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Demonstrating awareness on the impact of vapes in society

Jean Carlos Cortez-Rivera

Nova Southeastern University, jc4761@mynsu.nova.edu

Kianie Cruz Rosado

Nova Southeastern University, kc2756@mynsu.nova.edu

Andrea De Jesús Navia

Nova Southeastern University, ad2959@mynsu.nova.edu

Kenneth Hartú Rodríguez

Nova Southeastern University, kh2008@mynsu.nova.edu

Dayrimar Marchena Santiago

Nova Southeastern University, dm3326@mynsu.nova.edu

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Demonstrating awareness on the impact of vapes in society

Jean Carlos Cortes-Rivera; Kianie Cruz Rosado; Andrea De Jesús Navia; Kenneth Hartú Rodríguez; Dayrimar Marchena Santiago

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Abstract

Vaping, initially marketed as a smoking cessation tool, has become a public health concern due to its widespread use, particularly among youth. Despite claims of harm reduction compared to traditional cigarettes, vaping products pose significant health risks. These include respiratory issues, cardiovascular complications, and neurological impacts, largely driven by nicotine addiction and exposure to toxic substances. Vaping's appeal, fueled by extensive advertising and enticing e-liquid flavors, has led to an epidemic among adolescents, with notable social and economic consequences. Additionally, the improper disposal of vaping devices poses environmental hazards, contributing to pollution and carbon emissions. While advocates argue that vaping may assist in smoking cessation, the lack of FDA approval and conclusive evidence highlights the need for caution. This paper explores the health, environmental, social, and economic impacts of vaping, emphasizing the urgent need for education, prevention strategies, and regulatory measures to mitigate its effects on individuals and society.

Keywords: vaping, nicotine addiction, smoking cessation, respiratory health, cardiovascular risks, neurological impacts, environmental pollution, public health

Introduction

Vapes, or e-cigarettes, entered the market in 2007, and were initially promoted as a potential tool to aid in smoking cessation (Jones & Salzman, 2020). However, limited evidence supports their effectiveness for this purpose, and no e-cigarette products have been proven to assist with smoking cessation (American Lung Association, 2024). Between 2010 and 2016, there was a substantial increase in e-cigarette advertising which contributed to the vaping epidemic that has been observed in recent years (Jones & Salzman, 2020). According to data from the National Youth Tobacco Survey, about 1.5% of high school students reported using these products in 2011 (CDC, 2016). However, by 2015, this figure increased significantly to 16%, representing more than 2 million high school students and 600,000 middle school students who reported using these products in the past 30 days (CDC, 2016). Over the past decade, vapes or e-cigarettes have become the most used smoking product in the United States (CDC, 2023). These products can deliver substances like nicotine, cannabis, flavoring agents, among others (CDC, n.d.). E-cigarettes are categorized by device generation and work by heating a solution, known as e-liquid, which users inhale after an aerosol is produced by the device (CDC, n.d.). With more than 7,000 e-liquid flavors available, flavoring is considered a major factor in attracting users to these products (CDC, 2016). Many chemicals found in vapes can pose health risks for their users. Most vapes contain nicotine which is a highly addictive substance (American Lung Association, 2024). Frequent exposure and high intake of nicotine significantly contribute to the addictive nature of vaping (National Academies of Sciences, Engineering, and Medicine, 2018). Moreover, since users can obtain higher concentrations of nicotine with these products compared to traditional tobacco products, they may develop tolerance and dependence quicker (National Academies of Sciences, Engineering, and Medicine, 2018). Additionally, vapes can contain harmful substances like formaldehyde and acetaldehyde (both considered carcinogens), as well as acrolein (an herbicide), which may cause long-term cardiovascular and lung diseases, such as COPD (American Lung Association, 2024). Other toxic components found in vapes include propylene glycol (a solvent for nicotine), diacetyl (linked to bronchiolitis obliterans), cadmium, heavy metals such as nickel, tin and lead. (American Lung Association, 2024). Furthermore, the evolving trend of vaping in recent years has had significant health, environmental, economic, and social impacts which may pose challenges for the future of our population.

Health Impacts

Absorption of Vape Contents

The respiratory system is structured in a way that maximizes the surface area for gas exchange. This crucial function facilitates the absorption of substances, including those found in vape aerosols. When vaping, the aerosolized substances are inhaled into the lungs and follow the respiratory pathway. Upon inhalation, vape aerosols enter through the mouth, travel down the trachea, bronchi, and bronchioles, and eventually reach the alveoli, as shown in **Figure 1** (NIH, 2022). The aerosols are distributed through the branches of the bronchi and bronchioles, spreading evenly throughout the lungs.

The large surface area and thin walls of the alveoli allow for quick absorption of the vape contents, while the capillary network that surrounds the alveoli guarantees appropriate blood supply and efficient gas exchange (NIH, 2022). These substances spread across the alveolar membrane into the bloodstream and are rapidly transported throughout the body, leading to expected effects such as nicotine delivery or other potential adverse effects. Hence, while the respiratory system enables efficient oxygen and carbon dioxide exchange, it also facilitates the absorption of chemicals inhaled via vaping. This can lead to a rapid onset of effects and respiratory issues.

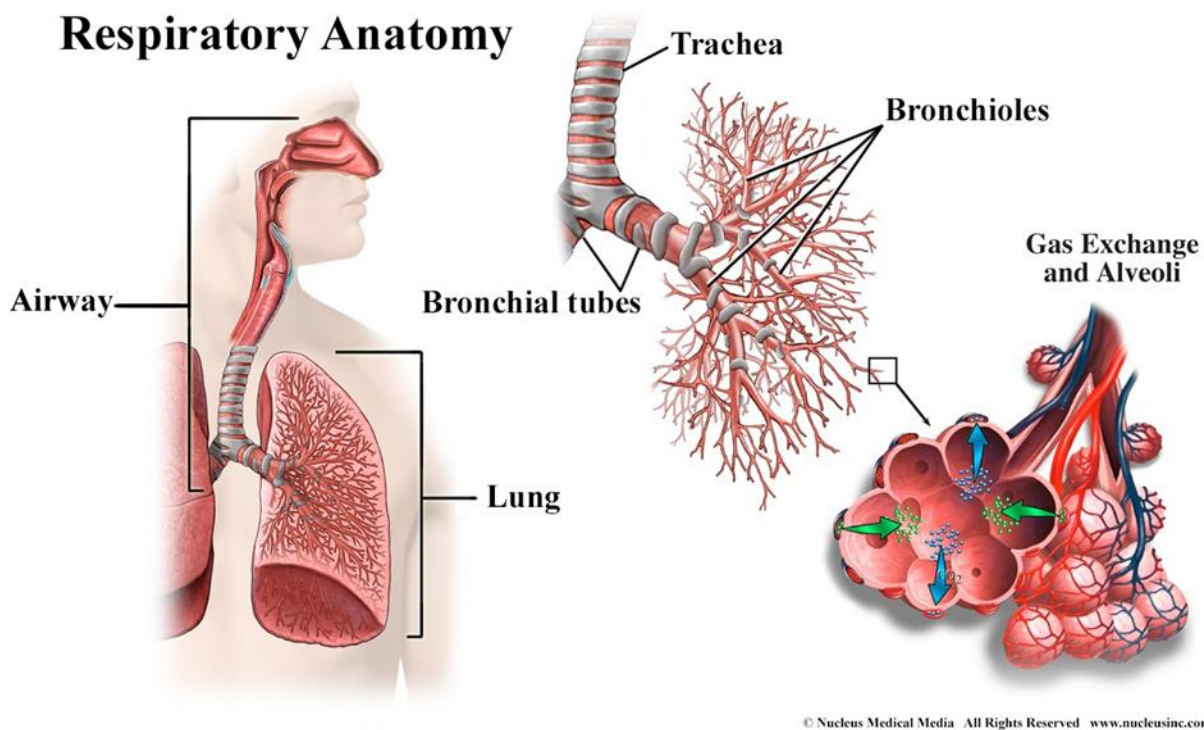


Figure 1 Gas Exchange: Enlarged view of the trachea, bronchial tubes (bronchi), and bronchioles, as well as the airways and lungs.

Negative Health Impacts

In January 2018, the National Academies of Science, Engineering, and Medicine released a comprehensive report that summarized over 800 studies which concluded that using e-cigarettes poses significant health risks (American Lung Association, 2024). The health implications of vaping are varied, and studies have shown it to impact the lungs, heart, and brain (Seiler-Ramadas, R., 2021). Vaping has been linked to several respiratory health issues, including exacerbations of pre-existing conditions such as asthma, bronchitis, and respiratory tract irritation. It can also lead to acute respiratory issues since users may present symptoms like coughing, throat irritation, and shortness of breath, particularly in those with a history of respiratory conditions. Additionally, long-term risks, such as lung cancer, are possible since e-cigarettes contain harmful chemicals which were previously mentioned (American Lung Association, 2024). Furthermore, inhalation of secondhand e-cigarette smoke has also proven to hold negative respiratory risks, since in 2016 the Surgeon General stated that such emission contained ultrafine particles, flavorings, and heavy metals (American Lung Association, 2024).

The heart is another organ affected by vaping. The Cardiac and Lung E-cig Smoking (CLUES) Study found that vaping may lead to an increase in blood pressure (about 122/72 mm Hg to approximately 127/77 mm Hg after vaping) and heart rate (around 4 beats per minute (bpm) increase after vaping) due to the nicotine it possesses (American Heart Association, 2022). Nicotine causes an increase in constriction of the brachial artery which in effect indicates the activation of the sympathetic nervous system (fight-or-flight response). During this response, the heart's demand for oxygen rises, leading to dysfunction in arterial walls (American Heart Association, 2022). Hence, there is an increase in the risk of stroke, heart attacks, and other heart diseases. The study also found that the cardiovascular effects of vaping are similar to those of combustible cigarettes, despite vapers being younger (average age 27.4 years vs. 42 years) and having vaped for a shorter duration (4.1 years vs. 23 years), highlighting the great impact these devices have on society's health (American Heart Association, 2022).

The nicotine found in vapes can cause dependence and impact brain development, especially in young adults. Nicotine intake leads to the release of dopamine (the feel-good chemical in the brain), making it an addictive component that, when not present, leads to withdrawal symptoms such as irritability, depression, and tremors (NSW Government, 2024). Many individuals vape to release stress and anxiety. However, addiction to this product has the potential to cause stress and anxiety as well, making it difficult to quit (NSW Government, 2024). Additionally, because of the greater neuroplasticity in the brain of its most common users (young individuals), exposure to nicotine can cause the brain to develop a significant addiction to nicotine and other

substances later as an adult (NSW Government, 2024). Vapes can also have short-term and long-term harmful effects. Nicotine exposure may affect brain areas associated with attention, learning, and impulse control leading to cognitive and behavioral issues such as brain fog, increased stress, and depression, among other issues (University of Nevada, Reno, 2023).

Positive Health Impacts

While the various adverse health effects of vaping continue to be studied, some question whether there are any benefits to using vapes. Research has been conducted to evaluate whether, for instance, vaping can help people who want to quit smoking. Since individuals who are quitting smoking may experience withdrawal symptoms, vaping may help reduce these symptoms in the initial days (Ashour, 2023). Moreover, many believe that vapes are less harmful than cigarettes. Although vapes lack certain contaminants found in tobacco and burning paper, they contain other potentially harmful substances (NIDA, 2020). Because the long-term effects of vaping are not yet fully understood, evidence supporting vaping as a tool for smoking cessation remains limited. For this reason, the FDA has not approved vapes as a treatment for smoking cessation (NIDA, 2020). Thus, although e-cigarette promoters claim that vaping can aid in quitting smoking, more research is needed to determine its effectiveness. Some studies suggest that users are more likely to continue smoking in addition to vaping ("Is Vaping Better Than Smoking," 2024).

Environmental Impacts

Negative Environmental Impacts

Vapes can not only affect human health, but also our surroundings. For example, vaping products contain e-cigarette batteries, which can be flammable and pose environmental hazards due to their lithium content. Lithium is classified as hazardous waste (VicHealth, 2023). Also, the non-biodegradable plastic in these products can contaminate water, soil, and air (Ngambo et al., 2023). Moreover, most vapes are designed for single use, leading to improper disposal and a lack of recycling (VicHealth, 2023). Another harmful factor of these is that the harmful chemicals, like nicotine and propylene glycol found in them, further degrade environmental quality (Ngambo et al., 2023). Furthermore, the production of these items generates carbon emissions, contributing to environmental damage and global warming.

Positive Environmental Impacts

Vapes can be regarded as having a minimal impact in enclosed spaces, therefore posing less harm to the health of other citizens (Marques et al., 2021).

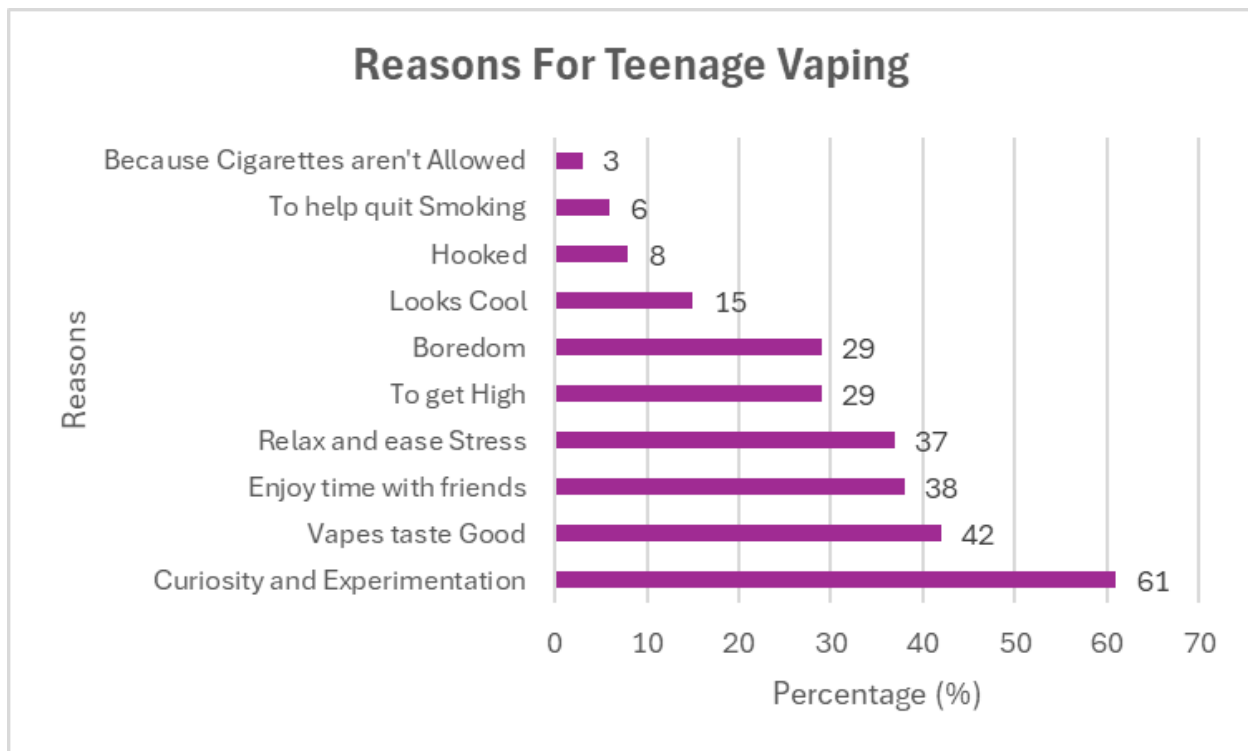
Social/Economical Impact

Negative Social/Economical Impact

Human beings have been fighting against stress, anxiety, and depression since the beginning of time. It is human nature that we find ways to make ourselves feel better and, in the past, we can see trends that previous generations used to cope with the hardships of their life. In the 1900s, adults used alcohol (from 1900-1915, the average adult drank 13 standard drinks per week, which is 2.5 gallons of pure alcohol a year) (Zagorsky, 2024) and cigarettes (before 1964, 42.3% of adults used to smoke cigarettes) to cope with the world around them (JAMA, 1999). Despite the decrease in the use of traditional cigarettes in recent years, newer generations have resorted to newer ways to deal with the hardships in their lives, like vaping (Lyzwinski, 2022).

Studies have found that young people who use vapes are more exposed to advertisements (CDC, 2016). The vaping trend has also had a social impact, as advertising on social media platforms, with companies paying for algorithms to ensure their ads appear as sponsored content abound. Young people are particularly affected by these algorithms. Therefore, this encourages young people to use vapes. This situation is psychological, leading to impulsivity, the feeling of acceptance in society, and dependence. Vapes are readily accessible in convenience stores, gas stations, and smoke shops. Hence, economically, this trend can hurt individuals, as it fosters a psychological dependence that encourages people to purchase and expend money on vaping products.

In **graph #1**, we can see a 2019 survey states that 60.9% of teens vape or use electronic cigarettes (Julia, 2024). Additionally, when consuming marijuana, the user expects to get high, but while vapes can contain ingredients that may cause the person to feel that high, some people simply use it to try the flavors. The same survey states that 60.9% of teens vape because they want to experience what vaping is like, but 41.7% of them keep vaping because it makes them feel good. However, out of this 41.7%, 37.9% of these teenagers continue vaping to enjoy social time with friends. This highlights vaping's strong social influence on youth, mirroring past trends where peer pressure led teenagers and adults to smoke, drink alcohol, or use illicit drugs. These behaviors often occur as part of longstanding social dynamics among young people.



Graph #1: Reasons for vaping in teens (Julia, 2024).

Vapes are also more convenient than smoking cigarettes or marijuana. They eliminate the need for the preparation of “blunts”, motivating consumers to continue using vapes. Additionally, since many teenagers purchase vapes illegally, they have easier access to vapes that contain nicotine or illicit drugs. As a result, many of these teenagers will have their futures negatively impacted by it (NIDA, 2024). These vapes can be laced with unexpected illicit drugs like fentanyl, which can increase the chances of an overdose, putting users in greater harm (PharmChem, 2024). Moreover, nicotine is more addictive than marijuana, causing many teenagers to grow dependent on it, leading to its prolonged use. This means that, even though vaping is more economical than smoking cigarettes, the constant use of vaping ingredients will result in individuals spending most of their money on vaping merchandise. In some cases, when these teenagers become adults, their main reason for vaping changes due to convenience, preference of ingredients, and friend’s preference. Also, some vape to control their anxiety, without knowing that vaping can further increase it (NSW Government, 2024). This creates a cycle of addiction, like alcohol and cigarette dependence, creating an ecosystem of people that vape. It's that constant exposure that also makes it difficult for people to quit vaping.

Positive Social/Economical Impact

The vaping industry has made significant economic contributions to the United States and businesses. This industry creates more job opportunities for citizens. Vape sales contribute \$9.15 billion to the national economy (Burgess,2024). When compared to normal cigarettes, single use vapes are cheaper and last longer than regular cigarettes (Burgess,2024). An example of this is Marlboro 20 pack cigarettes in New York which cost \$17 versus the Elf Bar vapes that range from \$5 - \$15 (these bring more puffs than regular cigarettes) (Burgess,2024).

Conclusion

To conclude, vaping can impact the population in many ways. A recent study published in 2023 from the CDC and the FDA, showed a decrease in the use of tobacco products among high school students (from 16.5% to 12.6%). Regarding the use of e-cigarettes, there was a decrease from 14.1% to 10% (CDC, 2023). Among middle school students an increase in the use of tobacco products from 4.5% to 6.6% was observed. Therefore, there is still room for improvement in both groups (CDC, 2023). Currently, no e-cigarette product has been found to be safe for use and none has been approved by the FDA for smoking cessation (American Lung Association, 2024). The use of these products can negatively impact the user's health as it can increase the risk for cardiovascular, lung, and neurological diseases. It could also negatively impact the environment and our society/economy. Our population (specifically adolescents and young adults) should be educated on the consequences of utilizing these vaping products and shown smoking/vaping prevention strategies to create more awareness about the impact that these products have in our society today. By doing this, we can improve the long-term quality of life of many consumers and the general population, prevent overdoses or illnesses caused by illicit drug-laced vapes, protect the environment, and create opportunities for further studies regarding these products.

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