *American Journal of Nursing* (AJN), first published in 1900, played an instrumental role in pushing nurses, in particular, to smoke cigarettes. During the first half of the twentieth century, the AJN worked to make the publication successful and to ensure its long-term viability. Mary Roberts, editor from 1921-1949, would oversee the most dramatic change: the introduction of paid advertisements as a means to achieve steady revenue. Roberts, like others, would argue that this change would prove beneficial to the publication as they would be able to ensure financial viability and maintain the content of their publication (Soine, 2018).

While advertised products varied, over time, more and more promoted tobacco directly. This gave way to an appearance of irony as nurses--individuals who had been viewed as the mark of responsible, educated, womanhood--were giving support to tobacco cigarettes by way of advertising, and, of course, by nurses actually purchasing tobacco products. To make matters worse, some nurses even recommended smoking tobacco to their patients, due to cigarettes prominent placement in the AJN alongside ads for nurses' uniforms, medical accessories, baby formulas, juices, and nutritional supplements (Soine, 2018). In the case of nurses, the tobacco industry followed a unique advertising plan: co-opt the public trust of nurses to push tobacco to average Americans.

This proved exceedingly problematic and even tragic as nursing, as a profession, was strengthened in many ways by the continued publication of the AJN--not only in building the confidence of nurses in their profession, but also by legitimizing their profession in the medical realm--all to be sullied by the profession's push for tobacco.

The Popularization of Cigarettes as a Cultural Phenomenon

While combating and confusing scientific and medical studies was a major tactic of normalizing cigarettes in daily life, a more implicit tactic allowed the tobacco industry to remain at the forefront of public life during the twentieth century: the presence of tobacco cigarettes in films. Before the advent of modern television, films and television shows were the primary methods of entertainment for the public at large, and particularly youth. It was through films that Americans sought to detach, even just briefly, from the monotony of their daily lives by offering exciting and interesting plots and scenarios.

First posited by psychologist Albert Bandura, the social cognitive theory of mass communication is a theory that highlights continual exposure to something as a means to entice the public to accept the given thing (Bandura, 2002). In the case of cigarette use portrayed in films, by the 1950s movie characters, both major and minor, began to portray cigarettes as a common item viewed in the periphery. While the plots of films, themselves, would have nothing to do with cigarettes or tobacco, the characters would casually, without acknowledging it, smoke cigarettes during various scenes. Bandura's theory leads us to expect the prevalence of cigarette use in films contributed to the commonality of cigarettes' use in modern society.

This assumption is confirmed through a study by Jamieson, that tracked the prevalence of cigarette use in films during the latter half of the twentieth century. Specifically, Jamieson found that total tobacco related content in films declined slightly in the 1950s before peaking in 1961, while total cigarette consumption for the same time studied waivered in the 1950s and peaked in 1966 (Jamieson, 2010). These findings are particularly troubling as films played an important role not only in American culture, but particularly in the culture of American youth (Jamieson, 2010). To target this demographic, specifically, many tobacco advertisements appealed to an individual's sense of independence and adventure seeking, two themes that are proven to be effective when communicating with/advertising to young people (Agaku, 2014). The prevalence of cigarettes in films, and thus, their normalization, once again gave rise to the tobacco industry, filling the remaining tobacco-less gaps that existed within society.

Modernized Tobacco Advertisements and Youth

As medical advice relating to tobacco use became more standardized and scientifically grounded in the latter half of the twentieth century, tobacco companies had significant work to do in combating the shifting general consensus on cigarettes. By 2000, the successes of print advertising and marketing in films for cigarettes would give way to a new age of media: the internet. In the twelve years alone following the turn of the millennium, it was found that tobacco advertisements on the internet nearly doubled--demonstrating the tobacco industry's appreciation for the effectiveness of this new media. Meanwhile, tobacco advertisements in newspapers, magazines, and even retail stores all declined during this same period of time (Agaku, 2014).

From findings such as these, we can infer that this shift in marketing strategy is a direct result of actions taken by the tobacco industry to continue to push cigarettes and tobacco on the American populous. Further, due to the fact that many, if not a majority, of internet users during this time were children and youth, many have speculated that this increased marketing effort on the internet was a scheme to attract more youth cigarette users. With the advent of social media in the mid-2000s, youth were more prone than ever to falling prey to tobacco internet advertisements (Agaku, 2014). This is not the first time, however, that tobacco companies have been accused of targeting youth in their advertisements. Many in the tobacco industry received pushback against youth-oriented advertising in the late twentieth century. In attracting young cigarette users, the tobacco industry would have a way to ensure viability and profit for years to come as these new youth users are not likely to quit easily.

Tobacco Industry Litigation since the 1990s

As the negative health effects of tobacco use had already become known by the 1990s, many began to search for something or someone to blame for the respiratory illnesses and diseases caused by tobacco over the years. The charge: that tobacco companies were fully aware of the negative health risks of tobacco use; and, instead of making the public aware of these risks, they buried them in search of profit. Beginning around this time, millions of confidential internal documents of the tobacco industry were made public, exposing their complicity in getting America hooked on a dangerous and even deadly substance. For each case of litigation, the tremendous power of the tobacco industry was eroded away, ceding more precious, ambiguous, pseudo-scientific research on which the industry had so long relied with the loss of each suit.

Broin vs. Philip Morris, Inc. and the birth of FAMRI. In the years leading up to the 1990s, following revelations of the harms of tobacco use, many had thought it impossible to successfully bring a class action lawsuit—or any lawsuit—against the tobacco industry. Due to the tobacco industry’s ability to obfuscate medical and scientific evidence, a plaintiff’s ability to prove the case beyond a reasonable doubt was exceedingly difficult.

Beginning in 1991, the story of one class action lawsuit, in particular, shaped litigation efforts relating to tobacco for decades to come: *Broin vs. Philip Morris, Inc.* (*Broin v. Philip Morris*). *Broin v. Philip Morris* was a class action lawsuit against all major cigarette companies, seeking damages for medical problems and expenses that flight attendants incurred as a result of second-hand smoke on airplanes (Daynard, 2004). In prior legal proceedings, the tobacco industry had always defended itself, having ‘expert’ witnesses testify to the lack of a clear ‘casual’ relationship between tobacco use and other health and respiratory problems. However, after six years of waiting, *Broin v. Philip Morris* was finally, to the surprise of many, brought to trial. After months of arguments and trial time, the jury was not even charged to render a decision--as the two involved parties reached a settlement outside of court (Daynard, 2004).

The settlement of the *Broin v. Philip Morris* case proved to be a big win in forcing the tobacco industry to recognize the harms of second-hand smoke. Per the settlement, if individual flight attendants could prove that they had been diagnosed with any one of various listed respiratory diseases, the tobacco companies conceded that it could then be presumed that the cause was that of second-hand tobacco smoke (Daynard, 2004).

Further, all of the tobacco industry leaders named in the suit were required to pay a total

of \$300 million to establish the Flight Attendant Medical Research Institute (FAMRI), an organization whose goal was to study, specifically, the potential effects of second-hand tobacco smoke (Daynard, 2004). This marked a monumental shift in the tide as the tobacco industry was finally accepting, even if only to a slight degree, the harms that tobacco can pose to individuals, particularly those who do not smoke but live or work in proximity to someone who does.

The Master Settlement Agreement of 1998. In the 1990s, in order to serve some degree of justice, various cases were brought to the federal court charging the tobacco companies with liability for the millions of people that tobacco harmed, or even killed (Daynard, 2012). In contrast to previous cases brought against the tobacco industry, these filings relied on real people who were affected by tobacco and their somber stories. Nevertheless, real people affected by tobacco were not the only possible plaintiff. States were also able to file suit, due to the medical costs incurred by the state when treating a patient with health conditions likely caused by tobacco. (Daynard, 2012). While dozens of lawsuits had been filed against the tobacco companies, the federal government believed that, due to the similarities of the cases, all of the cases could be settled with one action.

In 1998, the Master Settlement Agreement effectively settled all of the active lawsuits on the tobacco industry. This decision called for the industry's elimination of various marketing strategies, and to pay \$10 billion annually to the federal government (Daynard, 2012). Both of these steps proved successful in the curtailing youth tobacco use. While the former step would ensure that the aggressive and predatory marketing strategies of tobacco companies, targeting youths in particular, were ended, the latter step

would force the tobacco industry to augment the price of cigarettes in order to pay the required annual settlement to the government. This increase in the price of cigarettes, like the ending of predatory marketing, sought to directly lower the number of youths buying and using tobacco--as youth, in general, did not have as much disposable income to spend on products like tobacco as adults had.

Other Tobacco Litigation. Following successful suits against tobacco companies in the early 1990s, and culminating with the second-hand smoke ruling of *Broin v. Philip Morris*, lawsuits against the tobacco industry largely focused on the charge of ‘defective product,’ claiming that, based on the tobacco industry’s internal documents that had been made public, tobacco companies were fully aware of the health risks and problems associated with tobacco use; and, instead of taking measurable steps to correct the deficiencies, the tobacco company covered up its findings and sold the product, as is, to the consumer public (Cummings, 2006). In observing the change of tone in the tobacco industry’s handling of these suits, it is evident that the tobacco industry realized that, after the *Broin v. Philip Morris* case and the Master Settlement Agreement, they could no longer feign ignorance and, instead, must accept the science indicating the harms of tobacco. In four suits in particular, occurring from 1999-2002, study has shown that the arguments of the tobacco industry, therein, were supported by three main points: 1) smoking is risky, but the tobacco industry took no steps to make it riskier or more dangerous, 2) the tobacco industry did not actually do anything to physically stop an individual from attempting to quit smoking, and 3) the tobacco industry had already spent hundreds of millions of dollars to fund research to create the safest possible cigarette, in line with the public health community, without measurably detracting from the quality of

the product (Cummings, 2006). From these cases, tobacco companies clearly did change their strategy for battling these suits: they would argue from a common sense perspective that as people are free to make their own choices for themselves, they, alone, should be responsible for any addiction that may afflict them, not the tobacco industry.

The De-Popularization of Tobacco and the Introduction of NECs

Based on the prevailing uncertainty regarding the dangers of tobacco, and massive ad campaigns undertaken by cigarette companies in the mid-twentieth century, it is understandable why an impressionable public would have become so hooked on such a highly addictive plant. In 2007, nicotine electronic cigarettes (NECs) were first introduced into the U.S. market, offering a “safer” nicotine consuming alternative to tobacco use (Hsu, 2018). Many habitual tobacco users were drawn to NECs for a multitude of reasons. Whether it was the size and shape of the device, which can be designed to mimic that of a traditional cigarette, or whether it was the concentrated amount of nicotine that can be delivered through less infrequent use of the device, many former tobacco smokers reported that NECs helped in “smoking abstinence and improved smoking related symptoms” (Capponnetto, 2013). Regarding the shape of devices, as identified by Hsu, NECs are sold in three distinct styles: Cigalikes--devices that are shaped to mimic a traditional cigarette--eGos--a pen-style NEC--and mods--larger NEC devices that are not categorized by the aforementioned styles (Hsu, 2018). While mod NECs had not yet become prevalent at the introduction of NECs to the market, eGos and Cigalikes were a common choice for tobacco users that desired to either quit or remedy their smoking habits. Many smokers are happy to continue smoking until their death--whether by natural means or by cigarette use--due to the fact that they view cigarette use

as a binary option: continue smoking, unabated, or completely give up nicotine. As the latter option is difficult for habitual smokers who have become reliant on the addictive chemical of nicotine, many will continue to smoke, accepting their potential harm at the hands of tobacco related chemicals (Phillips, 2009). Thus, it would stand to reason that by offering a lower-risk source of nicotine, such as NECs, many smokers would at least be willing to try the alternative.

The emergence of NEC industries

In the nine years following the introduction of NECs into the American market, the NEC market has developed and grown to an estimated \$3.5B USD. Although local vape shops have proven their ability to compete during this nicotine revolution, reports of the U.S. Department of Health and Human Services (HHS) indicate that companies like Lorillard, Altria Group, and Reynolds American--major tobacco production and sale firms--have taken over a substantial portion of market power within the NEC industry (Hsu, 2018). While local vape shops typically sell mod NECs and the accompanying e-juice that users fill into the device themselves, the products of these larger NEC developers are often styled as Cigalikes or eGo NECs. From the perspective of the firm, Cigalikes and eGos offer the opportunity to style a device so as to prevent refilling of e-juice that is not supplied by the manufacturer. In just the one-year period between 2012 and 2013, sales of NEC devices more than doubled, earning an annual revenue of \$636 million (Chu, 2015). With the industry growing at an unprecedented rate, more and more former tobacco smokers are turning to NEC as a method of nicotine delivery. One example of an NEC firm that sought to restrict their user's ability to use the e-juice liquids of other competitors was that of JUUL: a company that has become almost

synonymous with the NEC industry as a whole, since 2018. It should be noted that JUUL Labs, and its device, is not representative of the entire NEC industry; rather, this exceedingly popular brand of NEC device is thought by many to be the defining NEC of the 2010s.

The efficacy of NECs as a method of Tobacco Harm Reduction

Tobacco Harm Reduction (THR) is a scholarly definition of methods and practices that combat the prevalence of tobacco use in the U.S. Specifically, THR aims to reduce the negative health effects of tobacco usage by permitting users to easily switch to less harmful ways of using tobacco, but, more specifically, nicotine (Adriaens, 2014). NECs are a viable method of THR for various reasons. As the sensory-motor cues associated with cigarette smoking can still be achieved with NEC use--i.e. the exhalation of smoke followed by the buzz from nicotine consumption--NEC proved to be more effective at enticing cigarette smokers than chewable gum, drink additives, or other methods of THR (Adriaens, 2014). Moreover, individuals who smoke cigarettes take a multitude of factors into account when determining a THR method that may suit them best. Product preferences among smokers vary and various tobacco users become attached to certain aspects of both the action of smoking and the social experience that comes along with it (Phillips, 2009).

Whether it be the flavour, the smell, the feel of a particular product in your mouth or in your airway, all of these aesthetic components play a large role in influencing the THR behaviours of tobacco smokers (Phillips, 2009). Due to these factors, one can easily understand why the possible reduction of 'benefits' from switching to a less-enjoyed

product would be greatly outweighed by the reduction health risks (Phillips, 2009).

Another aspect that has been proven to affect a cigarette smoker's likelihood to switch to an NEC device is the size and shape of the NEC device itself. While Cigalike and eGo styles of NEC had been less than popular when sold with cartomizers (due in part to the insufficient smoking experience), Cigalike and eGo styled NECs saw a new resurgence with the development of the clearomizer. As this heating element allowed for the production of a denser smoke, as well as the ability to use refillable e-juice, while not sacrificing the sleek design of Cigalikes or eGos, NEC use began to increase dramatically with the advent of second generation Cigalikes such as JUUL. These new NECs, like JUUL, proved to be one of the most effective THR methods produced to-date as cigarette smokers could switch without sacrificing the feeling of a small, ovular object in their hands, the density of inhaled smoke, or the flavour.

E-juice flavourings for NEC devices

One of the largest appeals that NECs have over tobacco and other methods of THR is their seemingly limitless offering of flavourings for e-juice liquids. The primary solvents of e-juice liquids are primarily propylene glycol and glycerol (Farsalinos, 2013). These solvents are mixed with nicotine as well as various chemical components that provide the actual flavour. Different from cigarettes, which all share the distinct flavour of tobacco, NEC users are not solely bound to tobacco e-juice flavourings. While studies have shown that tobacco flavourings are used most by first time NEC users making the switch from cigarettes, most NEC users eventually switch to either fruit or sweet flavours for everyday use (Farsalinos, 2013). Flavours have proven to play an important role in determining whether smokers actually stay on the road to ceasing tobacco use. Studies

have shown that a vast majority of NEC users who previously smoked cigarettes believe the variety of flavours to be very important in their effort to reduce or quit nicotine consumption/usage (Farsalinos, 2013). As for the potential effects of restricting the flavourings offered for NECs, a majority of NEC users indicated that a restriction of flavourings would make NECs less enjoyable, more than 48% indicated that this would increase their craving for traditional cigarettes, and almost 40% indicated that it would make it less likely for them to quit or reduce their nicotine consumption (Farsalinos, 2013).

Nicotine and youth

While there are many obvious benefits from the use of NECs, principally that NECs are a safer alternative to traditional cigarettes, the advent of NECs has caused a resurgence in youth and adolescent nicotine usage to levels as anecdotally high as ever. As was discussed earlier, JUUL developed much of its marketing strategy around social media as opposed to traditional advertisements on TV and the internet. Whether intentionally or unintentionally, JUUL began a trend of social media influencers using NECs on a regular basis to show just how cool they were. Moreover, NEC devices, particularly JUUL, have become increasingly prevalent in high schools and even middle schools (Krishnan-Sarin, 2019). As previously discussed, between 2011 and 2016, the number of high school students reportedly using NEC devices jumped at least ten-fold (Krishnan-Sarin, 2019). While it is acknowledged that numerous health concerns relating to the use of NEC devices have developed relatively recently--developments that will be discussed further in the fourth section of this thesis--one noted concern associated with nicotine use among youth is the actual effect that nicotine, a neurotoxin, can have on the

developing brain. Various studies have shown that the concentration of nicotine used by youth can be a determining factor in the individual's future smoking and NEC use behaviours (Krishnan-Sarin, 2019). This presents a particular problem as JUUL, particularly popular among youth, does not offer varying nicotine content; instead, they offer interchangeable pods--that can often be depleted in a single day--that have a set nicotine concentration equal to an entire pack of cigarettes.

CHAPTER III

Methodology

Through the use of a literature review, I sought to develop a deeper understanding of NEC devices, the harms associated with NEC use, the use of controversial marketing practices to entice youth into using an NEC, regulatory policies that have already been applied to NECs throughout the world, and other regulatory frameworks that already exist for other semi-controlled substances (i.e. tobacco, alcohol). I conducted this literature review through the use of the University of Mississippi Library's OneSearch tool. This tool enabled me to use one, uniform search mechanism to conduct queries related to the research topic while having the ability to access content from a variety of online databases. Analysed sources covered a variety of topics including, but not limited to, the history of the NEC industry, the evolution of NEC devices, the benefits of NEC use compared to smoking, the value of NECs as a method of tobacco harm reduction, the likelihood of NEC to lead to a cessation of nicotine use, the marketing practices employed by the NEC industry, as well as the safety concerns associated with NEC use.

In employing a literature review methodology, I am able to clearly present a comprehensive view of NEC devices. I believe presenting some quantitative information from previously conducted scientific studies alongside qualitative information sufficiently explores the safety factors and issues associated with NEC use.

The content of my literature review is focused on peer-reviewed articles that were published in journals. In order to determine what articles and sources were best suited to be included in this literature review, I initially conducted the literature review in the following manner. First, I conducted an advanced search on the library's OneSearch using the following string of search terms: (("e-cigarette" OR "e-cig" OR "electronic cigarette") AND ("advertisements" OR "ads") AND ("safety" OR "health" OR "illness" OR "death" OR "disease") AND ("flavour" OR "flavor") AND ("policy" OR "regulation")) AND ("america" OR "usa" OR "united states")). This yielded a total of 1,127 results. Next, I filtered the results to include only sources that offered a full text online and that had appeared in published journals. This yielded a total of 312 results. Finally, I filtered these results again filtered to include only articles that had been peer-reviewed, yielding a total of 291 results. Using the 'subject term' search refinement tool of OneSearch, these results were then filtered to show only results that included the following keyword/key terms: advertising; flavours; health, high-school-students; laws, regulations, and rules; safety; smoking and youth; smoking-cessation; and social media. Upon completion of this refinement, I was left with 141 sources from which information and findings presented in this literature review were derived. I then undertook to analyse the abstract of each source to determine relevance, with relevant articles being flagged and categorized for later review and use. After I compiled a body of scholarly sources for this study, I sought to examine each of the sources carefully to determine what information may be considered relevant or useful in providing background on NECs, in responding to each of the three research questions, and in the creation of a sound policy framework that seeks to allay adolescent NEC use. After I flagged relevant sources for

review, I categorized sources into the following groups: 1) Sources that offered general background on all aspects of NEC devices, including health and safety; 2) Studies that examine the habits and histories of NEC users, particularly adolescents; 3) Sources that examined the marketing practices of the NEC industry; 4) Sources that examine potential avenues of regulation for NECs. Each of these categories of data would be used in specific portions of this study.

In conducting research in this way, I was more fully able to respond to the research questions established in the introduction of this study. Further, I was able to present the reader with sufficient background information on NECs and its users that allows the reader to create a more informed opinion regarding the necessity of responsible regulation of NECs rather than a complete ban. In allowing readers to form a more informed opinion on NECs, I am able to present reasonable policy recommendations that can be employed at the governmental level to ensure that NECs remain a viable tool in tobacco harm reduction in the U.S. while ensuring that irresponsible sales and development practices do not encourage or allow adolescent abuse of NECs.

CHAPTER IV

Findings

The risks associated with NEC use

As was previously discussed in Chapter II, NEC devices function through the battery heating of an atomizer that vaporizes an e-juice liquid compound containing the chemical component of nicotine, among other ingredients (Capponnetto, 2013). While the chemical composition of every e-juice flavouring differs slightly, the principal chemical components in each are widely shared. Propylene glycol (PG) and vegetable glycerin (VG) are used either exclusively or in combination to create a liquid that, when combined with flavouring ingredients, distilled water, and nicotine, will function as an e-juice for NEC devices (Saiita, 2017). Some studies have indicated the presence of certain carcinogens in NEC vapor. In creating an effective policy framework that deters the adolescent use of NECs, the level or risk associated with NEC use must be established.

The safety of NEC e-juices. Various researchers have conducted studies that examine the factors of health and safety associated with e-juice products. In one such study that sought to analyse the safety of chemical ingredients in NECs, researchers in Germany tested fifty-four NEC e-juice samples by way of nuclear magnetic resonance spectroscopy (NMRS) in order to determine the precise quantitative chemical compositions of the samples (Hahn, 2014). It is important to note that this study analyses only the status of the chemical components when in the form of e-juice; this study does

not analyse the safety of these ingredients when vaporized and inhaled. Drawing from existing analytical models of other similar risk studies conducted on food and drink products, the researchers analyse the margin of exposure (MOE) for each chemical component. In using their metric to evaluate the activity of each chemical component in a bottle of e-juice, MOE values of 10 or more are considered to be negligible in determining risk while MOE values of 1 or lower are considered to be the highest risk. The results of this study demonstrated that among the samples of publicly-marketed and available e-juices, nicotine was the only chemical ingredient in the e-juices that could quantitatively pose a “high risk” of exposure for an NEC user, with nicotine MOE values ranging from as high as 10 and as low as 0.1. All other chemical components discovered in the NMRS had MOE values higher than 100 for most e-juices; however, some outliers existed with MOE values slightly lower than 100 (Hahn, 2014).

While it is noted that the sample of e-juices tested in this study was geographically limited to Europe, and that only fifty-four products were actually tested, due to the randomness of the sample collection—as well as the scientific grounding for the data that was collected—this information indicates that among the major chemical components of most e-juices, nicotine is the only chemical component that is present in e-juice products in a large enough quantity to be deemed as a “high risk exposure” ingredient (Hahn, 2014). Nevertheless, in evaluating the safety of the chemical ingredients that are used in NEC devices, the exposure risks of these chemicals must be analysed not only for their liquid form, but also for their vaporized form—and how the latter interacts, specifically, with the respiratory tract.

Carcinogenic concerns when vaporizing NEC e-juice. As was previously noted, PG and VG are the two principal solvents used in most, if not all e-juice products. Little scientific evidence has been found to determine that VG, even when vaporized and inhaled, poses a scientific or medical risk; and, in fact, VG is considered a “safe additive” due to its ability to decrease the consistency of bronchial fluid (Callahan-Lyon, 2014 as cited in Kaiser, 2016). Nevertheless, the vaporization of PG can lead to the production of more harmful chemicals like formaldehyde, acetaldehyde, and acrolein (Zhang, 2018). For NEC users, the production of formaldehyde would likely be the most concerning of these findings due to the chemical’s classification as a “Class 1 carcinogen”—indicating its ability to lead to the development of cancer cells; however, acrolein—which has been found to stimulate and effect the nasal cavity, lungs, and blood vessels—if used chronically, can lead to, among other things, an acceleration in the hardening of the aorta by as much as 1.6 times. (Zhang, 2018; Conklin, 2015 as cited in Zhang, 2018).

In addition to PG, VG, and nicotine, flavouring chemicals are added to e-juices to provide an aromatic essence to the vapor created when the liquid is heated. While many of these flavouring chemicals do not pose a significant risk of exposure, some have been found to have carcinogenicity. Volatile organic compounds (VOCs) like toluene and meta xylene have been observed in NEC vapor and are known to have irritating effects on skin and mucous membranes, anesthetic effects on the central nervous system, and certain cancer-causing tendencies (Goniewicz, 2014 as cited in Zhang, 2018). Further, in some e-juice liquids, three tobacco specific nitrosamines (TSNAS) have been observed in concentrations that exceed their respective concentrations in traditional tobacco cigarettes (Kim, 2013 as cited in Zhang, 2018). In addition to VOCs and TSNAS, many studies,

like that of Zhang et al., erroneously point to heavy metals as being potential carcinogenic byproducts of NEC vapor. While it is true that a tested brand of a Cigalike NEC did emit vapor that contained measurable levels of lead, nickel, and cadmium, this finding specifically points to problems in the design of the cartomizer—the heating element—and not the chemical composition of the e-juice that lead to the emission of heavy metal particles (Williams, 2013).

In summary, the only chemical flavouring components of an NEC e-juice that can pose carcinogenic risks are the aforementioned TSNAS and VOCs; and, VOCs occur in NECs at a lower level than that of traditional tobacco cigarettes (Zhang, 2018). Although TSNAS have a high carcinogenicity and are believed to be responsible for interactions that can mutate DNA, it must be noted that, even in light of the fact that NEC devices can emit higher concentrations of TSNAS than tobacco cigarettes, no scientific studies have proven or indicated a correlation between NEC use and the development of a type of cancer (Zhang, 2018). Further, when compared to the seventy carcinogens that have been identified in harmful concentrations in tobacco smoke, these TSNAS and VOC components can be considered negligible to the overall policy interest of public health (CDC, 2019). Although the chemical composition of NEC vapor may be considered safe for the public's use in light of the risk present in already permitted and regulated substances—such as tobacco—NEC vapor does still contain potentially harmful carcinogens for which effects on the human body are not yet fully known. In light of these concerning findings, some policy solutions to adolescent NEC use have included new restrictions on adult NEC users; however, this thesis argues that the safety concerns

presented are not significant enough to necessitate a policy solution that restricts adults from NEC use.

Nicotine contents in NEC e-juices. While PG and VG are used as solvents in e-juice liquids, the chemical nicotine—used in tobacco cigarettes as well—is the addictive ingredient used in NECs. In research and laboratory settings, nicotine has been found to cause adverse health effects for pregnant women, as well as impacts on brain function in child, adolescent, pregnant, and reproductive-aged women (Zhang, 2018). Further, nicotine has been proven to have a pharmacological effect on the body that can lead to changes in brain function (Yuan et al., 2015 as cited in Bhalerao, 2019). As cognitive maturation is ongoing during adolescence, exposure to nicotine during adolescence can lead to long-term structural and functional changes in brain function including cognitive and behavioral impairments, disrupted memory attention, and effects on executive function (England et al., 2015 as cited in Duderstadt, 2015). From this data, nicotine clearly poses the most immediate, provable, health risk in adolescents' use of NEC devices. Research has found little evidence to support the existence of widespread mislabeling of nicotine contents in e-juice products—Hahn et al. found that “[i]n general, the values were in agreement with labelling” (Hahn, 2014). As part of NEC devices serving as an effective method of THR, NEC e-juices will have a wide variety of nicotine contents, ranging from 60mg/ml to nicotine free, so as to permit tobacco cigarette smokers the ability to choose a nicotine content that is right and necessary for them to cease traditional tobacco use. More frequent and habitual users of tobacco cigarettes will need an NEC e-juice with a higher nicotine content than an occasional tobacco user, so as to quell the desire to return to the use of traditional tobacco cigarettes.

Norton et al. conducted a study to evaluate the intensity with which habitual tobacco users smoke an NEC device with a nicotine content of 11mg/ml (relatively low). The findings of the study indicated that with the relatively low nicotine content of the NEC device, users would smoke an NEC device more intensely and often than they would a tobacco cigarette; and, even with a more intense use, the nicotine delivery would still be substantially lower than that of tobacco (Norton, 2014). Further, the tobacco users indicated that they still desired to return to the use of traditional tobacco cigarettes due to this lack of nicotine (Norton, 2014).

This data shows that choosing the right nicotine content for an NEC device is the most important consideration for a user when trying to cease traditional tobacco use. Had participants in Norton's study been exposed to an NEC with higher nicotine concentration than 11mg/ml, they may have had less of a desire to return to tobacco use. For NEC devices to serve as effective THR, it is critical that e-juice products offer a wide variety of nicotine contents. In doing so, more frequent tobacco users can elect to use an e-juice with a very high nicotine content (50-60mg/ml) in order to quell many if not all desires to begin using tobacco again. Further, former tobacco users who have switched to NECs can use the variability of nicotine content to progressively ween down the amount of nicotine that they use over a period of time.

In light of these findings, this thesis argues that while regulation of the e-juice industry is necessary to ensure that advertised nicotine contents match actual nicotine contents, limiting the amount of nicotine that can be in an NEC e-juice would not be an effective policy solution to address adolescent use of NEC devices. Instead, limits such as these would take away from the efficacy of NEC devices and prevent them from being

used by adult tobacco users as a method of THR. Instead, policies that seek to deter adolescent use of NEC devices must focus on educating adolescents of the harms that nicotine, itself, can pose—whether it be delivered through a traditional tobacco cigarette or an NEC device—as well as the highly addictive nature of this chemical.

The emergence of JUUL Labs, Inc. and the JUUL device

In 2015, JUUL Labs, Inc. created a new electronic vaping device called JUUL (Liu, 2018). This device used a Cigalike style and allowed users to use disposable and interchangeable pods containing e-juice. These disposable pods were specially designed to be used *only* with the JUUL NEC device and were designed to prevent tampering with or re-filling of the pods. Further, all e-juice pods sold by JUUL, at the time, contained the same content of nicotine: 59mg (Liu, 2018). As JUUL has, and continues to be, a substantial player in the NEC industry, observations discovered through the study of JUUL can prove helpful in understanding the issues associated with NECs.

JUUL NECs. Up until the development of JUUL, mod NECs had been widely popular due to their ability to serve as a smoking cessation aid rather than simply a smoking alternative. In using NEC mods that permitted a user to purchase and fill their own e-juice, users were able to begin using NECs with a high level of nicotine content in their e-juice and were able to progressively use e-juices that contained less and less nicotine over time, leading to smoking cessation. Thus, JUUL's refusal, at least at the outset, to provide varied nicotine contents in their e-juice pods was understood to mean that JUUL, was not attempting to help people quit using nicotine, but rather to stop smoking tobacco. The select offering of e-juice flavourings included more traditional

flavours, like mint and tobacco, as well as more fruit and sugar oriented flavours, including crème brulée and fruit medley.

To establish perspective on the strength of the aforementioned nicotine quantity, ten puffs of JUUL e-juice, provides the same effects of nicotine as that of a single traditional cigarette. With JUUL's focus on cessation of tobacco use rather than that of nicotine, their prevalence within the NEC market would mark a dramatic shift in NEC use, as many NEC users would take more than the cigarette equivalent ten puffs on frequent occasions throughout the day.

In addition to subconscious increases in nicotine intake, JUUL NEC users were able to take advantage of the sleek, Cigalike design of the NEC, as well as its low-level voltage that enabled less smoke to be produced for puffs that garner high levels of nicotine, to allow for stealth usage of nicotine. JUUL was designed to look dramatically different than any prior NEC; and the device could be quickly recharged using a computer-USB plug. This unique design played a key role in attracting young users, as kids were able to fool their parents into believing the device was nothing more than a computer flash drive and as they were able to stealthily use the device without adults knowing. Since March of 2018, JUUL Labs, Inc. has represented more than half of the NEC market, while Vuse, another closed-pod Cigalike system, has dramatically decreased its market share to almost a third of what it once was (Craver, 2018). This market prevalence, paired with the stealth benefits previously discussed, lead to an increased public call for additional government control or regulation of the NEC industry. Further, many have accused JUUL of complicity in the new, resurging epidemic of adolescent nicotine use.

The Marketing of NECs

Since the development of NEC devices, NEC firms have employed many marketing and advertisements strategies to entice potential users. As discussed in Chapter II, the rise of tobacco gave way to unconventional marketing strategies that had not before been seen. Tobacco companies not only created and published cigarette ads in print publications, but they also received help from Hollywood directors and actors. Similar to the fact that television and film were, at the time, new mediums, the internet has proven to be the most effective method of advertising for NEC devices. While many NEC firms took to the internet to advertise their devices, none were as brazen as JUUL.

JUUL Marketing. Beginning at the company's inception in 2015, JUUL employed a great deal of advertising on social media, including using Instagram and snapchat influencers to promote their product. Many questioned why this type of advertising would be necessary if the product was truly geared towards current-adult smokers—a demographic that did not often use these social media applications (Liu, 2018). Social media influencers would often simply post pictures of themselves using the JUUL, often in professional or normal, everyday settings. In using this type of advertisement, JUUL made tremendous strides in eroding the stigma behind the use of nicotine—a stigma that was previously defined by smoking tobacco products. By making NEC usage seem more fun, main-stream, and safer than cigarette smoking, JUUL was able to become the “iPhone of e-cigarettes” and plant a seed of safety in its young users who were either incapable of or unwilling to learn the harms of NEC usage (Fadus, 2019).

NEC Messaging on Twitter. As was the case with JUUL, social media has served as a key driver for most NEC product marketing campaigns. Researchers have recently studied companies’ Twitter use in propagating messages relating to NEC devices.

Promotional	4675 (29.35%)						
Flavors	495 (3.11%)	3857 (24.22%)					
Person Tagging	752 (4.72%)	567 (3.56%)	3419 (21.47%)				
Juice Composition	251 (1.51%)	1515 (9.51%)	500 (3.14%)	2806 (17.62%)			
Cannabis	1089 (6.84%)	768 (4.82%)	180 (1.13%)	436 (2.74%)	2680 (16.83%)		
Nicotine Health Risks	44 (0.28%)	166 (1.04%)	302 (1.90%)	216 (1.36%)	27 (0.17%)	1018 (6.39%)	
Quit Smoking	39 (0.24%)	13 (0.08%)	51 (0.32%)	3 (0.02%)	1 (0.01%)	2 (0.01%)	90 (0.57%)
	Promotional	Flavors	Person Tagging	Juice Composition	Cannabis	Nicotine Health Risks	Quit Smoking

Figure 1. (from Figure 1 of Allem et al., 2019)

In a 2019 study, Allem et al., performed a qualitative evaluation of all public postings made to Twitter during the 2018 calendar year that included the keywords “e-juice(s)” and “e-liquid(s).” With 15,927 postings by 4,590 distinct users, the researchers categorized the content and messaging of the postings into seven distinct categories: promotional (sponsored post created by producer), flavours, person tagging (another user was identified in the post), juice composition, cannabis, nicotine health risks, and quit smoking (Allem, 2019). While the full results of Allem et al.’s study can be found in Figure 1, it is noted that of these 15,927 postings, less than 7% discussed the risks associated with nicotine use or actually quitting smoking (Allem, 2019). As also shown in Figure 1, when combining the values of “person tagging” and “promotional” postings, it can be observed that more than half of the evaluated postings appear to be promoting the use of NEC e-juice to other users on Twitter. These findings indicate that while e-

juices are widely discussed on social media platforms like Twitter, very little of the messaging discusses NEC's use as an alternative to tobacco, and instead, most involves the positive promotion of an NEC product.

Another study of NEC messaging on Twitter looks at the prevalence of postings that contain NEC keywords alongside keywords associated with healthy food (Basanez, 2018). The study found that in a three-month period at the beginning of 2017, 54% of the 1,200 twitter postings in their analysis were found to have been made by product marketers and not by unique twitter users (Basanez, 2018). This finding indicates that some NEC firms are marketing their products with these health buzzwords in order to appeal to potential NEC users who are health-conscious. There is no evidence to effectively support the claim that NEC devices are "harmless" or "health-enhancing;" and, NEC firms "have traditionally focused marketing efforts arguing that their products are less harmful than cigarettes or can be used as smoking cessation devices" (Basanez, 2018). Thus, it is interesting to note this recent push to accommodate health-conscious users by advertising NEC products as harmless. This is not problematic if the NEC product in question truly is as advertised (natural, organic, etc.); however, as no regulation exists for the use of these words in the marketing of NEC products, NEC firms are presently free to market their products with these words even if they do contain chemicals.

NEC flavourings as a method of marketing. One of the reasons NEC devices can serve as such effective forms of THR is that they permit a nicotine user to select their own desired flavouring for nicotine delivery. In order to evaluate the opinions of NEC users regarding e-juice flavouring preferences, a 2017 study evaluated over 14,000 e-

liquid reviews (presumably written by adult-age users as purchasing NEC products online often requires age verification) that were posted on JuiceDB (one of the largest independent review websites for e-juices) over a period of approximately two-and-a-half years. The findings of this study indicate that fruit and cream flavour categories were the first and second most popular (widely used), respectively, and that nut flavour categories were, by far, the statistical “favourite” as identified by users (Chen, 2017). Further, various studies have found that tobacco and menthol flavours were among the three least popular flavour categories (Chen, 2017; Russell, 2018).

These findings support the assumption that adult-age NEC users care greatly about the flavourings available for their NEC device as it contributes to the effectiveness of the THR; and, many NEC users will seek out specific, preferred flavourings for NECs when deciding which product to purchase. Regardless of the importance of flavour variability to NECs’ service as an effective method of THR for adults, some flavours, and the way in which they have been marketed by their producers, are extremely appealing to some adolescents. As adolescents and children, in particular, would be drawn to candy-like flavours with brand names like ‘Gummy Bear’ or ‘Sour Skittles,’ regulators must establish common sense marketing rules that limit this type of implicit marketing without affecting adult-age NEC users’ abilities to choose the flavour of their nicotine delivery.

The effect of NEC marketing in the 2010s. Until recently, little regulation was placed on the types of medical and health warnings that must be included on NEC device and e-juice packaging. Due to this lack of regulation, NEC firms were able to advertise freely, by focusing on a few key points: NECs can cut down tobacco cigarette use, NECs

can help traditional cigarette smokers cease tobacco use, and NECs can be used in places that do not typically permit tobacco cigarette smoking (Duderstadt, 2015).

While these points are factual, they do not effectively inform a user about all of the risk factors involved with NEC use. For adolescents, it is understandable why marketing such as this could lead to a false sense of security and safety. In contrast to the youth of the twentieth century, adolescents of our time have been consistently informed about the harms from tobacco use; however, education on NEC devices, due to their recent market introduction, has not been offered in the same way. As these positive talking points are the only messages being offered, credulous members of the public are less likely to be aware of the potential risks and would be more likely to begin using NECs even if they are not using it as a method of THR. Over the past decades, the federal government has placed far greater restrictions on the types of advertisements that tobacco firms may use (Duderstadt, 2015). TV and internet cartoon advertisements, celebrity endorsements, and the sponsoring of sporting events and music festivals are all now prohibited by tobacco firms; however, NEC firms, by the mid-2010s, have not faced the same restrictions on their marketing practices (Duderstadt, 2015).

Overall, the marketing of NEC firms during the 2010s did have an effect on adolescent perceptions of the use of NEC devices. According to one study, 72% of surveyed, adolescent males indicated that they perceived NECs to be “healthier” than tobacco cigarettes (Johnson, 2017). While this statement is scientifically true in that NECs have far fewer harmful component ingredients than tobacco cigarettes, it is troubling that an adolescent would choose to describe an NEC, in any context, as “healthy.” While it is difficult to convincingly prove that the internet advertisements and

marketing messages of NEC firms were developed to specifically target adolescents, NEC firms, nevertheless, can certainly do more to ensure that their messaging is targeting adult-aged tobacco users looking for a method of THR to quit. These findings speak to the impressionability of adolescents, and can be used to justify a call for more stringent regulation on the marketing practices employed by NEC firms.

Addressing Adolescent NEC use

While teenagers and youth can be rebellious risk-takers, these tendencies are accepted as a part of adolescents' strive for independence and adulthood (Nasr, 2017). Nevertheless, it must be acknowledged that these tendencies can lead to more sinister behaviour, including the initiation of drug use (Nasr, 2017). With the rise of tobacco related advertising in the twentieth century, adolescents—teens and children—viewed tobacco and its anesthetic effects as a mark of popularity and quickly began smoking. NEC devices provide users with a quick, flavourful, and discreet method for consuming nicotine; thus, when considered alongside a teenager's desire to take risks, it is understandable why adolescents in the twenty-first century appear to be flocking to its use. "Evidence from the National Youth Tobacco Survey indicates that the current (i.e. past month) [NEC] use among high school students increased from 1.5% in 2011 to 11.3% in 2016, and [NECs] were the most commonly used product [that was studied in the survey] in 2016" (Jamal et al., 2017 as cited in Krishnan-Sarin, 2018). These findings show a significant increase in teenage use of NEC over a five-year period. Further, a 2019 study evaluated the smoking behaviours of approximately 2500 adolescents aged sixteen to nineteen for 2017 and compared the results to a similar sample group for 2018. The results indicated that the current (past month) use of NEC devices experienced an

increase from 11.1% in 2017 to 16.2% by 2018 (Hammond, 2019). Regardless of how large or small an increase in NEC use among adolescents may be, any increase marks the continued existence of systematic failures to address the problem of adolescent NEC use. Further, other studies suggest that adolescent use of NEC devices can lead to a greater propensity to switch to tobacco cigarettes later in life (Barrington-Trimis, 2016 as cited in Camenga, 2018).

The JUUL Curriculum and School District Action. In response to public criticism of their marketing practices, JUUL Labs, Inc. announced in 2018 that they would be investing \$30M to prevent underage vaping and to pay for development of a school curriculum to educate youth about NEC's 'true' use as a smoking alternative. The JUUL Curriculum, as it was titled by the company, gave individual school districts up to \$10,000 in exchange for using the curriculum in their schools. The curriculum sought to tackle three main principles: The Science, E-Cigs and Social Influences, and Using Mindful Practices as a Replacement (Liu, 2018). While some school districts reported positive outcomes from the JUUL Curriculum at the outset, many have questioned the true effectiveness of the curriculum as it lacks discussion of NEC advertisements and product flavourings (Liu, 2018). Further, this curriculum is critiqued as ineffective due to its lack of focus on flavourings as a primary cause for youths beginning the use of NEC devices (Liu, 2018). While the JUUL Curriculum marked a tremendous step in allowing NEC firms to fix the problem some feel they have created, its use has fallen from popularity due to these critiques ; instead, some school districts are opting to use their own curricula on NEC education that are free from the influence of NEC firms, like JUUL (Liu, 2018).

The Current Status of Federal and State Regulations on NECs

Although it was not until recently that adolescent NEC use became so widespread—and, thus, a topic of concern—it must be noted that the Food and Drug Administration (FDA) began taking federal regulatory steps to address NEC use, broadly, more than ten years ago. As early as 2008, the “FDA attempted to regulate [NEC devices]... as an unapproved drug and drug device because it was initially marketed as a tobacco cessation product” (Duderstadt, 2015). In response to this determination, NEC firms fought back in federal court arguing that NEC devices were “tobacco products” and not “unapproved drugs” as claimed by the FDA; and, in 2010, the Supreme Court would rule in favour of the NEC firms (Duderstadt, 2015). In 2009, Congress passed the Family Smoking Prevention and Tobacco Control Act (FSPTCA) enacting, among other things, measures that delegated authority to the FDA to regulate tobacco products—which, by legal definition, now included NEC devices (Government o.U.S.o.A., 2014 as cited in Bhalerao, 2019). Although the FSPTCA delegated authority to the FDA to regulate the production of NEC devices broadly, the Act did not grant the FDA the authority to enforce regulation on certain NEC manufacturers and producers—leaving a gap in the regulatory regime.

FDA Takes Aim at Age and Marketing Restrictions. In 2014, the FDA took more dramatic steps to address these unregulated NEC producers; however, even then, they did not take steps to address the targeted marketing practices of NEC firms (Duderstadt, 2015). In 2016, the FDA issued itself new authority, under the purview of the Federal Food, Drug, and Cosmetic Act (FFDCA), to regulate the sale of tobacco products by requiring NEC firms to report their ingredients, as well as any harmful

constituents that their product may contain, and ensure that chemical compositions are within the requirements of the law (Prochnow, 2017). Further, the FDA established a federal minimum legal sale age (MLSA) of eighteen, as well as some manufacturing and marketing limitations for all tobacco products in an attempt to address the then-emerging problem of adolescent NEC use (Bhalerao, 2019). Also, as part of this 2016 action, the FDA gave NEC producers two years to begin printing warning labels on all NEC product packaging that specify: “WARNING: This product contains nicotine. Nicotine is an addictive chemical” (FDA, 2016 as cited in Marynak, 2017).

Even in light of these strides forward in addressing adolescent use of NEC devices, youth have continued to ‘run toward the smoke’ in using NEC devices at higher rates than ever before. According to published findings from the FDA, adolescent use of NEC devices has risen sharply in previous years with reported current use (within last month) of NEC devices increasing from 2.1 million youth in 2017, to more than 3.6 million youth in 2018, and, by 2019, to more than 5.0 million youth (Wang et al., 2018 as cited in Bhalerao, 2019; FDA, 2019). More alarmingly, as of 2019, almost one million youth reported to be using an NEC device daily (FDA, 2019). In 2018, “the FDA and the Federal Trade Commission (FTC) issued warnings to four [NEC] manufacturing companies around youth-focused advertisement, sale and distribution of [NEC] products, especially on social media platforms;” however, no further actions have been taken relating to the marketing practices of NEC firms (FDA, 2019 as cited in Bhalerao, 2019).

Although little other federal regulatory action was taken leading up to 2020, many states began to establish laws and regulations for the sale and use of NEC devices. As shown in Figure 2, as of April 2019, with the exceptions of Michigan and Pennsylvania,

all states now have laws that restrict youth access to NEC devices. While these state regulations, paired with federal regulations, do well to quell adolescents' abilities to access NEC products, Figure 2 also makes clear that much work can be done from a state

Law(s) in effect across all States & the District of Columbia in the USA (March 15, 2019)					
State	Law(s) that define e-cigarettes	Law(s) taxing e-cigarettes	Law(s) on product packaging of e-cigarettes	Law(s) restricting youth access to e-cigarettes	Law(s) requiring licenses for retail sales of e-cigarettes
1 Alabama				Yes	
2 Alaska				Yes	Yes
3 Arizona				Yes	
4 Arkansas			Yes	Yes	Yes
5 California	Yes	Yes	Yes	Yes	Yes
6 Colorado	Yes			Yes	
7 Connecticut				Yes	Yes
8 Delaware	Yes	Yes		Yes	Yes (vape liquid)
9 District of Columbia	Yes	Yes		Yes	Yes
10 Florida				Yes	
11 Georgia				Yes	
12 Hawaii	Yes			Yes	Yes
13 Idaho				Yes	
14 Illinois			Yes	Yes	
15 Indiana	Yes		Yes	Yes	Yes
16 Iowa				Yes	Yes
17 Kansas		Yes		Yes	Yes
18 Kentucky				Yes	
19 Louisiana		Yes		Yes	Yes
20 Maine	Yes		Yes	Yes	Yes
21 Maryland				Yes	Yes
22 Massachusetts	Yes		Yes	Yes	
23 Michigan					
24 Minnesota	Yes	Yes	Yes	Yes	Yes
25 Mississippi				Yes	
26 Missouri			Yes	Yes	Yes
27 Montana				Yes	Yes
28 Nebraska				Yes	
29 Nevada				Yes	
30 New Hampshire			Yes	Yes	
31 New Jersey	Yes	Yes	Yes	Yes	
32 New Mexico			Yes	Yes	
33 New York			Yes	Yes	
34 North Carolina	Yes	Yes	Yes	Yes	Yes (non-local manufacturers)
35 North Dakota			Yes	Yes	
36 Ohio			Yes	Yes	
37 Oklahoma				Yes	
38 Oregon			Yes	Yes	
39 Pennsylvania	Yes	Yes	Yes		Yes
40 Rhode Island			Yes	Yes	Yes
41 South Carolina				Yes	
42 South Dakota	Yes		Yes	Yes	
43 Tennessee			Yes	Yes	
44 Texas			Yes	Yes	Yes
45 Utah	Yes		Yes	Yes	Yes
46 Vermont			Yes	Yes	Yes
47 Virginia			Yes	Yes	
48 Washington			Yes	Yes	Yes
49 West Virginia	Yes	Yes		Yes	
50 Wisconsin				Yes	
51 Wyoming	Yes		Yes	Yes	

Figure 2. (from Table 3 of Bhalerao et al., 2019)

level to further the effectiveness of NEC regulations. As a legal definition of NEC devices, at the state level, is integral to giving states full capability to regulate and deal with NECs, it is troubling that only sixteen states, and the District of Columbia, have a formally legislated definition.

Lung Injury Cases in 2019 and Most Recent FDA Action. Beginning in late 2019, the CDC began investigating an outbreak of “e-cigarette, or vaping, product use-associated lung injury (EVALI). With reported cases occurring among adolescents in many states, the nationwide outbreak would go on to peak in September 2019 (CDC, 2020). Originally, the specific cause of the EVALI cases were unknown, leading many to speculate that the EVALI cases were occurring due to the ingredients used in NEC devices. These misconceptions led many to believe that all vaping—whether with NECs or cannabis vaporizers—in general, was responsible for the reported lung injuries (CDC, 2020). Nevertheless, as time and the investigation progressed, the CDC determined that the presence of “vitamin E acetate” in certain cannabis e-juice and bootleg (made by a non-approved manufacturer) e-juice products was to blame for the EVALI outbreak (CDC, 2020). It is important to note that of all studies evaluated for the purposes of this literature review, none indicated consistent, or even novel, use of vitamin E acetate in the chemical ingredients of regulated NEC e-juices.

Although these EVALI cases were found to not be associated with the use of vaping devices as a whole, reports of EVALI deaths frightened the American public, creating a policy window for the federal government to respond. On December 20, 2019, Congress and President Trump took advantage of this policy window by passing and signing legislation that amended the FDCA to raise the MLSA of tobacco products

(including NECs) from eighteen to twenty-one (Food and Drug Administration, 2020). In further responding to public concern and outcry, in January 2020, the FDA issued new regulatory guidance restricting the sale of all NECs with prefilled flavours with the exception of tobacco and menthol (FDA Commissioner, 2020). While it is difficult to argue that these policy solutions do not address the problem of adolescent NEC use, the policy solutions fail to take in to account the privileges and desires of adult-age NEC users who are directly impacted by these changes—as will be further discussed in Chapter 5.

CHAPTER V

Discussion and Policy Recommendation

This Chapter will offer discussion on the key findings presented in Chapter 4, before establishing a policy solution that is believed to be most effective in deterring adolescent use of NEC—while not affecting adults who rely on NECs as a method of THR. The discussion of findings, offered herein, will be centered around four key themes: E-juice, Marketing, Education, and Government Action. In offering a policy recommendation to address the public problem, this thesis will employ certain evaluative criteria in order to highlight an effective policy for deterring adolescent use of NECs.

Discussion

E-Juice. As was previously discussed, NEC devices and vape pens are nothing more than heating/vaporizing implements. It is only through the addition of e-juice to an NEC device that a user is able to obtain a flavoured, vaporized, and inhaled delivery of nicotine. While some have raised safety concerns regarding the content of NEC e-juices, others have critiqued the e-juice industry's use of product names that appear to target adolescent and teen users. Further, the importance of flavour variability in an adult's use of an NEC as a method of THR cannot be understated.

The potential risks to personal health and safety associated with the use of NECs come from the content of an NEC's e-juice, rather than the device itself. PG, VG,

distilled water, nicotine, and flavouring chemicals are the identified ingredients of most, if not all, NEC e-juices (Saiita, 2017). Although it was noted that the byproducts of vaporized PG and *some* flavouring chemicals are considered to have carcinogenicity—thus, amplifying health and safety concerns—it must be acknowledged that no research has indicated that these potentially harmful byproducts are present in a high enough quantity in NEC vapor to cause verifiable harm to an NEC user (Zhang, 2018). Thus, this thesis argues that as no scientific evidence has proven that these chemicals are prevalent enough in NEC vapor to cause harm to an individual, human user, considerations for the safety of e-juice ingredients should not inform policy decisions for addressing NEC use. Further, since 2016, e-juice producers have been required to submit ingredient and harmful component lists for their products to the FDA for regulation (Prochnow, 2017). Of all the chemical ingredients, nicotine was the only that was found to have undeniable health risks for adolescent users—as nicotine has been shown to have a potentially deteriorating effect on an adolescent brain (England et al., 2015 as cited in Duderstadt, 2015). While this thesis argues that these findings do not necessitate policy, as will be later discussed in this Chapter, the existence of these potential risks can be used in educating the adolescents of today to ensure understanding that NEC devices are not risk-free.

Regardless of the relative safety of NEC e-juices, many have critiqued e-juice producers for creating flavours whose product names are arguably targeted towards appealing to adolescent youth. Product names based off of appealing snack or treats meant for kids including “Gummy Bear,” “Sour Skittles,” and “Sprinkles” will particularly attract adolescents who may not know about the harms of NECs and are instead focused

on using a particular product flavour with which they are familiar. Research findings did indicate that adult NEC users have preferences regarding the flavour they use in their NEC; thus, it is reasonable to assume that adults using NECs as a method of THR would suffer if NEC flavours were entirely banned (Chen, 2017). With these concerns in mind, this thesis argues that policies to address adolescent use of NECs should not include restricting the flavour choices of consumers; rather, these policies should include regulation for the product names that manufacturers assign to a particular flavour.

Marketing. Based on the findings of this thesis, it is evident that NEC firms are able to easily use social media as a means for marketing NEC products. As social media is accessible and used by individuals of all age demographics, it can be argued that advertising on these platforms is no different than advertising on any other medium. Based on the unique ability of social media to allow advertisement messages to be propagated at a much higher rate by users that are not marketers—by way of retweets and re-postings—NEC advertisement messaging on social media platforms are often not easily identified as “promotional” (Allem, 2019). Tagging is a term used to describe a user’s reposting of content while tagging other user accounts on the repost, so as to send the tagged user a notification. Allem et al.’s 2019 study found that 21.67% of analysed Twitter posts relating to NEC e-liquids were identified as “person tagging” (Allem, 2019). This finding clearly shows that NEC messaging content is being circulated on social media platforms, like Twitter, often without exterior influence from NEC firms, themselves; rather, NEC messaging has been driven on social media platforms by the way public users interact with and share the content. Further, some NEC firms, like JUUL, have gone further in using social media, creating ad-campaigns that are often

nothing more than famous or celebrity users posing with JUUL devices in posted pictures (Fadus, 2019). While the FDA recently took action to address youth-focused advertising campaigns among four NEC manufacturers, the FDA must take further steps to address the industry's youth-focused advertising problem as a whole, and not just that of four NEC firms (FDA, 2019 as cited in Bhalerao, 2019). In all advertisements that are initiated by NEC firms, NECs are carefully portrayed using the factual talking points of 1) NECs can cut down tobacco cigarette use, 2) NECs can help traditional cigarette smoker cease tobacco use, and 3) NECs can be used in locations and places that do not typically permit conventional tobacco cigarette smoking (Duderstadt, 2015). While these statements are true, they neglect to make references to any of the potential harms that could come from an NEC including the overall harm that nicotine use can cause to a developing brain. Further regulation is required to ensure that NECs do not misrepresent the purpose and use of their devices by way of marketing or advertising. One such action, taken by the FDA in 2016, mandated the inclusion of a warning label on all tobacco products—including NECs (FDA, 2016 as cited in Marynak, 2017). While this was a great first step in addressing the youth-targeted marketing being done by NEC firms, this warning label has not, unilaterally, shown a measurable effect on adolescent use of NECs (Marynak, 2017). Nevertheless, as the rate of adolescent NEC use continues to climb, further regulations could be established to include warnings that are more specifically-targeted toward deterring adolescent use.

Education. Throughout America, education curricula for health and wellness have been used for many years to inform children and adolescents about the dangers of obesity an unhealthy lifestyle, as well as the risks of tobacco use. In recognizing that a

pathway already exists to inform children and adolescents about the health and scientific risks that different substances can have on a developing body and brain, many have called for additional education of all grade levels regarding the true nature and risks of NEC devices. In responding to calls such as these, JUUL took a big-step in 2018, by creating a “JUUL Curriculum” (Liu, 2018). JUUL would provide individual school districts with the educational tools necessary to inform adolescents on the science and social influences of NECs, as well as their proper use as a method of THR; and, in exchange, individual school districts would receive \$10,000 in subsidy from JUUL (Liu, 2018). In offering a monetary subsidization to local school districts, JUUL was able to encourage a more widespread use of the JUUL Curriculum. Nevertheless, although the JUUL Curriculum has benefitted both school districts and adolescents alike, the curriculum still failed to address NEC advertising and NEC flavourings (Liu, 2018). As previously discussed in this Chapter, NEC advertisements have shown implicit targeting of youth and adolescents in recent years. Further, given the appealing names of some NEC e-juice flavours, children and adolescents may be more willing to make the risky decision of trying an NEC in order to taste or use a particular flavour. These findings support that the shortcomings of the JUUL Curriculum are serious, and must be addressed in order to create a fully effective tool for the education of youth an adolescent. Education curricula regarding NECs must include discussion about the pressures that advertisements and the marketing of flavours place on an adolescent to first try and NEC device. As this thesis argues that any policy solution to deter adolescent use of NEC devices must consider the rights and desires of adults that rely on NECs as a method of

THR, improving adolescent education on NEC devices may prove to be the most powerful tool in quelling adolescent use of NECs.

Government Action. As was identified in Chapter 4, regulatory policies for NECs have already been established at the federal and state levels. As many NEC product producers and manufacturers operate on a nationwide scale, their advertisement and marketing campaigns often include multiple rather than just a single state. While this thesis argues that regulation at state and local levels is typically preferable to that of regulation by the federal government, as adolescent-targeted advertising can be perpetrated online, across many states, stronger regulatory action is required at the federal in order to address this issue. While some action has been taken by the FDA and FTC, as recently as 2018, to quell advertisements that either explicitly or implicitly target adolescents, the FDA has not imposed further advertisement regulation on the NEC industry as a whole (FDA, 2019 as cited in Bhalerao, 2019). In order to address the obvious problem of adolescent-targeted NEC advertisements, NEC marketing must be restricted in the same manner that tobacco marketing is regulated. While it is acknowledged that the 2016 FDA action requiring all NEC products to be labelled with a nicotine warning may have been effective in informing some adolescent users about the risks that an NEC can pose, the warning, itself, gave no information that was specifically informative of the risks that NEC use can pose to adolescents. As will be discussed later in this Chapter, one concrete step that the FDA could take to regulate the marketing of NECs would be to revise the required warning statement to more specifically target adolescents.

In September of 2019, a resurgence of EVALI cases and deaths led to increased calls for action by the public, opening the political stream that would allow action to be taken (CDC, 2020). By early 2020, the federal government had responded in two ways to these concerns: 1) Amendments to the FFDCA that raise the federal MLSA of all tobacco products (NECs and tobacco cigarettes alike) from eighteen to twenty-one; and, 2) FDA regulation of flavours that prohibit NEC devices that are pre-filled with e-juice flavours other than tobacco or menthol (FDA, 2020; FDA Commissioner, 2020).

In addressing their first response, it must be noted that raising the MLSA of tobacco products to twenty-one may succeed in preventing adolescents from have such easy access to NEC devices—as adolescents are far more likely to associate with peers between the ages of eighteen and twenty (18-20s) than they are to do so with individuals over the age the age of twenty. Nevertheless, this thesis argues that this policy action directly, and unnecessarily, discriminates against 18-20s that had previously used NEC devices as a method of THR. Beginning at the age of eighteen in the United States, an individual is legally designated as an adult, being permitted to make decision about their own life without the influence of parental figures. An eighteen-year-old in the United States is permitted to vote, take out a loan, serve and die for their country, and, before this federal policy, purchase tobacco products just like every other adult aged American. However, with these new age restrictions, a substance that is legally permitted for other adults to use is now restricted for 18-20s. While this policy action may have proved effective in addressing adolescent NEC use, this thesis argues that the policy was unnecessary to the goal of deterring adolescent NEC use, and, instead, led to a negative effect on the rights and privileges of 18-20s.

Regarding the FDA's action on the flavourings used in pre-filled NEC devices—like Cigalikes and eGos—it is believed that these steps directly, and effectively address the questions of an adolescent's ease of use of an NEC product. As the Cigalike NEC JUUL is identified as the most popular NEC device among adolescent NEC users, this policy action directly limits the flavour variability of most adolescent NEC users. (Food and Drug Administration, 2019). While it could be argued that this action discriminates against adult users that rely on NECs as a method of THR—in the same way as is observed with the increase in the MLSA of tobacco products—this thesis holds that this is not, in fact, the case. If an adult that relies on NECs as a method of THR prefers an NEC flavouring other than tobacco or menthol, they have the option to easily change to another NEC device—like Mod NECs, for which e-juice flavorings must be manually added by the user—in order to still use their preferred flavour for THR. As an adolescent is less likely to use and abuse a Mod NEC due to its lack of stealth, denser cloud production, and higher requirements for maintenance and troubleshooting, this thesis believes that this policy action by the FDA was extremely effective in deterring adolescent use of NECs without discriminating against adults who rely on NECs as a method of THR.

Policy Recommendation

In order to effectively analyse the findings presented and discussed in this thesis, an evaluative framework was created to determine what policy solutions would be best suited to achieve the goal of adolescent NEC use reduction. This thesis argues that the most effective policy tools currently able to be enacted to deter adolescent NEC use are: regulation of NEC product manufacturers, education of adolescents regarding NECs,

amending the FFDCFA to revert the MLSA to eighteen, and no further action on flavour availability. The policy recommendations presented, herein, will be evaluated using criteria developed by Kraft and Furlong in *Public Policy: Politics, Analysis, and Alternatives* (2015).

Regulate NEC product manufacturers. In order to address the implicit marketing bias of some NEC e-juice products, the FDA must institute regulations that require NEC e-juice manufacturers to use plain labelling on their products—void of graphics and specialized fonts; including a white background with black font—to include a clearly marked list of “flavours” rather than a flavour name, and to amend the presently required warning label to more directly target adolescent NEC users.

While the FDA has taken action on the flavours permitted for Cigalike and eGo pre-filled NECs, action has yet to be taken to address the e-juices that are used in Mod NECs. Mod NEC e-juice products have a wide and diverse variety of names and product labelling. While some product names are simple, and nothing more than a simple listing of the primary flavour included therein, other product names are derivatives of the names of foods, snacks, or candies that are primarily used by children. Further e-juice manufacturers have often used colorful graphics and specialized fonts in order to make their product stand out from the others. The 2019 National Youth Tobacco Survey demonstrated that 31% of adolescent NEC users noted that the reason for their use of NECs was the availability of certain flavours (FDA, 2019). While it is obvious that these e-juice flavour offerings can be problematic in attracting NEC adolescent users, adults who rely on NECs as a form of THR care deeply about the flavours of their NEC devices, and would likely change their use of NECs if their preferred flavour was no longer

offered (Chen, 2017). This thesis argues that this regulation of the naming and labelling of flavours would be effective in deterring adolescent use of NECs as the hype among adolescents around using specific e-juice products would decrease as the products look less discernable from one another. In creating this uniformity in product availability, adolescents would be far less likely to be affected by the “marketing of flavours” previously done by NEC firms.

As of 2016, the FDA required all nicotine products to contain the label: “WARNING: This product contains nicotine. Nicotine is an addictive chemical” (FDA, 2016 as cited in Marynak, 2017). This thesis argues that the warning label on nicotine products must be amended to more directly target adolescent users. The results of one study suggest that “warning labels with messages about harms beyond nicotine’s addictiveness are perceived as believable, informative, understandable and credible among young adults, may provide novel information, and may discourage e-cigarette use among young people” (Wackowski, 2019). As was discussed in a 2018 study conducted by Zhang et al., nicotine can have many developmental effects, including an effect on the development of the adolescent brain. As this fact certainly goes to speak about the effects of nicotine beyond its addictiveness, this thesis argues that the FDA should revise the warning message included on all of their products to read: “WARNING: This product contains nicotine. Nicotine is an addictive chemical. Nicotine can impact brain development in adolescents.”

Although this action may have a slight effect on adults who rely on NECs as a method of THR—based on the fact that an e-juice bottle must be more carefully examined at point of sale by the purchaser to ensure that they are purchasing their

preferred flavour—this thesis argues that adults that are using NECs for this legitimate purpose are not likely to be overly burdened by these changes that would take steps to deter adolescent NEC use. Further, as the additional nicotine warning is specifically targeted toward adolescents, it is unlikely to have an impact on adult NEC users. In light of this, this thesis judges this recommendation to be effective. Further, the costs of this policy actions would most likely be at the expense of NEC e-juice manufacturers that are no longer able to actually market their e-juice flavourings and NEC products as they once were; and, the benefits will be a reduction in adolescent's desire to initiate or continue NEC use. Thus, in weighing the potential costs and benefits that could arise from this policy action, it is believed that this policy would be efficient in deterring adolescent use of NECs. Regarding the criterion of liberty, this policy action would have a negative and restrictive impact on the desires of adolescent users and could have an impact on adult NEC users. In contriving a policy solution to deter adolescent use of NECs, it is accepted that the liberties of adolescent users can, and should be directly minimized; however, any restrictions on the liberties of adult NEC users must be appropriately considered. While the liberties of adult NEC users could be somewhat restricted with this action, it is noted that this restriction would likely not have a negative impact on mature, adult aged users, in comparison to impressionable adolescent users. It could be further argued that this policy's most negative impacts would be felt by NEC e-juice manufacturers, who are no longer able to market their products to be associated with their brand and who have to include an even lengthier warning message; however, this thesis argues that as the issue of adolescent NEC use has presented such a concern to overall public health, strong

policy action by the federal government must rely primarily on considerations of NEC users rather than those of NEC producers.

Education of Adolescents. In an effort to change adolescent perceptions of NECs, sound NEC education curricula are required within individual school-districts. In an effort to address this desire, JUUL released the JUUL Curriculum, educating youth on three principle topics associated with NECs: The Science, E-Cigs and Social Influences, and Using Mindful Practices as a Replacement (Liu, 2018). This curriculum, at the time of its release, was rightly critiqued due to its incompleteness in addressing marketing practices and health concerns. In identifying specific modifications that could be made to each of these three curriculum modules, this thesis argues that the JUUL Curriculum, if amended, could prove to be one of the most effective tools in deterring adolescent use of NECs. “The Science” module must be improved so as to discuss all of the chemical components of NECs, including chemical byproducts found in flavourings. Further, this aspect of the curriculum must include discussion about the harmful effects of nicotine, itself—including its addictiveness, and its potential harms to brain development. Regarding the second module, “E-Cigs and Social Influences,” more educational information must be made available regarding the internet-marketing practices employed by NEC firms. As adolescents are more susceptible to targeted messaging on social media than adults are, it is critical that adolescents understand their own shortcomings in discerning what is sensationalism and what is fact. Finally, the “Using Mindful Practices as Replacement” module must ensure to include education about how adults that rely on NECs can vary nicotine content in their e-juices so as to wean themselves off of nicotine reliance. By educating adolescents on the true purpose of NECs a method of THR and not

simply another vice that adolescents could experiment with, adolescents would be far less likely to initiate NEC use. As education is a passive policy tool that does not often lead to negative costs, and as public concern regarding adolescent use of NECs continues to mount, this thesis argues that this policy would have a high social and political acceptance. Further, this policy solution is deemed to be effective as it is highly probable that adolescents would deter their own NEC use if they were offered uniform, NEC education.

Amend the FFDCA to lower the tobacco MLSA to eighteen. In late 2019, President Trump signed legislation to amend the FFDCA to increase the MLSA of tobacco from eighteen to twenty-one (FDA, 2020). As NECs had already been previously categorized as tobacco products, this change affected the sale and distribution of NECs as well. The intent of this change was to impede adolescents' ease of access to NEC products—in recognizing that a high-school student is more likely to be associated with eighteen-year-old individuals than with a twenty-one years old. While this action by the federal government could be viewed as effective in deterring adolescent use of NECs—through restricting ease of access—this action did not take into consideration the liberties of 18-20s, who may rely on NECs as a method of THR or who had previously been able to purchase and use tobacco products without restriction from the government. In this way, the liberties of a select demographic of tobacco users—18-20s—were negatively impacted by this decision. Thus, the FFDCA must be amended, again, to revert the MLSA of tobacco products to eighteen. While the reversion of the MLSA would arguably serve as counter to the cause of deterring adolescent NEC use, this thesis argues that with the implementation of the other recommendations included herein, the goal of

detering adolescent use of NECs is attainable without negatively impacting the liberties of select individuals in the population. Beyond considerations of liberty, this policy action would prove to be create equity where there is currently none in the regard that 18-20s—who are able to vote, takeout a loan, and die for their country—would once again be able to have free choice in consuming or using products that are permitted by law (like NECs and tobacco).

No further action on flavour restrictions. For greater certainty, this thesis argues that no further action should be taken to restrict the availability of flavours for NEC e-juice products. In response to the results of the 2019 National Youth Tobacco Survey, which indicated JUUL NECs as being the most popular among adolescents, the FDA prohibited the sale of pre-filled Cigalike and eGo NECs that had flavourings other than menthol and tobacco (FDA, 2020). At the time, the FDA did not take further action to restrict the use of flavourings in NEC devices that the user must fill with e-liquid—like Mod NECs. Although this action was restrictive to adult NEC users that had used Cigalike or eGo devices like JUUL, adult NEC users, due to their lack of concern for the stealth that an NEC provides, are able to switch to other NEC products that allow them to vary their flavour. Meanwhile, adolescent NEC users are far less likely to continue using NECs if they are not able to do so with stealth (Craver, 2018). Thus, this thesis argues that a sufficient amount of regulation has already been placed on the sale and use of NEC flavours. While further flavour restrictions could prove to be effective in the deterrence of adolescent NEC use, they would not prove to be efficient in the regard that the nonmonetary costs to the adult aged NEC user would far outweigh the benefit adolescent users. Any further action by the FDA would risk directly and negatively impacting the

liberties of adult NEC users that would no longer be able to use their preferred flavour for THR.

CHAPTER VI

Limitations, Future Research, and Conclusions

Limitations & Future Research

While this thesis offers a comprehensive view of adolescents' use of NECs, it must be acknowledged that this topic is complex and requires additional research. With tobacco, over time, the public became more aware of its negative health effects and began to ween themselves off of it. Nevertheless, today, in 2020, tobacco use among Americans, and adolescents in particular, is still prevalent. Thus, if lessons are to be learned from the story of tobacco and to be used in predicting NEC market trends, it is possible that adolescent NEC use does not have a dramatic decrease regardless of the policy solutions that may be implemented. In order to understand the complexities of NECs, more research must be conducted to analyse adolescent perceptions of NECs after policy solutions like these have been implemented. Further, more research is required to understand the ways in which youth and teens, in particular, obtain NEC products, in light of these seemingly stringent regulations.

Conclusions

Beginning with the rise of tobacco in the twentieth century, Americans have become more hooked than ever on the addictive chemical of nicotine. Due to the use of misinformation and predatory marketing practices of this era, adolescent use of tobacco

products was rampant in late twentieth century America. While the federal government would take steps in the years following to curtail the practices of the tobacco industry, technological innovation gave way to a new form of nicotine consumption: the NEC. Shortly after the introduction of the NEC, many began to see its benefits as a method of THR—in allowing users to vary the concentration and flavour of their nicotine delivery. Throughout the first decade of widespread NEC use, it became clear that many Americans erroneously associated no health or safety risks with the use of NECs. This is not to say that Americans ignored warnings; however, little research had been conducted by that time to indicate the existent risks of NEC use. Since, research has shown that NEC products do contain chemicals that can pose varying degrees of risk to users of all ages. Further, through the use of the predatory marketing practices similar to that of the tobacco industry in the twentieth century, NEC firms were able to increase the popularity and use of their products. With this increase of NEC use in the total population, adolescents also saw a dramatic increase in use. In 2011, just 4 years after the emergence of NECs, only 1.5% of high school students reported that they were currently (at the time) using NECs; and, by 2016, that number was shown to have jumped almost tenfold to 11.3% (Krishnan-Sarin, 2019). As of 2019, this same statistic was estimated to be as high as 27.5% of high school students. In the early 2010s, recognizing the developing problem arising from a lack of regulation for NECs, the federal government began taking measured policy steps in order to quell the rise of adolescent NEC use. While these regulatory measures were somewhat beneficial in their own rights, this problem still demands more regulation on the part of the federal government. In analyzing the findings of various researchers, this thesis argues that specific policy solutions are necessary to

address the still existent problem of adolescent NEC use. Through regulation of NEC product manufacturers, education of adolescents regarding NECs, amending the FFDCFA to revert the MLSA to eighteen, and taking no further action on flavour availability, the federal government would be able to offer a reasoned policy response to the problem of adolescent NEC use without negatively impacting the abilities of adults (over the age of eighteen) to rely on NECs as a proper method of THR.

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