**E-Cigarettes: Boon/Bane to the Salubrious Mankind**

**Tahir Nasir Sheikh, Prachi Harish Trivedi**

Department of Chemistry, RTM Nagpur University, Campus Nagpur-440033, M.S. India

Email: sheikhtahir878@gmail.com phone: +919623742624

**Preamble**:

An electronic cigarette or the E-cigarettes is a device that simulates tobacco smoking. These cigarettes look alike with the conventional tobacco and nicotine packed cigarettes but they do not actually burn the smoke and combust the tobacco leaves. E-cigarettes being marketed as the healthier and better version of the conventional cigarettes. These gives the smoker or the person the apparent effect of the nicotine intake without literally delivering the toxic components like tobacco, carcinogenic carbon monoxide and tar that harms human body especially the lungs.

The study reveals the effects and affects of these E-cigarettes, and tells about evil effects on kids and adults and unveiling the bane prospects.

**I] Prolusion:**

E-cigarettes first became commercialized in China in 2003 and entered the United States market in 2007.  E-cigarettes are electronic devices that heat a liquid to produce a vapour inhaled by the user. E-cigarettes are known by many different names. They are sometimes called e-cigs, e-hookahs, mods, vape pens, vapes, tank systems and electronic nicotine delivery systems (ENDS).” An e-cigarette can also be a device that may look like a cigarette, a cigar, a pipe, a pen, or a USB drive. The liquid inside may smell fruity, but it can have to possess high nicotine content.

The product was introduced in order to replace the carcinogenic tobacco and nicotine filled cigarettes by a healthier version. But so far studying it profoundly reveals its many disadvantages and reveals that it’s not any healthier version but a pack with lesser nicotine which also leads to addiction to smoking. And can really lead to many extremely dangerous human diseases like: lung cancer, cardiovascular disease, and also COPD. Its efficacy as a smoking cessation aid is not yet firmly established and some studies have in fact shown increased numbers of ‘dual users’,that is continued use in smokers of both E-Cigarettes and conventional cigarettes.

**II] E-cigarettes**

1. E-cigarettes come in many shapes and sizes. Most have a battery, a heating element, and a place to hold a liquid.
2. E-cigarettes produce an aerosol by heating a liquid that usually contains nicotine—the addictive drug in regular cigarettes, cigars, and other tobacco products—flavorings, and other chemicals that help to make the aerosol. Users inhale this aerosol into their lungs. Bystanders can also breathe in this aerosol when the user exhales into the air.
3. E-cigarettes are known by many different names. They are sometimes called “e-cigs,” “e-hookahs,” “mods,” “vape pens,” “vapes,” “tank systems,” and “electronic nicotine delivery systems (ENDS).”
4. Some e-cigarettes are made to look like regular cigarettes, cigars, or pipes. Some resemble pens, USB sticks, and other everyday items. Larger devices such as tank systems, or “mods,” do not resemble other tobacco products.
5. Using an e-cigarette is sometimes called “vaping.”
6. E-cigarettes can be used to deliver marijuana and other drugs.

**III] Constituents of E-cigarettes:**

E-cigarettes come in many shapes and sizes. Most have a battery, a heating element, and a place to hold a liquid. Some e-cigarettes contain a light emitting diode in the tip which illuminates when the user inhales, giving the appearance of the burning end of a conventional cigarette. Chemicals introduced into the liquid vehicle produce aromas and flavors of tobacco, chocolate, mint, fruit, and coffee.

**IV] E-cigarette aerosols**

The e-cigarette aerosol that users breathe from the device and exhale can contain harmful and potentially harmful substances, including:

* Nicotine
* Ultrafine particles that can be inhaled deep into the lungs
* Flavoring such as diacetyl, a chemical linked to a serious lung disease
* Volatile organic compounds

**V] Mechanism:**

When the operator sucks on the mouthpiece, the warming element vaporizes the solution, which the person then “vapes,” or inhales. The [nicotine in the e-cigarette content](https://www.researchgate.net/publication/224824796_Nicotine_Levels_in_Electronic_Cigarettes) of the liquid can range from “very high” to zero. Flavors vary widely, from “traditional” and menthol to watermelon and “lava flow.” The device does not transmit tar or chemical elements in our body that is present in regular cigarettes that is usually known to cause and increase the risk of developing cardiovascular and pulmonary diseases. Instead, there is a replaceable cartridge containing, chemical additives, and flavors (example: chocolate, coffee, mint, fruits). As the user exhales, some visible vapour is released, but it’s not the conventional smoke of tobacco leaves. With these features, the e-cigarette industry insists that the device is safe, can be used in non-smoking areas, and is free from second-hand smoke concerns. Some e-cigarettes taste like traditional cigarettes and even mimic the tastes of specific brands.

**VI] Security towards health:**

As these e-cigarettes are developed by a variety of manufacturers and are unregulated, the contents of e-cigarettes vary widely depending upon the manufacturer and in some cases are not consistent with labeling also. The use of e-cigarettes appears to have resulted in some positive health changes for former smokers. Smokers converting to vaping demonstrated reduced carboxyhemoglobin levels after 2 weeks straight. In a case study, one smoker was able to relieve chronic idiopathic neutrophilia after switching from tobacco smoking to e-cigarettes. But no more positive effects were found to be available or discovered but several other ill effects were reported. A survey conducted by FDA (Food and Drug Administration) of United States of America showed that these E-cigarettes contain carcinogens, including nitrosamines, toxic chemicals such as diethylene glycol, and tobacco-specific components suspected of being harmful to humans. The FDA also found that e-cigarette cartridges labeled as containing no nicotine did in fact contain low levels of nicotine. Subsequently, the inhaled vapour contains impurities that are dangerous to customers.

Also, the major diseases caused by E-cigarettes are: Lung disease, as well as cardiovascular (heart) disease. E-cigarettes also contain acrolein, an herbicide primarily used to kill weeds. It also causes acute lung injury and COPD also may cause asthma and lung cancer.

**VII] Virtues of E-cigarettes:**

  The long-term effects of e-cigarettes are not fully understood, and research is ongoing to assess their potential health impacts. While e-cigarettes are often considered to be less harmful alternative to traditional cigarettes, it is essential to approach the topic with caution, as they are not entirely risk-free. Here are some potential positive effects that have been suggested by certain studies and experts:

1. **Harm reduction:** E-cigarettes are generally believed to be less harmful than conventional tobacco cigarettes. They work by delivering nicotine through a vapor, which may reduce the exposure to harmful chemicals found in tobacco smoke.
2. **Smoking cessation aid:** Some studies have indicated that e-cigarettes might be helpful for individuals trying to quit smoking. They can serve as a transitional tool to wean smokers off traditional cigarettes, potentially reducing the overall harm associated with smoking.
3. **Reduced secondhand smoke exposure:** E-cigarette vapor tends to have fewer toxicants than tobacco smoke, leading to reduced exposure to harmful chemicals for those around the user. However, this doesn't mean that e-cigarette vapor is entirely harmless, as it may still contain some potentially harmful substances.
4. **Convenience**: E-cigarettes provide a more convenient and discreet way to consume nicotine compared to traditional cigarettes. They do not produce ash or require matches or lighters, which may be considered advantages for some users.
5. **Aromas and flavors:** E-cigarettes come in a variety of flavors, which some people find appealing and enjoyable. This may be particularly relevant for smokers who are looking for alternatives that offer a different taste experience.

However, it is important to emphasize that the long-term health effects of e-cigarettes are still not well-established. Some concerns associated with e-cigarette use include:

* 1. **Nicotine addiction**: E-cigarettes contain nicotine, which is highly addictive and can lead to dependence, especially in young users.
	2. **Respiratory issues:** Inhaling e-cigarette vapor can still cause respiratory problems, particularly in individuals with pre-existing lung conditions.
	3. **Unknown long-term effects:** Since e-cigarettes have not been on the market for an extended period, their long-term health effects, including potential links to cancer and other diseases, are not yet fully understood.
	4. **Youth usage:** The popularity of e-cigarettes, especially flavored ones, has raised concerns about attracting young people to use these products, potentially leading to nicotine addiction and subsequent tobacco use.

 While e-cigarettes may have some potential benefits as harm-reduction tools for adult smokers trying to quit, they are not without risks. It is crucial to approach their use with caution and continue to monitor research and health guidelines to make informed decisions about their potential benefits and risks.

**VIII] Unpleasant effects on human brain:**

Almost all e-cigarettes has nicotine-the addictive drug in regular cigarettes, cigars, and other tobacco containing products. A CDC study found that 99% of the e-cigarettes sold in assessed venues in the United States contained nicotine. Nicotine can harm the developing adolescent brain. The brain keeps developing until about age 25 and using nicotine in adolescence can harm the parts of the brain that control attention, learning, mood, impulse control and various other vital functions. Each time a new memory is created or a new skill is learned, stronger synapses are built between brain cells. Young youths mind build synapses faster than adult brains. Nicotine replaces the way all synapses are formed. Using nicotine in adolescence may also increase risk for future addiction to other drugs.

Also, when a certain smoker, relies on nicotine i.e. addicted to smoking and suddenly stops smoking, their body as well as brain gets used the fact that no nicotine is being intake. This can many a times leads to temporary symptoms of a disease known as nicotine withdrawal. The symptoms include craving nicotine, restlessness, anxiety, depression, insomnia, loss of concentration or focus in some work or life, etc.

**IX] Major concerns regarding E-cigarettes:**

A study from 2013-14 showed that amongst the maximum youth smoking E-cigs, the major reason for smoking was the n number of flavors available.

On January 2, 2020, the U.S. Food and Drug Administration (FDA) concluded an enforcement policy that restricts the sale of prefilled cartridge e-cigarettes of all flavors other than tobacco or menthol, unless authorized by FDA.

And most recently, survey of 2022 unveils that most youth i.e. 84.9% used flavored cigars. And to highlight the fact the majorly used flavors were, 69.1% for fruity candy flavor, 38.3% sweet flavor, 29.4% mint flavor and 26.6% menthol flavor. The data was given for all middle school and high school students.

Many youths also report using e-cigarettes because they are curious about these products.Widespread advertising for e-cigarettes, including via media for which advertising for conventional tobacco products is prohibited (e.g., TV), and the lower costs of some e-cigarettes relative to regular cigarettes has contributed to use among youth.

**X] Motives to quit E-cigarettes:**

1. E cigarettes usually contains Nicotine(carcinogen).
2. Chances to contain other toxin like: acetaldehyde, formaldehyde, acrolein, benzene (compound present in exhaust of cars), heavy metals like lead or chromium, antifreeze agent like propylene glycol, etc.
3. Higher percentage of secondhand smoking is prevalent.
4. Harmful after effects on brain.

The use of E-cigarettes in the name of replacement of conventional available cigarettes, is dangerous to health. Youths and adults both the groups of people are at major health risk if addicted to smoking.

Extensive studies should be carried and words should be given against the use of E-cigarettes, and norms should be formed.

**XI] Comparative portrayal of E-cigarettes and regular cigarettes**

E-cigarette is harmless as its native aerosol usually encloses comparatively lesser toxic compounds over the lethal. But, e-cigarette aerosol is rather little unsafe and offensive as it comprises injurious and potentially detrimental ingredients like nicotine, heavy metals like Pb, Cd, Ni and some volatile organic compounds which are viably for causing cancer in severe and chronic conditions.

**XII] E-cigarettes relief quit smoking**

E-cigarettes are not presently sanctioned by the FDA as a quit smoking option. The U.S. A. Preventive Services Task Force, a assembly of health authorities certifies recommendations about preventive health care, [concluded](https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/tobacco-use-in-adults-and-pregnant-women-counseling-and-interventions1)  evidences remains insufficient to indorse e-cigarettes for smoking cessation in adults, comprising pregnant adults.

Although, e-cigarettes may affect non-pregnant adults especially who smoke and can be used as a complete additional way for all cigarettes and remaining smoked tobacco products.

* Till date, numerous studies on this concern are diversified. A [Cochrane Review](http://www.cochrane.org/CD010216/TOBACCO_can-electronic-cigarettes-help-people-stop-smoking-and-are-they-safe-use-purpose) establish evidence from two randomized controlled trials that e-cigarettes with nicotine ,may aid adults who smoke and stop smoking which are in the long term associated with placebo (non-nicotine) e-cigarettes. Still, numerous boundaries to the existing research, including the minimum number of trials, small sample sizes, and wide margins of error nearby the estimates.
* Most recent [CDC survey](https://www.cdc.gov/pcd/issues/2017/pdf/16_0600.pdf)found that many adults usage of e-cigarettes in an effort to quit smoking. Though, many adult e-cigarette consumers do not avoid smoking cigarettes and are instead continuing to use both products (known as “dual use”).[Dual use](https://www.cdc.gov/tobacco/campaign/tips/diseases/dual-tobacco-use.html) may not be an operative way to defense mankind health, whether you’re using e-cigarettes, smokeless tobacco, or other tobacco products in addition to regular cigarettes. Because smoking even a few cigarettes a day can be dangerous, quitting smoking completely is very important to protect your health.

**XIII] E-cigarettes consumers**

Most commonly used tobacco product among youths is E-cigarettes.

1. In 2022, 2.55 million U.S. middle and high school students used e-cigarettes in the past 30 days, including 3.3% of middle school students and 14.1% of high school students.
2. In 2021, 4.5% of U.S. adults currently used e-cigarettes.
3. In 2019, among adults who currently used e-cigarettes overall, 36.9% also currently smoked cigarettes, 39.5% formerly smoked cigarettes, and 23.6% had never smoked cigarettes.
4. Among adults who currently used e-cigarettes, the percentage who have never smoked cigarettes is highest among those aged 18–24 years (56.0%), and is lower in older age groups.

**Outline:**

The debate surrounding e-cigarettes is complex and multifaceted, and opinions on their overall impact vary significantly. E-cigarette holds a battery, a lit section, and a place to grip a liquid which are viable to create an aerosol by means of liquid heating typically has nicotine addictive compound in normal cigarettes/cigars, or other tobacco stuffs flavorings, chemicals aiding in aerosol formation.

**Boon:**

1. **Reduce Harm**: Advocates of e-cigarettes argue that they are a less harmful alternative to traditional tobacco cigarettes. They do not produce tar, which is one of the most harmful components of tobacco smoke, and may reduce the risk of certain smoking-related diseases.

2. **Smoking End**: Some studies suggest that e-cigarettes can help some individuals quit smoking or reduce their tobacco intake. For smokers who have struggled to quit through other means, e-cigarettes may serve as a useful tool in their cessation efforts.

3. **Reduced Secondary Smoke Exposure**: E-cigarettes produce vapor rather than smoke, which may lead to lower exposure to harmful chemicals for both the user and those around them.

4. **Ease and Access**: E-cigarettes can be more convenient than traditional cigarettes since they don't require matches or lighters. They are also often available in places where smoking is prohibited.

**Bane**:

1. **Health Menaces**: While e-cigarettes are generally considered less harmful than traditional cigarettes, they are not entirely risk-free. The long-term health effects of vaping are still being studied, and some studies suggest potential risks to cardiovascular health and lung function.

2. **Youth Plea**: E-cigarettes have been criticized for their popularity among young people, leading to concerns about the potential for nicotine addiction and the gateway effect to traditional smoking.

3. **Lack of Directive**: The e-cigarette market has faced challenges with inconsistent regulations and quality control. This lack of oversight can lead to the sale of substandard products and potentially harmful substances.

4. **Dual Usage:** Some users end up using both e-cigarettes and traditional cigarettes, which may negate some of the potential harm reduction benefits of vaping.

**Conclusion:** Recent evidences designates that consuming e-cigarettes is harmful and also fatal, specifically for youths and people who never smoked. While they may help some people stop smoking, vaping products [do not have Trusted Source](https://www.cdc.gov/tobacco/basic_information/e-cigarettes/pdfs/Electronic-Cigarettes-Infographic-p.pdf) FDA approval as a tool for quitting. E-cigarettes even keep persons from trying confirmed practices of quitting smoking. Several states have [imposed restrictions](https://publichealthlawcenter.org/resources/us-e-cigarette-regulations-50-state-review) on the sale of e-cigarettes. There are also restrictions on liquids with flavors that may be more attractive to younger people. Since the [end of 2019 Trusted Source](https://www.fda.gov/tobacco-products/products-ingredients-components/vaporizers-e-cigarettes-and-other-electronic-nicotine-delivery-systems-ends), it is illegal to sell vaping products to people younger than 21 years. E-cigarettes are nicotine-based products, and no nicotine use is safe. Until we know more, it is probably best to avoid these products whenever possible, including secondhand smoke.Though, complete knowledge about e-cigarettes or electronic nicotine delivery systems (ENDS) and concerns about their safety and public health impact have raised important concerns about their use. ENDS are extensively available, they are specifically not FDA approved as quit smoking devices in the market of smoking.

**State-of-the-Art:**
**Safety and Health:** Research had shown that e-cigarettes generally considered less harmful than traditional combustible cigarettes. However, concerns remained about potential health risks, especially in long-term use and among non-smokers, as well as the possible presence of harmful substances in e-liquids. Research studies are being done in order to assess the safety and potential health impacts of e-cigarettes.

**Smoking Cessation**: E-cigarettes are being frequently explored as a potential tool for smoking cessation to quit smoking as another option. Some studies suggested that e-cigarettes could be effective in helping smokers quit or reduce smoking when used as a cessation aid. However, long-term cessation rates and the comparative effectiveness of e-cigarettes versus other cessation methods were still under investigation.

**Regulation and Policy:** Governments and health organizations worldwide were grappling with how to regulate e-cigarettes. Balancing the potential benefits for smokers seeking alternatives to combustible tobacco with the need to protect non-smokers, particularly young people, from the risks associated with nicotine use was a challenge. Regulations varied across different countries and regions.

**Flavorings:** E-liquids came in a wide variety of flavors, which appealed to both adult smokers seeking alternatives and youth experimenting with vaping. The presence of appealing flavors raised concerns about potential attraction to non-smokers and the risk of initiating nicotine use among youth.

**Technology Advancements**: E-cigarette technology continued to evolve, with improvements in device design, battery life, and e-liquid delivery systems. Some devices even allowed for more precise control over nicotine delivery, catering to varying nicotine preferences. **Dual Use:** The phenomenon of dual use, where individuals used both e-cigarettes and traditional cigarettes, was being studied to understand its impact on overall health outcomes and smoking cessation efforts. **Youth Vaping:** The rise in youth vaping was a significant concern for health authorities. Studies were examining the factors influencing youth vaping and the potential long-term consequences of nicotine use during adolescence.

**Public Perception:** Public perception of e-cigarettes varied widely. Some viewed them as a valuable harm reduction tool, while others raised concerns about their long-term safety and potential to undermine efforts to reduce smoking rates.

Whether e-cigarettes are viewed as a boon or a bane depends on the context and the specific aspects being considered. While they have the potential to be a useful harm reduction tool for adult smokers trying to quit, concerns about health risks and youth usage warrant careful consideration and effective regulation. Further research is needed to fully understand the long-term effects of e-cigarette use on public health. It is essential to strike a balance between promoting harm reduction options for smokers while safeguarding against potential risks, especially for younger populations.

**Acknowledgments**

Authors are thankful to Head, Department of chemistry, R.T.M. Nagpur University, Nagpur for providing platform to submit this paper and also thankful to our guide Prof. Rajendra S. Dongre and adorable parents for his guidance and moral supports.

**References**

1. US Department of Health and Human Services. [E-cigarette use among youth and young adults: a report of the Surgeon General](https://www.cdc.gov/tobacco/data_statistics/sgr/e-cigarettes/pdfs/2016_sgr_entire_report_508.pdf). Atlanta, GA: US Department of Health and Human Services, CDC; 2016.
2. Goniewicz ML, Gupta R, Lee YH, et al. Nicotine levels in electronic cigarette refill solutions: a comparative analysis of products from the U.S., Korea, and Poland. Int J Drug Policy. 2015; 26 (6):583–588.
3. Patnode CP, Henderson JT, Thompson JH, Senger CA, Fortmann SP, Whitlock EP. Behavioral Counseling and Pharmacotherapy Interventions for Tobacco Cessation in Adults, Including Pregnant Women: A Review of Reviews for the U.S. Preventive Services Task Force. Evidence Synthesis No. 134. AHRQ Publication No. 14-05200-EF-1. Rockville, MD: Agency for Healthcare Research and Quality; 2015.
4. Hartmann-Boyce J, McRobbie H, Bullen C, Begh R, Stead LF, Hajek P. [Can electronic cigarettes help people stop smoking, and are they safe to use for this purpose?](http://www.cochrane.org/CD010216/TOBACCO_can-electronic-cigarettes-help-people-stop-smoking-and-are-they-safe-use-purpose) Published 13 September 2016.
5. Caraballo RS, Shafer PR, Patel D, Davis KC, McAfee TA. [Quit Methods Used by US Adult Cigarette Smokers, 2014–2016](https://www.cdc.gov/pcd/issues/2017/16_0600.htm). Prev Chronic Dis 2017; 14:160600.
6. Bjartveit K, Tverdal A. Health Consequences of Smoking 1-4 Cigarettes Per Day. Tobacco Control 2005;14(5):315–20.
7. [QuickStats: Cigarette Smoking Status Among Current Adult E-cigarette Users, by Age Group — National Health Interview Survey, United States, 2015](http://dx.doi.org/10.15585/mmwr.mm6542a7). MMWR Morb Mortal Wkly Rep 2016;65:1177.
8. Park-Lee E, Ren C, Sawdey M, et al. [Notes from the Field: E-Cigarette Use Among Middle and High School Students — National Youth Tobacco Survey, United States, 2021](https://www.cdc.gov/mmwr/volumes/70/wr/mm7039a4.htm?s_cid=mm7039a4_w). Morbidity and Mortality Weekly Report, 2021; 70:1387–9.
9. Park Lee E, Ren C, Cooper M, Cornelius M, Jamal A, Cullen KA. [Tobacco Product Use Among Middle and High School Students – United States, 2022](https://www.cdc.gov/mmwr/volumes/71/wr/mm7145a1.htm?s_cid=mm7145a1_w). Morbidity and Mortality Weekly Report, 2022; 71:45.
10. Cornelius ME, Loretan CG, Jamal A, et al. [Tobacco Product Use Among Adults — United States, 2021](https://www.cdc.gov/mmwr/volumes/72/wr/mm7218a1.htm). MMWR Morb Mortal Wkly Rep 2023;72:475–483.
11. Cornelius M., E, Wang T., W, Jamal A, Loretan C, Neff L. [Tobacco Product Use Among Adults – United States, 2019.](https://www.cdc.gov/mmwr/volumes/69/wr/mm6946a4.htm?s_cid=mm6946a4_w) Morbidity and Mortality Weekly Report, 2020. Volume 69(issue 46); pages 1736–1742. [Accessed 2020 November 19].
12. Hajek, P., Phillips-Waller, A., Przulj, D., Pesola, F., Myers Smith, K., Bisal, N., ... & McRobbie, H. J. (2019). A randomized trial of e-cigarettes versus nicotine-replacement therapy. New England Journal of Medicine, 380(7), 629-637.
13. Farsalinos, K. E., & Polosa, R. (2014). Safety evaluation and risk assessment of electronic cigarettes as tobacco cigarette substitutes: a systematic review. Therapeutic Advances in Drug Safety, 5(2), 67-86.
14. McNeill, A., Brose, L. S., Calder, R., Bauld, L., & Robson, D. (2018). Vaping in England: an evidence update including mental health and pregnancy, March 2018. A report commissioned by Public Health England.
15. Hartmann-Boyce, J., McRobbie, H., Bullen, C., Begh, R., Stead, L. F., & Hajek, P. (2016). Electronic cigarettes for smoking cessation. Cochrane Database of Systematic Reviews, (9), CD010216.
16. Caponnetto, P., Campagna, D., Cibella, F., Morjaria, J. B., Caruso, M., Russo, C., & Polosa, R. (2013). EffiCiency and Safety of an eLectronic cigAreTte (ECLAT) as Tobacco Cigarettes Substitute: A Prospective 12-Month Randomized Control Design Study. PloS One, 8(6), e66317.
17. Polosa, R., Morjaria, J. B., Caponnetto, P., Caruso, M., Strano, S., Battaglia, E., & Russo, C. (2014). Effectiveness and tolerability of electronic cigarette in real-life: a 24-month prospective observational study. Internal and Emergency Medicine, 9(5), 537-546.
18. Etter, J. F., Bullen, C., Flouris, A. D., Laugesen, M., Eissenberg, T., & Vardavas, C. (2011). Electronic nicotine delivery systems: a research agenda. Tobacco Control, 20(3), 243-248.