E-CIGARETTES: SOLUTION TO A PROBLEM OR A NEW MENACE ITSELF.

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ABSTRACT

Introduction: The trend of using E-cigarettes is growing day by day especially among youths in city. Vaping in a prefilled battery operated refill activates reward circuit. Methodology: The systemic review of available literatures including pubmed, google scholar, science direct, cochrane database has been reviewed with the available search engines. Results: Amidst the much hype with high pressured advertisements, e-cigarettes should be used judiciously knowing the pros and cons. No proper longitudinal follow up has been done. Conclusion: FDA approval, current safety regards guideline is not available in India. The use of e cigarettes should be watched for its potential adverse effects.

KEYWORDS: e-cigarettes, FDA approval, smoking cessation, vaping, hazards.

INTRODUCTION

Electronic cigarettes are products designed to deliver nicotine or other substances to a user in the form of a vapor. The modern e-cigarette arose from a 2003 invention by Hon Lik in
China and as of 2015 most devices are made there. Typically, they are composed of a rechargeable, battery-operated heating element, a replaceable cartridge that may contain nicotine or other chemicals, and an atomizer that, when heated, converts the contents of the cartridge into a vapor. This vapor can then be inhaled by the user. These products are often made to look like such products as cigarettes, cigars, and pipes. They are also sometimes made to look like everyday items such as pens and USB memory sticks, for people who wish to use the product without others noticing.\[1\]

It is not known whether E cigarettes are less harmful because research into the effects of e-cigarettes is infrequent in comparison to its global acceptance and popularity. It has already become a billion-dollar booming industry and use among teens and tweens has been doubled in between 2011 to 2012.\[2\] Apparently E-cigars looks like real one and it generates puff of smoke and the vapour is similar to fog. It has in built battery and heating element, and a cartridge that holds nicotine and other liquids and flavorings. Some of them are disposable and some have rechargeable battery others have a rechargeable battery and refillable cartridges. “Vaping” is the term used of using e-cigarette.\[3\] The nicotine inside the cartridges is addictive and there will be withdrawal symptoms on discontinuation. The biggest danger with tobacco is the smoke and e-cigarettes don’t burn.” Electronic cigarettes are battery operated devices that can generate flavours can resemble traditional; cigarettes in appearance and can also generates smokes. More than 250 different e-cigarette brands are currently on the market.\[4\]

![Fig 1: Parts of modern e cigarettes.](image)

**Mechanism of action**

Most e-cigarettes consist of three different components, including.

- a cartridge, which holds a liquid solution containing varying amounts of nicotine, flavorings, and other chemicals.
- a heating device (vaporizer).
• a power source (usually a battery).

In many e-cigarettes, puffing activates the battery-powered heating device, which vaporizes the liquid in the cartridge. The resulting aerosol or vapor is then inhaled (called "vaping").[5]

There is no conclusive evidence till date that E-cigarettes are better than conventional ones. E-cigarettes are designed to simulate the act of tobacco smoking by producing an appealingly flavored aerosol that looks and feels like tobacco smoke and deliver nicotine but with less of the toxic chemicals produced by burning tobacco leaves.

Because they deliver nicotine without burning tobacco, e-cigarettes appear as if they may be a safer, less toxic alternative to conventional cigarettes. At their most basic level, electronic cigarettes are an alternative nicotine delivery system. According to the CDC, smoking tobacco is responsible for one out of every five deaths in the US. The unfortunate irony of the situation is that the ingredients which cause smoking-related illnesses aren’t the important component in a cigarette. Smokers inhale tar, carbon monoxide, arsenic, formaldehyde and bucketloads of carcinogens all in the name of getting access to nicotine.[6]

**Benefits of E-Cigarettes in comparison to conventional cigarettes**

From the user’s perspective, they simply screw the cartridge into the battery and inhale on the end just like a real cigarette. The only difference is that there is no smoke – which means no smell – no burning – which means no ash and no butts – and nothing other than the nicotine you want and some flavorings to make it taste nice.

The e-cigarette is designed to reduce the harm caused by cigarettes. With the staggering associated death-rate, tobacco should really be avoided at all costs. Preliminary research looks extremely promising, but even if there could be some minor risk from e-cigarettes, they are undoubtedly much safer than cigarettes (Table 1). Smokers switching to “vaping” still get the nicotine they crave and the sensation, but without all of the risks. Read more about the benefits of e-cigarettes here.[7]
Table 1: Explanation in favouring shifting to e- cigarettes\textsuperscript{[8,9,10]}

<table>
<thead>
<tr>
<th>No.</th>
<th>Explanation</th>
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<tbody>
<tr>
<td>1.</td>
<td>No Ash. E-cigarettes work through heating a solution to turn it into vapor. Since this doesn’t involve any combustion, it doesn’t produce any ash.</td>
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<tr>
<td>2.</td>
<td>Save Money. A single e-cigarette cartridge contains the same amount of nicotine as around 20 cigarettes.</td>
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<td>3.</td>
<td>Plenty of Choice. E-cigarettes seem pretty futuristic, with more companies sprouting up by the day.</td>
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<td>4.</td>
<td>Flavors:. One of the best things about e-cigarettes is that they can be flavored much more easily than tobacco.</td>
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<tr>
<td>5.</td>
<td>Choosing strength:. Not all e-cigs contain the same amount of nicotine. One can start on 18mg cartridges, and then get used to it work down to 12mg, 6mg and eventually no nicotine at all.</td>
</tr>
<tr>
<td>6.</td>
<td>Just Like Smoking. Electronic cigarettes are intended to replicate the sensation of smoking, and they accomplish their goal very well.</td>
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<td>7.</td>
<td>Avoid Smoking Bans. Using an e-cigarette is vaping, not smoking. This means that (since there’s no combustion, just heating) they aren’t covered by the vast majority of smoking bans.</td>
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<td>8.</td>
<td>Easy to Use. They may be modern technology, but they’re extremely simple to use. Most are two-piece models, which simply require you to screw a cartridge end onto a battery attachment and start puffing. The batteries usually activate automatically, creating vapour which comes out of the mouthpiece during inhalation.</td>
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<tr>
<td>9.</td>
<td>No Fire Risk. Falling asleep with an e-cig in hand will not burn the house, as there’s no fire involved.</td>
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<td>10.</td>
<td>No Smell. The smell of smoke is extremely off-putting to many people. Most smokers even don’t like their clothes reeking of pungent cigarettes. E-cigarettes smell only faintly, and that’s just the flavouring.</td>
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<tr>
<td>11.</td>
<td>No Stained Teeth. The tar and excessive junk an individual pumps inside own body when one smoke a cigarette are removed with e-cigarettes. Without the dirty chemicals, it won’t stain the teeth at sickly yellow-brown.</td>
</tr>
<tr>
<td>12.</td>
<td>Less Second Hand Smoke. E-cigarettes are efficient when it comes to smoke. They don’t pump anything out from the tip (the “side-stream” with cigarettes), and since they’re much safer than smoking anyway, they don’t pose a risk to anybody close to you.</td>
</tr>
<tr>
<td>13.</td>
<td>Less Smoker’s Cough. It’s actually the wide range of toxins present in cigarette smoke which irritates the back of the throat and causes a smoker’s cough. E-cigarettes don’t have these toxins, so the cough will disappear.</td>
</tr>
<tr>
<td>14.</td>
<td>Less chances of Cancer. There are 70 known carcinogens in tobacco smoke. In e-cigarettes, there’s only nicotine, propylene glycol (used in smoke machines) and food flavourings. There are trace amounts of carcinogens called nitrosamines, which are a consequence of extracting the nicotine from tobacco. These are found in FDA-approved patches in similar quantities, and one gets 1,400 times more of them in tobacco cigarettes. E-cigarettes lower your risk of cancer exponentially.</td>
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Choosing E-Cigarettes over Tobacco Smoking\textsuperscript{11,12}

Smoking cigarettes and using tobacco products can cause tremendous health problems. But quitting is hard, even with cessation products like nicotine patches or gum. Now there is an easier alternative: electronic cigarettes. E-cigarettes mimic the experience of smoking without the negative effects of traditional cigarettes. Choosing e-cigarettes offers health, financial and social benefits compared to the hazards of smoking regular cigarettes.

Hazards of Tobacco

Smoking tobacco can lead to many serious life threatening conditions (Table 2). Using tobacco increases the risk of various types of cancer, particularly lung cancer and head or neck cancer. It also greatly increases the incidence of heart disease and other cardiovascular problems. In addition to heart attacks, smoking increases the risk of strokes and a variety of pulmonary problems such as emphysema. These are simply the most common and dangerous negative health effects of smoking. There are a myriad of other health issues that come from long term use of tobacco. Quitting or switching to a non-tobacco product can help decrease the level of damage done by tobacco.\textsuperscript{13}

Electronic cigarettes provide an alternative that addresses many of the problematic issues surrounding cigarettes. Also, they are free of the social stigma that comes with traditional cigarettes. Because they are smokeless, electronic cigarettes can be used around others with a decreased concern about second hand smoke. Using an electronic cigarette allows to continue normally with your day, rather than wasting time looking for an unrestricted area and dealing with the social stress of being seen as a smoker. Smoking regular cigarettes also comes at a high financial cost.\textsuperscript{14}

Fig 2: E cigarette devices with battery & charger.
The price of traditional cigarettes is on the rise as some cities in the U.S. have added taxes that can take the price of a single pack into the double digits. E-cigarettes have a much lower cost over time as cartridges last longer and cost less than traditional cigarette packs. Cartridges also come with different levels of nicotine so the user also gets to determine just how much, if any, nicotine they consume. This can be particularly beneficial to people who enjoy the ritual of smoking but would like to cut down on their nicotine consumption.\cite{15}

Table 2: Negative health effects of tobacco and the benefits of choosing e-cigarettes as an alternative\cite{16,17,18}

<table>
<thead>
<tr>
<th>1. Health Effects of Cigarette Smoking: This factsheet released by the CDC outlines some of the major health problems caused by smoking tobacco cigarettes.</th>
<th>2. Electronic Cigarette Holds Promise as Aid to Quitting. A recent study from Boston University suggests that e-cigarettes may more beneficial than other smoking cessation products in helping smokers quit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Electronic Cigarettes Primarily Used to Quit Tobacco: This article discusses a UK study which suggests e-cigarettes are primarily used as a healthier alternative to tobacco by people who wish to quit smoking</td>
<td>6. Electronic Cigarettes: Scientific Evidence versus Social Cost: A short, scientific look at the difference between electronic cigarettes and traditional cigarettes</td>
</tr>
<tr>
<td>7. One in Five Adult Cigarette Smokers Have Tried an Electronic Cigarette: This press release discusses growing popularity of electronic cigarettes</td>
<td>8. Successful Smoking Cessation with Electronic Cigarettes: A scientific study measuring the success of relapsed smokers who attempted quitting using e-cigarettes</td>
</tr>
<tr>
<td>9. E-Cigarettes, A Safe Substitute for Smokers?: A balanced and concise summary on electronic cigarettes, the surrounding controversy, and how to decide if they’re right for individual.</td>
<td>Electronic Cigarettes are Smokeless and Tasty, but Are They Safer?: An interview with a smoker who used electronic cigarettes to quit smoking.</td>
</tr>
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</table>

Because the nicotine in an e-cigarette is derived from tobacco and because e-cigarettes are not licensed as smoking cessation tools or treatments for any medical disorder, they are legally defined as tobacco products in the United States.\cite{19} Importantly, there are many different types of e-cigarettes including so-called “cig-a-likes” that are designed to look like cigarettes. Some e-cigarettes are cartridge-based; they can be rechargeable or disposable and usually contain approximately 1 mL of nicotine liquid. Others are tank-based rechargeable systems that have reservoirs which store up to 8 mL of nicotine liquid above the heating element. In addition to these configurations, e-cigarettes can differ in the voltage of the power.
source, resistance of heating element and dose of nicotine liquid (generally up to 36 mg/mL). Although marketed as a distinct product, an e-hookah is a type of e-cigarette. In the same product category, personal vaporizers are pocket-sized devices that operate the same way as e-cigarettes but may not be tube-shaped like many e-cigarettes. The many types of e-cigarette configurations, coupled with the fact that relatively few of these devices and liquids have been subject to empirical investigation, limit the generalizability of e-cigarette research.[20]

In the handful of studies focused on e-cigarette aerosol, results indicate that it contains nicotine and that it may also include some of the same toxicants as cigarette smoke, such as tobacco-specific nitrosamines and metals. One study characterized the amounts of certain toxicants in e-cigarette aerosol as between 9 and 450 times less than the amounts in cigarette smoke, although the levels of one particular carcinogen (formaldehyde) can match those found in tobacco smoke if the liquid in the e-cigarette is heated using higher voltage batteries. Most physical effects of e-cigarette use, including airway impedance, cough, dry mouth, and headache, appear to be of low severity, although there have been case reports of more serious illnesses like lipid pneumonia. Propylene glycol and vegetable glycerin (the humectants found in e-cigarette liquid) can irritate airways when inhaled for short periods. The flavored liquids inside e-cigarette cartridges and refill solutions raise additional health concerns. Exposure to high concentrations of nicotine, such as that found in a 30 mL bottle of 36 mg/mL “cotton candy” flavored nicotine liquid used to refill an e-cigarette, can be toxic. Calls received by U.S. Poison Control Centers about e-cigarette exposure are increasing. The long-term health effects of users’ and nonusers’ exposure to e-cigarette aerosol are unknown.[21]

Also, testing of some e-cigarette products found the vapour to contain known carcinogens and toxic chemicals (such as formaldehyde and acetaldehyde), as well as potentially toxic metal nanoparticles from the vaporizing mechanism. Another worry is the refillable cartridges used by some e-cigarettes. Users may expose themselves to potentially toxic levels of nicotine when refilling them. Cartridges could also be filled with substances other than nicotine, thus possibly serving as a new and potentially dangerous way to deliver other drugs.[22]

E-cigarettes and quitting

Some people believe e-cigarette products may help smokers’ lower nicotine cravings, however, at this point it is unclear whether e-cigarettes may be effective as smoking-cessation
aids. Because e-cigarettes are not currently marketed either as tobacco products or as devices having a therapeutic purpose, they are not regulated by the FDA. In addition, there is currently no regulation of the liquids that are used in e-cigarettes. So, there are no accepted measures to confirm their purity or safety.

**Adolescents using E cigarettes**

E-Cigarettes are increasingly popular among adolescents. Some states have banned sale of e-cigarettes to minors, but they can get around that by ordering online. Their easy availability (online or via mall kiosks), in addition to their wide array of cartridge flavours (such as coffee, mint, candy and fruit flavors), may make them particularly appealing to this age group. A recent study showed that students who have used e-cigarettes by the time they start 9th grade are more likely than others to start smoking traditional cigarettes and other tobacco products within the next.

**FDA stand**

FDA has not evaluated any e-cigarettes for safety or effectiveness. When FDA conducted limited laboratory studies of certain samples, FDA found significant quality issues that indicate that quality control processes used to manufacture these products are substandard or non-existent. FDA found that cartridges labeled as containing no nicotine contained nicotine and that three different electronic cigarette cartridges with the same label emitted a markedly different amount of nicotine with each puff. Experts have also raised concerns that the marketing of products such as e-cigarettes can increase nicotine addiction among young people and may lead kids to try other tobacco products.

FDA issued warning letters to five distributors of electronic cigarettes for violations of the Federal Food, Drug, and Cosmetic Act (FDCA). These violations included unsubstantiated claims and poor manufacturing practices. FDA issued a letter to the Electronic Cigarette Association inviting electronic cigarette firms to work in cooperation with the agency toward the goal of assuring that electronic cigarettes sold in the United States are lawfully marketed.[23]

Since their introduction to the market in 2004, global usage has risen exponentially. As of 2014, about 13% of American high school students have used them at least once in the last month. As of mid-2015 around 10% of American adults are current users of e-cigarettes. In the UK user numbers have increased from 700,000 in 2012 to 2.6 million in 2015. Most US
e-cigarette users still smoke traditional cigarettes. About 60% of UK users are smokers and about 40% are ex-smokers, while use among never-smokers remains "negligible". Most peoples' reason for using e-cigarettes is related to quitting, but a considerable proportion use them recreationally. The European Parliament passed regulations in February 2014, to come into effect by 2016, standardizing liquids and personal vaporizers, listing ingredients and child-proofing liquid containers. The US FDA published proposed regulations in April 2014 with some similar measures. As of 2014, there were 466 brands with sales of around $7 billion.

Many young people who use e-cigarettes also smoke tobacco. Some young people who have tried an e-cigarette have never smoked tobacco, so ECs can be a starting point for nicotine use. There are high levels of dual use with e-cigarettes and traditional cigarettes.\textsuperscript{[24]}

**Motivation**

Reasons for e-cigarette usage often relate to quitting cigarettes, relaxation and recreation. Many people use them to circumvent smoke-free laws and policies, or to cut back on cigarette smoking. College students often practices vaping for experimentation. Expensive marketing aimed at smokers suggests e-cigarettes are "newer, healthier, cheaper and easier to use in smoke-free situations, all reasons that e-cigarette users claim motivate their use". The belief that e-cigarettes are safer than traditional cigarettes could widen their use among pregnant women. E-cigarettes feel or taste similar to traditional cigarettes, and vapers disagreed about whether this was a benefit or a drawback. The majority of committed e-cigarette users interviewed at an e-cigarette convention found them cheaper than traditional cigarettes.

Some surveys found that a small percentage of users' motives were to avoid smoking bans, but other surveys found that over 40% of users said they used the device for this reason. The health and lifestyle appeal may also encourage young non-smokers to use e-cigarettes, as they may perceive that trying e-cigarettes is less risky and more socially appealing. This may ameliorate negative beliefs or concerns about nicotine addiction. Adolescent experimenting with e-cigarettes may be sensation seeking behavior and is not likely to be associated with tobacco reduction or quitting smoking. Young people may view e-cigarettes as a symbol of rebellion. The main reasons young people experimented with e-cigarettes were due to curiosity, flavors and peer influences. Infants and toddlers could ingest the e-liquid from an e-cigarette device out of curiosity.
There are three main types of e-cigarettes: cigalikes, looking like cigarettes; eGos, bigger than cigalikes with refillable liquid tanks; and mods, assembled from basic parts or by altering existing products. As the e-cigarette industry is growing, new products are quickly developed and brought to market. First generation e-cigarettes tend to look like tobacco cigarettes and so are called "cigalikes". Most cigalikes look like cigarettes but there is some variation in size. A traditional cigarette is smooth and light while a cigalike is rigid and slightly heavier. Second generation devices are larger overall and look less like tobacco cigarettes. Third generation devices include mechanical mods and variable voltage devices. The fourth generation includes Sub ohm tanks and temperature control devices. The power source is the biggest component of an e-cigarette, which is frequently a rechargeable lithium battery.

In July 2014, a report produced by the World Health Organization (WHO) found there was not enough evidence to determine if electronic cigarettes could help people quit smoking, suggesting smokers be encouraged to use approved methods for help with quitting. The World Lung Foundation has applauded the WHO report's recommendation of tighter regulation due to safety concerns and the risk of increased nicotine or tobacco addiction among youth.

In 2015, the Public Health England released a report stating that e-cigarettes are estimated to be 95% less harmful than smoking. and said that The UK National Health Service followed with the statement that e-cigarettes have approximately 5% of the risk of tobacco cigarettes, while also concluding that there won't be a complete understanding of their safety for many years. As of 2014 there are clinical trials in progress to test the quality, safety and effectiveness of e-cigarettes, but until these are complete the NHS maintains that the government could not give any advice on them or to recommend their use.

In October 2015, the American Academy of Pediatrics recommends against e-cigarettes for quitting smoking and stated among adolescents, e-cigarette use is related with reduced quitting smoking. In August 2014, the American Heart Association released a policy statement in which they support "effective FDA regulation of e-cigarettes that addresses marketing, youth access, labeling, quality control over manufacturing, free sampling and standards for contaminants." In 2015 the California Department of Public Health issued a report that stated the "aerosol has been found to contain at least ten chemicals that are on California’s Proposition 65 list of chemicals known to cause cancer, birth defects, or other
reproductive harm." In 2014, the US FDA said "E-cigarettes have not been fully studied, so consumers currently don't know: the potential risks of e-cigarettes when used as intended, how much nicotine or other potentially harmful chemicals are being inhaled during use, or whether there are any benefits associated with using these products. Additionally, it is not known whether e-cigarettes may lead young people to try other tobacco products, including conventional cigarettes, which are known to cause disease and lead to premature death."[25,26]

E-cigarettes for smoking cessation
Authors of a 2015 meta-analysis on clinical trials found that compared with an e-cigarette device with no nicotine, use of e-cigarettes helped 20% of people quit smoking. They compared that finding with the results from other studies of the success of conventional NRT in smoking cessation, which found that they help 10% of people quit. There has only been one study directly comparing first generation e-cigarettes to conventional NRT as smoking cessation tools so the comparative effectiveness is not known.

However, e-cigarettes have not been subject to the same efficacy testing as nicotine replacement products. Several authorities, including the World Health Organisation, take the view that there is not enough evidence to recommend e-cigarettes for quitting smoking in adults and there are studies showing a decline in smoking cessation among dual users. A 2014 review found that e-cigarettes do not seem to improve cessation rates compared to regulated nicotine replacement products, and a trial found 29% of e-cigarette users were still vaping at 6 months, but only 8% of patch users still wore patches at 6 months.

Tobacco harm reduction (THR)
It is the replacement of tobacco cigarettes with lower risk products to reduce tobacco related death and disease. THR has been controversial out of fear that tobacco companies cannot be trusted to produce and market products that will reduce the risks associated with tobacco use. E-cigarettes can reduce smokers' exposure to carcinogens and other toxic substances found in tobacco. Tobacco smoke contains 100 known carcinogens, and 900 potentially cancer causing chemicals, none of which has been found in more than trace quantities in the cartridges or aerosol of e-cigarettes. According to a 2011 review, while e-cigarettes cannot be considered "safe" because there is no safe level for carcinogens, they are doubtless safer than tobacco cigarettes.
The British Medical Association encourages health professionals to recommend conventional nicotine replacement therapies, but for patients unwilling to use or continue using such methods, health professionals may present e-cigarettes as a lower-risk option than tobacco smoking. The American Association of Public Health Physicians (AAPHP) suggests those who are unwilling to quit tobacco smoking or unable to quit with medical advice and pharmaceutical methods should consider other nicotine containing products such as electronic cigarettes and smokeless tobacco for long term use instead of smoking. In an interview, the director of the Office on Smoking and Health for the U.S. federal agency Centers for Disease Control and Prevention (CDC) believes that there is enough evidence to say that using e-cigarettes is likely less harmful than smoking a pack of conventional cigarettes. However, due to the lack of regulation of the contents of e-cigarettes and the presence of nicotine, the CDC has issued warnings. A 2014 WHO report concluded that some smokers will switch completely to e-cigarettes from traditional tobacco but a "sizeable" number will use both.\[23\] This report found that such "dual use" of e-cigarettes and tobacco "will have much smaller beneficial effects on overall survival.

A 2014 WHO report said, "ENDS use poses serious threats to adolescents and fetuses." Aside from toxicity, there are also risks from misuse or accidents such as contact with liquid nicotine, fires caused by vaporizer malfunction, and explosions as result from extended charging, unsuitable chargers, or design flaws. Battery explosions are caused by an increase in internal battery temperature and some have resulted in severe skin burns. There is a small risk of battery explosion in devices modified to increase battery power.\[27\]

The e-liquid has a low level of toxicity, and contamination with various chemicals has been identified in the product. E-cigarette vapor contains fewer toxic substances, and lower concentrations of potential toxic substances than cigarette smoke. Metal parts of e-cigarettes in contact with the e-liquid can contaminate it with metals. Normal usage of e-cigarettes generates very low levels of formaldehyde. A 2015 review found that later-generation e-cigarettes set at higher power may generate equal or higher levels of formaldehyde compared to smoking. Users detect the "dry puff" and avoid it, and the report concluded that "There is no indication that EC users are exposed to dangerous levels of aldehydes." E-cigarette users are exposed to potentially harmful nicotine.

E-cigarettes create vapor that consists of ultrafine particles, with the majority of particles in the ultrafine range. The vapor has been found to contain flavors, propylene glycol, glycerin,
nicotine, tiny amounts of toxicants, carcinogens, heavy metals, and metal nanoparticles, and other chemicals. Exactly what comprises the vapor varies in composition and concentration across and within manufacturers. However, e-cigarettes cannot be regarded as simply harmless. There is a concern that some of the mainstream vapor exhaled by e-cigarette users can be inhaled by bystanders, particularly indoors. E-cigarette use by a parent might lead to inadvertent health risks to offspring. A 2014 review recommended that e-cigarettes should be regulated for consumer safety. There is limited information available on the environmental issues around production, use, and disposal of e-cigarettes that use cartridges. A 2014 review found "disposable e-cigarettes might cause an electrical waste problem."

![Fig 3: A burning e cigarette is a electrical waste problem.](image)

E-liquid
It is the mixture used in vapor products such as e-cigarettes. The main ingredients in the e-liquid usually are propylene glycol, glycerin, water, nicotine, and flavorings. However, there are e-liquids sold without propylene glycol, nicotine, or flavors. The liquid typically contains 95% propylene glycol and glycerin. The flavorings may be natural or artificial. About 8,000 flavors exist as of 2014. There are many e-liquids manufacturers in the USA and worldwide. While there are currently no US Food and Drug Administration (FDA) manufacturing standards for e-liquid, the FDA has proposed regulations that are expected to be finalized in late 2015. Industry standards have been created and published by the American E-liquid Manufacturing Standards Association (AEMSA).

Nicotine yield
Smoking a traditional cigarette yields between 0.5 and 1.5 mg of nicotine, but the nicotine content of the cigarette is only weakly correlated with the levels of nicotine in the smoker's
bloodstream. Nicotine in tobacco smoke is absorbed into the bloodstream rapidly, and e-cigarette vapor is relatively slow in this regard. The concentration of nicotine in e-liquid ranges up to 36 mg/mL. New EU regulations cap this at a maximum of 2% (20 mg/mL), but this is an arbitrary ceiling based on limited data. In practice the nicotine concentration in an e-liquid is not a reliable guide to the amount of nicotine that reaches the bloodstream.

The earliest e-cigarette can be traced to American Herbert A. Gilbert, who in 1963 patented "a smokeless non-tobacco cigarette" that involved "replacing burning tobacco and paper with heated, moist, flavored air". This device produced flavored steam without nicotine. The patent was granted in 1965. Gilbert’s invention was ahead of its time. There were prototypes, but it received little attention and was never commercialized because smoking was still fashionable at that time. Gilbert said in 2013 that today's electric cigarettes follow the basic design set forth in his original patent.

In the UK in 2015 the "most prominent brands of cigalikes" were owned by tobacco companies, but except for one model all the tank types came from "non-tobacco industry companies". However some tobacco industry products, while using prefilled cartridges, resemble tank models.

As the electronic cigarette industry grows, a subculture has emerged which calls itself "the vaping community". The online forum E-Cig-Reviews.com was one of the first major communities. Another online forum known as UKVaper.org was the origin of the hobby of modding. Large gatherings of vapers, called vape meets, take place around the US. They focus on e-cig devices, accessories, and the lifestyle that accompanies them. Vapefest, which started in 2010, is an annual show hosted by different cities. People attending these meetings are usually enthusiasts that use specialized, community-made products not found in convenience stores or gas stations. The Electronic Cigarette Convention in North America which started in 2013, is an annual show where companies and consumers meet up. As of 2014, e-cigarette availability in US stores is increasing, especially in places with low taxes and smoking bans. In the US they are more likely available in places with a higher median family income.

A growing subclass of vapers called "cloud-chasers" configure their atomizers to produce large amounts of vapor by using low-resistance heating coils. This practice is called "cloud-chasing"and is growing more popular. By using a coil with very low resistance, the batteries
are stressed to a potentially unsafe extent. This could present a risk of dangerous battery failures. As vaping comes under increased scrutiny, some members of the vaping community have voiced their concerns about cloud-chasing, claiming the practice gives vapers a bad reputation when doing it in public.\textsuperscript{[169]} The Oxford Dictionaries' word of the year for 2014 is "vape".\textsuperscript{[28]}

**Economics**

As of 2014 the number of e-cigarettes sold has increased every year. In 2015, a slowdown in the growth in usage occurred in both the US and the UK. As of 2014 there were at least 466 e-cigarette companies. Worldwide e-cigarette sales in 2014 were around US$7 billion, yet it is expected to continue to rise, and even exceed traditional cigarette sales by 2047. In the US, tobacco producers have a significant share of the e-cigarette market, and they are the major producers.

Tobacco manufacturers dismissed e-cigarettes as a fad at first; but the purchase of the US brand blu eCigs by US tobacco manufacturer Lorillard for $135 million in April 2012 signaled their entry into the market. Tobacco companies have bought some e-cigarette businesses and greatly increased their marketing efforts. As of 2015 e-cigarette devices are mostly made in China. A 2015 review said there are more than a hundred small e-cigarette businesses in the US, with about 70% of the market held by 10 businesses. A sizable share of the e-cigarette business is done on the internet. The majority of e-cigarette businesses have their own homepage and approximately 30–50% of total e-cigarettes sales are handled on the internet in respect to English-language websites. Canada is an expanding market for e-cigarettes. There are numerous e-cigarette retail shops in Canada. In 2013, the company Smoke NV was the leading seller of e-cigarette products in Canada. Smoke NV does not sell vapor products containing nicotine. France is a growing market for e-cigarettes, which is said to be about €100 million (£85 million) in sales as of 2013. In 2013, there were about 150 e-cigarette retail shops there. According to Nielsen Holdings, convenience store e-cigarette sales in the US went down for the first time during the four-week period ending on 10 May 2014.

**Regulation**

The legal status of e-cigarettes is currently pending in many countries. Some countries such as Brazil, Singapore, the Seychelles, and Uruguay have banned e-cigarettes. In Canada, they are technically illegal to sell, as no nicotine-containing e-fluid is approved by Health Canada, but
this is generally unenforced and they are commonly available for sale Canada-wide. In the US and the UK, the use and sale of e-cigarettes are legal.

In February 2014 the European Parliament passed regulations requiring standardization and quality control for liquids and vaporizers, disclosure of ingredients in liquids and child-proofing and tamper-proofing for liquid packaging. In April 2014 the US FDA published proposed regulations for e-cigarettes along similar lines.

In the US, as of 2014 some states tax e-cigarettes as tobacco products, and some state and regional governments have broadened their indoor smoking bans to include e-cigarettes. As of 9 October 2015, at least 48 states and 2 territories banned e-cigarette sales to minors.[29]

E-cigarettes have been listed as drug delivery devices in several countries because they contain nicotine and their advertising has been restricted until safety and efficacy clinical trials are conclusive. Since they do not contain tobacco, television advertising in the US is not restricted. Some countries have regulated e-cigarettes as a medical product even though they have not approved them as a smoking cessation aid.

As of 2014 electronic cigarettes had not been approved as a smoking cessation device by any government. A 2014 review stated the emerging phenomenon of e-cigarettes has raised concerns in the health community, governments, and the general public and recommended that e-cigarettes should be regulated to protect consumers. It added, "heavy regulation by restricting access to e-cigarettes would just encourage continuing use of much unhealthier tobacco smoking." A 2014 review said these products should be considered for regulation in view of the "reported adverse health effects".

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DISCLAIMER

Majority of the information gathered are from media sources which don’t reflect the author’s own opinion.
REFERENCES
2. Philip Morris International sells Atria's vaping products outside of the US, while Altria only sells two e-cigarette brands in the US.


27. www.youtube.com/watch?v=Iz67IqkLwYs&feature=youtube.
