International Journal of Early Childhood Special Education (INT-JECSE)
DOI:10.48047/INTJECSE/V15I4.1 ISSN: 1308-5581 Vol 14, Issue 10, 2022

AN OVERVIEW ON ELECTRONIC CIGARETTES: COMPONENTS, BENEFITS, AND CONCERNS

R.Meenakshi, Dr.N.L.Venkataraman, K.Kokulavani, Dr.S.Sumithra

Assistant Professor, Department of Electronics and Communication Engineering, J.J. College of Engineering and Technology, Trichy, Tamilnadu

Assistant Professor, Department of Electronics and Communication Engineering, J.J. College of Engineering and Technology, Trichy, Tamilnadu

Assistant Professor, Department of Electronics and Communication Engineering, J.J. College of Engineering and Technology, Trichy, Tamilnadu

Professor, Department of Electronics and Communication Engineering, J.J. College of Engineering and Technology, Trichy, Tamilnadu

ABSTRACT:

E-cigarettes, also known as electronic cigarettes or vapes, have gained significant attention in recent years as an alternative to traditional tobacco smoking. These devices utilize a battery-powered heating element to vaporize a liquid solution, commonly referred to as e-liquid or vape juice, which is then inhaled by the user. The aim of this article is to provide an overview of e-cigarettes, including their components, potential benefits, and concerns. The structural composition of e-cigarettes typically consists of a battery, a heating element (atomizer), a cartridge or tank to hold the e-liquid, and a mouthpiece through which the vapor is inhaled. The e-liquid itself typically contains propylene glycol (PG), vegetable glycerine (VG), flavourings, and, in some cases, nicotine. By eliminating the combustion of tobacco, e-cigarettes offer a potentially reduced exposure to harmful chemicals and a smoke-free environment. E-cigarettes are often considered as smoking cessation aids, providing an alternative nicotine delivery system for smokers who want to quit or reduce their tobacco consumption. They mimic the sensory aspects of smoking, such as the hand-to-mouth motion and inhalation/exhalation, while allowing users to choose from a variety of flavours and nicotine strengths. However, concerns have been raised about the potential health risks associated with e-cigarette aerosols, as well as their appeal to youth and non-smokers. This article highlights the need for ongoing research to better understand the long-term health effects of e-cigarette use and the potential risks and benefits they present. It also emphasizes the importance of regulation and quality control to ensure product safety and responsible marketing. A comprehensive and balanced approach is necessary to inform regulations, promote smoking cessation strategies, and protect public health in relation to e-cigarette use.

Keywords: *E-cigarettes, nicotine, vaping systems*

INTRODUCTION:

In recent years, the rise of electronic cigarettes, commonly known as e-cigarettes or vapes, has sparked significant interest and debate worldwide. These innovative devices have rapidly gained popularity among smokers and non-smokers alike, revolutionizing the way people approach nicotine consumption. By offering a potentially less harmful alternative to traditional tobacco products, e-cigarettes have emerged as a disruptive force in the realm of smoking cessation and harm reduction. This introduction aims to provide a comprehensive overview of e-cigarettes, exploring their history, components, working mechanism, and potential benefits and risks. The concept of an electronic cigarette dates back to the 1960s, when a visionary named Herbert A.[1] Gilbert patented a device that resembled a modern-day e-cigarette. However, it wasn't until the early 2000s that the first commercially successful e-cigarette was introduced by a Chinese pharmacist named Hon Lik. Since then, e-cigarettes have undergone significant technological advancements and have become increasingly popular worldwide. E-cigarettes typically consist of three main components: a battery, an atomizer, and a cartridge or tank. The battery powers the device and can be rechargeable or disposable. The atomizer, also known as a heating element, vaporizes a liquid solution, often referred to as e-liquid or vape juice.[2] This e-liquid contains a mixture of propylene glycol, vegetable glycerine, flavourings, and sometimes nicotine. The cartridge or tank holds the e-liquid and connects to the atomizer.

When a user inhales through the mouthpiece of an e-cigarette, the battery activates the atomizer, which heats up the e-liquid, converting it into an aerosol commonly known as vapor. This vapor is then inhaled and exhaled, mimicking the act of smoking while producing a sensation similar to traditional tobacco smoking. The user can often customize the experience by choosing different flavours and nicotine strengths in their e-liquids. One of the main advantages of e-cigarettes is their potential as a harm reduction tool for smokers.[3] Unlike traditional cigarettes, e-cigarettes do not burn tobacco, which results in the release of numerous harmful chemicals and toxins associated with combustion. While not risk-free, e-cigarettes are generally considered to be less harmful than combustible tobacco products. They eliminate the production of smoke, thereby reducing second hand smoke exposure and the associated health risks for bystanders.[4]

Moreover, e-cigarettes provide smokers with an alternative nicotine delivery system that closely replicates the behavioural aspects of smoking. This feature makes them an appealing option for individuals seeking to quit smoking by gradually reducing their nicotine intake. Additionally, e-cigarettes may serve as a bridge for smokers who are not yet ready to quit, potentially reducing their tobacco consumption and exposure to harmful chemicals. Despite their potential benefits, e-cigarettes are not without controversy.[5] Some concerns arise from the lack of long-term scientific evidence

regarding their safety and efficacy in smoking cessation. The nicotine present in e-cigarettes can still be addictive, potentially leading to dual use or prolonged dependence.

There have been debates regarding the potential gateway effect of e-cigarettes, particularly among youth, who might transition from vaping to traditional smoking. Furthermore, there have been cases of severe lung injuries associated with the use of illicit or contaminated vaping products, highlighting the importance of quality control and regulation within the industry.[6] Balancing the promotion of harm reduction benefits with appropriate safeguards to prevent unintended consequences remains a critical challenge. E-cigarettes have revolutionized the tobacco industry and smoking cessation landscape, presenting smokers with an alternative that has the potential to reduce harm. While ongoing research and regulation are necessary to address concerns and ensure.

According to a report by Grand View Research, the global e-cigarette market was valued at approximately USD 15.6 billion in 2020. The market was expected to witness a compound annual growth rate (CAGR) of 23.8% from 2021 to 2028. Factors contributing to the growth of the market included increasing awareness about the harmful effects of traditional smoking, a shift toward smoke-free alternatives, and the availability of a wide range of flavours and products. Given below is the data collected from multiple researches to highlight the market trends of e-cigarette.[7]

YEAR	GROWTH IN THE E-CIGARETTE MARKET
2021	15.6
2022	19.29
2023	23.85
2024	29.49
2025	36.46
2026	45.08
2027	55.73
2028	68.91

Table. 1

Given below is the graphical representation depicting a rise in the market size of e-cigarettes.

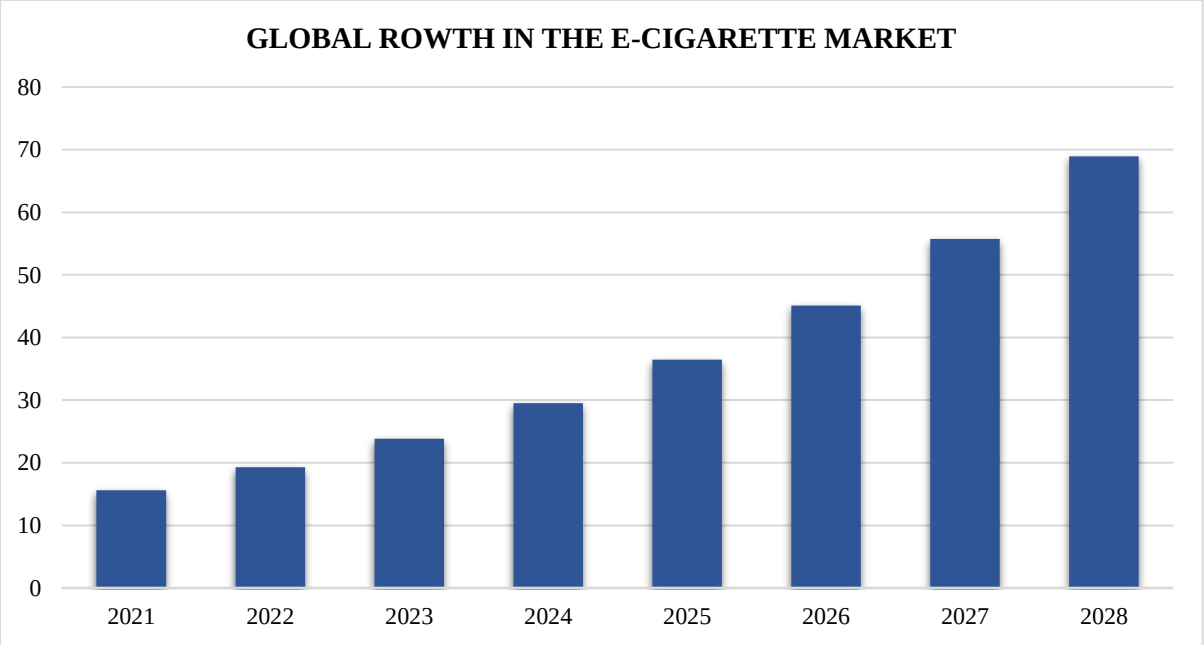

Fig. 1

STRUCTURAL COMPOSITIONS:

The structural composition of e-cigarettes consists of several key components that work together to deliver the vaping experience. These components include a battery, an atomizer, a cartridge or tank, and a mouthpiece:

Battery: The battery is the power source of the e-cigarette. It is usually rechargeable and provides the energy required to operate the device. The battery may be integrated into the main body of the e-cigarette or detachable for easy replacement or charging.[8]

Atomizer: The atomizer, also known as a heating element or coil, is responsible for vaporizing the e-liquid. It consists of a resistance wire coil that heats up when the battery is activated. The coil is typically made of materials like kanthal, stainless steel, or nichrome. As the coil heats up, it comes into contact with the e-liquid, causing it to vaporize and create the aerosol that is inhaled by the user.

Cartridge or Tank: The cartridge or tank holds the e-liquid and connects to the atomizer. In earlier e-cigarette models, cartridges were used and were often prefilled with e-liquid. However, modern e-cigarettes commonly use refillable tanks. These tanks are larger and allow users to fill them with their choice of e-liquid. Tanks may be made of glass or plastic and typically have a capacity ranging from 1 to 5 milli-litres.[9]

E-Liquid: The e-liquid, also known as vape juice or e-juice, is the liquid solution that is vaporized and inhaled by the user. It typically consists of a mixture of propylene glycol (PG) and vegetable glycerine (VG), which serve as the base for the e-liquid. These ingredients help produce the vapor and provide a smooth vaping experience. Flavourings, such as fruit, menthol, or tobacco flavours, are added to enhance the taste. Some e-liquids also contain nicotine, although there are nicotine-free options available as well.

Mouthpiece: The mouthpiece is the part of the e-cigarette that the user inhales from. It is usually a removable plastic or metal piece attached to the top of the device. The mouthpiece allows the vapor to pass through to the user's mouth and lungs.[10]

Additionally, many modern e-cigarettes come equipped with various features and components to enhance the vaping experience. These may include airflow control systems, adjustable wattage or voltage settings, LED displays, and even Bluetooth connectivity for device customization and data tracking.

SMART E-CIGRETTES: A NEW REVOLUTION

Smart e-cigarettes, also known as connected or electronic smart devices, are a type of advanced e-cigarette that incorporates technology to enhance the vaping experience. These devices are designed to connect to mobile applications or other smart devices via Bluetooth or other wireless technologies, offering a range of features and functionalities. Smart e-cigarettes can be connected to dedicated mobile applications, allowing users to access various settings, track their vaping habits, and customize their device. Through the app, users can adjust settings such as temperature, wattage, and airflow, providing a personalized vaping experience.

Smart e-cigarettes enable users to track and monitor their vaping habits, including puff count, nicotine intake, and usage patterns. This data can be valuable for those looking to reduce their nicotine consumption or gain insights into their vaping behaviour.[3] Smart e-cigarettes offer features like child lock mechanisms, device locking, and passcode protection, ensuring the device is safe and secure. Users can also remotely lock or locate their e-cigarettes through the mobile app, providing added peace of mind. With smart e-cigarettes, manufacturers can release firmware updates that can be easily installed through the connected mobile app. These updates can introduce new features, enhance performance, and address any potential bugs or issues, ensuring the device remains up to date.[11]

Some smart e-cigarettes include social features, allowing users to connect with other vapers, share their experiences, and participate in vaping communities.[4] These features can create a sense of community and provide a platform for knowledge sharing and discussions. Additionally, while smart e-cigarettes can offer added convenience and customization, users should still prioritize safety, proper usage, and adhere to relevant regulations and guidelines.

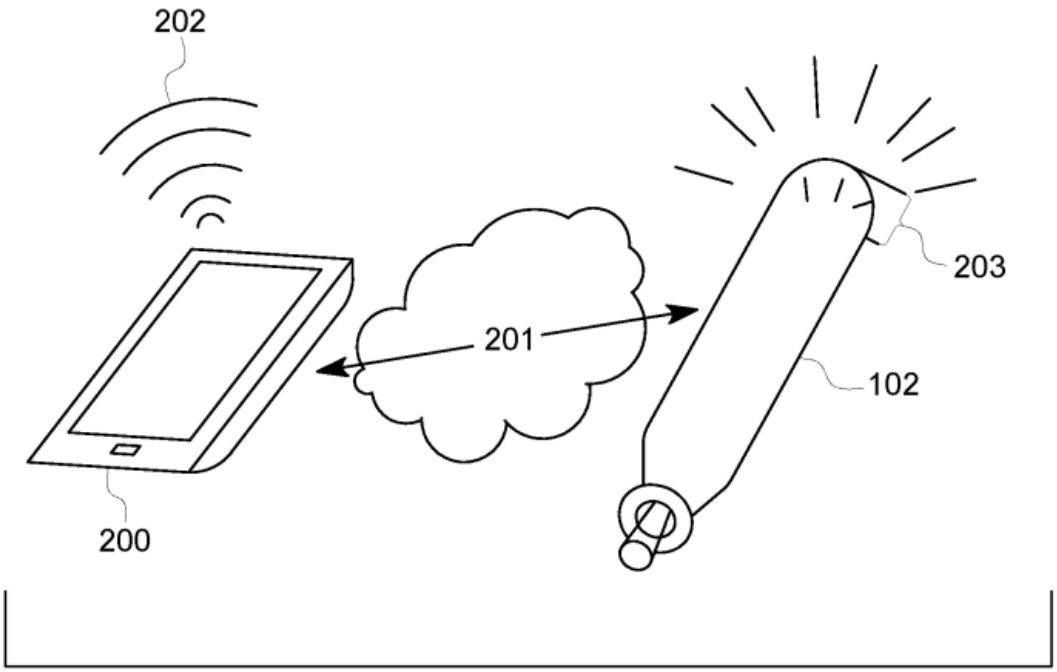

Fig. 2 Connecting E-cigarettes with mobile phones (PCT/US2016/018047 Dt. 16th September 2016)

CHEMICAL COMPOSITION OF E-CIGARETTES:

The chemical compositions used in e-cigarettes, specifically in the e-liquids or vape juices, can vary depending on the brand, flavour, and type of e-cigarette. However, here are some common components found in e-liquids:

1. Propylene Glycol (PG): Propylene glycol is a synthetic organic compound commonly used as a base ingredient in e-liquids. It is a clear and odourless liquid that helps produce vapor when heated. PG is generally recognized as safe for inhalation and is commonly used in various food and medical products.

2. Vegetable Glycerine (VG): Vegetable glycerine is another common base ingredient in e-liquids. It is a natural and slightly sweet substance derived from vegetable oils. VG is responsible for creating vapor clouds when heated. Like PG, VG is generally recognized as safe for inhalation and is also used in various food and cosmetic products.

3. Flavourings: E-liquids often contain flavourings to provide a wide range of tastes and aromas. These flavourings can be natural or artificial and are used to mimic the flavours of fruits, desserts, beverages, menthol, tobacco, and more. The specific flavouring chemicals used can vary, but they are typically food-grade and considered safe for ingestion.

DOI:10.48047/INTJECSE/V15I4.1 ISSN: 1308-5581 Vol 14, Issue 10, 2022

4. Nicotine: Many e-liquids contain nicotine, a highly addictive substance found in tobacco. Nicotine is an optional ingredient and its concentration can vary. E-liquids typically specify the nicotine strength, often ranging from 0mg/mL (nicotine-free) to higher levels such as 3mg/mL, 6mg/mL, 12mg/mL, and even higher for heavy smokers. It is important to note that nicotine is a toxic substance and can be harmful if ingested in high quantities.

5. Other Additives: Some e-liquids may contain additional additives, such as sweeteners, cooling agents, or throat hit enhancers, to enhance the vaping experience. These additives are used in varying amounts depending on the specific e-liquid formulation.

It is essential to mention that e-liquids should be sourced from reputable manufacturers who adhere to quality control standards and regulatory guidelines. While these ingredients are generally considered safe for inhalation, it is crucial to remember that the long-term health effects of inhaling e-cigarette aerosols are still being studied, and some additives may carry potential risks.

Furthermore, it is worth noting that not all e-liquids or e-cigarette products are the same, and specific formulations may vary among brands and products. Users should always read and follow the instructions and warnings provided by the manufacturers, and exercise caution when using e-cigarettes.

ADVANTAGES OF E-CIGARETTES

E-cigarettes, also known as electronic cigarettes or vapes, have gained attention for their potential advantages compared to traditional tobacco cigarettes. While ongoing research is being conducted to fully understand their long-term effects. E-cigarettes do not involve the combustion of tobacco, which is responsible for the release of numerous harmful chemicals found in traditional cigarettes.[5] While not risk-free, e-cigarettes generally produce fewer toxicants and carcinogens. This reduced exposure to harmful chemicals may lead to potentially lower health risks compared to smoking tobacco.

Unlike traditional cigarettes, e-cigarettes produce vapor instead of smoke. This means that they do not release the strong odor and smoke associated with tobacco combustion. As a result, e-cigarette use can lead to a more pleasant environment for both users and those around them, reducing second hand smoke exposure. E-cigarettes have emerged as a popular tool for smokers who want to quit or reduce their tobacco consumption. They provide an alternative nicotine delivery system that mimics the behavioural aspects of smoking, such as hand-to-mouth motion and inhaling/exhaling. E-cigarettes offer smokers a potential pathway to gradually reduce their nicotine intake, as they can choose e-liquids with varying nicotine strengths or even opt for nicotine-free options.

E-cigarettes come in a wide range of flavours, allowing users to choose from options like fruits, desserts, beverages, or tobacco-like flavours. This variety can make the vaping experience more enjoyable and

personalized. Flavours can be especially appealing to smokers who are looking for an alternative to the taste of traditional tobacco. Although the initial investment for purchasing an e-cigarette device may vary, using e-cigarettes can be more cost-effective in the long run compared to smoking traditional cigarettes. The ongoing expense primarily involves purchasing e-liquids and replacement coils, which can be cheaper than buying packs of cigarettes regularly. E-cigarettes are widely available in many countries, both online and in physical stores. This accessibility makes them convenient for individuals seeking an alternative to traditional smoking. Moreover, e-cigarettes do not require matches or lighters for use, as they are powered by batteries that can be easily recharged or replaced.

While e-cigarettes have potential advantages, it is important to note that they are not without controversy. Ongoing research is needed to better understand the long-term health effects and potential risks associated with e-cigarette use, particularly among non-smokers and youth. Additionally, regulations and safety standards play a crucial role in ensuring the quality, manufacturing, and responsible marketing of e-cigarettes.

DISADVANATGES OF E-CIGARETTES

Alongside the potential advantages, it is important to consider the disadvantages and concerns associated with e-cigarettes. While e-cigarettes are generally considered to be less harmful than traditional cigarettes, they are not risk-free. The long-term health effects of e-cigarette use are still being studied, and certain risks have emerged. Some studies suggest that e-cigarette aerosols may contain harmful substances such as heavy metals, volatile organic compounds, and ultrafine particles, which could have adverse health effects on users and bystanders. E-cigarettes often contain nicotine, a highly addictive substance. Nicotine addiction can lead to continued use of e-cigarettes or even dual use with traditional cigarettes, which may undermine the goal of smoking cessation. Furthermore, the use of nicotine in e-cigarettes can potentially lead to nicotine dependence, especially among young individuals who may be more susceptible to addiction. E-cigarettes have raised concerns about their appeal to youth and non-smokers. The availability of appealing flavours and marketing strategies targeting younger demographics have been associated with increased e-cigarette use among youth. There are concerns that e-cigarette use among non-smoking youth may serve as a gateway to conventional tobacco smoking or nicotine addiction.[6] The e-cigarette market has experienced rapid growth, and regulatory frameworks have struggled to keep pace. This has resulted in varying product quality, inconsistent manufacturing standards, and the presence of counterfeit or substandard e-cigarettes and e-liquids. The lack of uniform regulations and quality control can pose risks to consumers in terms of product safety and reliability. Although e-cigarette aerosols are generally considered to be less harmful than second hand smoke from traditional cigarettes, they are not completely harmless. Non-users and bystanders can still be exposed to the aerosols, including potentially harmful substances and nicotine. This raises concerns about the potential health risks associated with second hand exposure to e-cigarette vapor. E-cigarettes have

sparked debates surrounding their normalization and potential renormalization of smoking behaviours. Some argue that the increased visibility and use of e-cigarettes may undermine decades of progress in tobacco control efforts by normalizing the act of smoking and re-glamorizing nicotine use.

CONCLUSION:

In conclusion, e-cigarettes have emerged as an alternative to traditional tobacco smoking, offering potential advantages and disadvantages. While they are generally considered to be less harmful than combustible cigarettes and may assist in smoking cessation efforts, it is crucial to recognize that they are not without risks.

One of the main advantages of e-cigarettes is the reduced exposure to harmful chemicals compared to traditional cigarettes. By eliminating the combustion of tobacco, e-cigarettes minimize the release of toxicants and carcinogens associated with smoking. This can potentially lead to lower health risks for users and reduced second hand smoke exposure for those around them. Additionally, e-cigarettes offer a wide range of flavours and a smoke-free environment, making them more appealing to some individuals. Furthermore, e-cigarettes have shown promise as smoking cessation aids, providing an alternative nicotine delivery system and mimicking the behavioural aspects of smoking. They offer smokers the option to gradually reduce their nicotine intake and choose from various nicotine strengths or even nicotine-free options. However, it is important to note that further research is needed to determine their long-term efficacy as smoking cessation tools and to understand the potential risks associated with their use.

On the other hand, there are also concerns regarding e-cigarettes. These include the potential health risks associated with the inhalation of e-cigarette aerosols, particularly in relation to the presence of harmful substances and nicotine addiction. The appeal of e-cigarettes to youth and non-smokers, as well as the lack of regulation and quality control in the industry, raise concerns about potential gateway effects and the need for comprehensive regulatory measures to ensure product safety and responsible marketing.[8] It is crucial for users to exercise caution and make informed decisions when using e-cigarettes. Choosing reputable manufacturers, understanding the ingredients and potential risks of e-liquids, and adhering to responsible usage practices are important for minimizing potential harms. Additionally, ongoing research, continued monitoring of the industry, and evidence-based regulation are essential for balancing the potential benefits of e-cigarettes with public health considerations. Overall, while e-cigarettes have the potential to offer harm reduction and smoking cessation benefits, their long-term effects and broader impact on public health are still being investigated. A comprehensive and balanced approach that considers both the advantages and disadvantages is necessary to inform regulations, support effective smoking cessation strategies, and promote public health in relation to e-cigarette use.

REFERENCES:

1. David J. K. Balfour, et al. “Balancing Consideration of the Risks and Benefits of E-Cigarettes,” American Journal of Public Health 111, no. 9 (September 1, 2021): pp. 1661-1672.
2. Kim Pulvers, Ashley S Emami, Nicole L Nollen, Devan R Romero, David R Strong, Neal L Benowitz, Jasjit S Ahluwalia, Tobacco Consumption and Toxicant Exposure of Cigarette Smokers Using Electronic Cigarettes, Nicotine & Tobacco Research, Volume 20, Issue 2, February 2018, Pages 206–214, https://doi.org/10.1093/ntr/ntw333
3. Adam EM Eltorai PhD, Warren Alpert Medical School, Brown University, 70 Ship St., Providence, RI 02906. E-mail: adam_eltorai@brown.edu.
4. Sapru, S., Vardhan, M., Li, Q. et al. E-cigarettes use in the United States: reasons for use, perceptions, and effects on health. BMC Public Health 20, 1518 (2020). https://doi.org/10.1186/s12889-020-09572-x
5. Benowitz, N. L., & Fraiman, J. B. (2017). Cardiovascular effects of electronic cigarettes. Nature Reviews Cardiology, 14(8), 447-456. https://doi.org/10.1038/nrcardio.2017.36
6. Bozier, J., Chivers, E. K., Chapman, D. G., Larcombe, A. N., Bastian, N. A., Masso-Silva, J. A., Byun, M. K., McDonald, C. F., Crotty Alexander, L. E., & Ween, M. P. (2020). The Evolving Landscape of e-Cigarettes: A Systematic Review of Recent Evidence. Chest, 157(5), 1362-1390. https://doi.org/10.1016/j.chest.2019.12.042
7. McKelvey K, Baiocchi M, Halpern-Felsher B. Adolescents’ and Young Adults’ Use and Perceptions of Pod-Based Electronic Cigarettes. JAMA Netw Open. 2018;1(6):e183535. doi:10.1001/jamanetworkopen.2018.3535
8. Marin Kuntic, Omar Hahad, Andreas Daiber & Thomas Münzel. (2020) Could E-cigarette vaping contribute to heart disease?. Expert Review of Respiratory Medicine 14:11, pages 1131-1139.
9. Gorukanti, A., Delucchi, K., Ling, P., Fisher-Travis, R., & Halpern-Felsher, B. (2016). Adolescents' attitudes towards e-cigarette ingredients, safety, addictive properties, social norms, and regulation. Preventive Medicine, 94, 65-71. https://doi.org/10.1016/j.ypmed.2016.10.019
10. Fadus, M. C., Smith, T. T., & Squeglia, L. M. (2019). The rise of e-cigarettes, pod mod devices, and JUUL among youth: Factors influencing use, health implications, and downstream effects. Drug and Alcohol Dependence, 201, 85-93. https://doi.org/10.1016/j.drugalcdep.2019.04.011
11. Bhatt, J. M., Ramphul, M., & Bush, A. (2020). An update on controversies in e-cigarettes. Paediatric Respiratory Reviews, 36, 75-86. https://doi.org/10.1016/j.prrv.2020.09.003