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E-Cigarettes: Potential benefits and harms

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Abstract
Electronic cigarette (e-cigarette) is a device developed with intent to enable smokers to quit smoking and avoid the unhealthful effects of cigarettes. Electronic cigarettes (e-cigarettes) are products that deliver a nicotine-containing aerosol (commonly called vapor) to users by heating a solution typically made up of propylene glycol or glycerol (glycerin), nicotine, and flavoring agents invented in their current form by Chinese pharmacist Hon Like in the early 2000s. The US patent application describes the e-cigarette device as "an electronic atomization cigarette that functions as substitutes for quitting smoking and cigarette substitutes*"*. The increase in its use during the adolescence period is attention-grabbing. Despite the fact that e-cigarette has become popular in a dramatic way, there are certain differences of opinion regarding its long-term effects on health, in particular In this article, we are discussing about the potential benefits and harms of the e-cigarette or electronic cigarette among the users.

Keywords: electronic cigarette, aerosol, adolescent, harmful

1. Introduction
Electronic cigarettes (e-cigarettes), a type of electronic nicotine delivery system, represent a dramatic new nicotine delivery technology. These devices can deliver nicotine along with other constituents via an aerosol, which is then inhaled, mimicking the feel of a conventional cigarette. This may serve to satisfy many of the behavioral and sensory cues of smoking in addition to providing nicotine. Introduced in the United States in 2007, e-cigarettes sales have been doubling annually and by 2013 were projected to become a nearly 2 billion industry [1]. This rapid uptake suggests e-cigarettes are a disruptive innovation to the conventional cigarette market. They may represent a less risky alternative to conventional cigarettes because users are not exposed to carbon monoxide (CO) or other toxicants at the same levels produced by the combustion of tobacco as in conventional cigarettes. However, the consequences of long-term exposure to the constituents of e-cigarettes remain unknown. Data on the effects of e-cigarettes on human physiology and health are limited in part due to their recent emergence as well as their rapidly evolving construction and lack of standardization [2]. These topics were further dividedinto subsections, presented below. In addition, regulatory perspectiveswere provided by representatives from the FDA Center for Tobacco Products (CTP) and the FDA Center for Drug Evaluation and Research (CDER).e-electronic cigarettes (e-cigarettes) have become increasinglypopular over the last decade. Although they areperceived by many to be safer than traditional cigarettes, many of the devices still contain nicotine, and inhaling their vapors exposes users to toxic substances, including lead, cadmium, and nickel—heavy metals that are associated withsignificant health problems. Withoutregulation, there is no way to know with certainty how muchnicotine the devices contain and what else is in them.Things, however, are changing. The Food and Drug Administration (FDA) recently announced that e-cigarettes andother tobacco products like cigars and hookahs will now beregulated in the same way the government regulates tobacco cigarettes and smokeless tobacco.

1.1 Government Regulation of E-cigarettes
In 2016, the FDA established a rule for e-cigarettes and their liquid solutions. Because e-cigarettes contain nicotine derived from tobacco, they are now subject to
Government regulation as tobacco products, including the requirement that both in-store and online purchasers be at least 18 years of age.

2. What Are E-Cigarettes
- E-cigarettes are known by many different names. They are sometimes called "e-cigs," "e-hookahs," "modes," "valepes," "vales," "tank systems," and "electronic nicotine delivery systems."
- Some e-cigarettes are made to look like regular cigarettes, cigars, or pipes. Some resemble pens, USB sticks, and other everyday items.
- 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.
- E-cigarettes can be used to deliver marijuana and other drugs.(fig.1) [3]

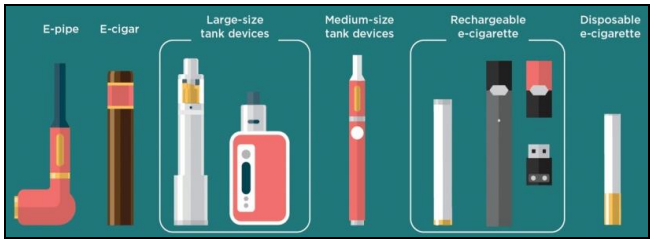

Fig 1: Various types of e-cigarette devices

Fig 2: Examples of electronic cigarette devices currently available on the market

3. What Are the Parts of E-Cigarettes

Fig 3: Various Parts of E-cigarette

Most e-cigarettes consist of four different components, including a cartridge or reservoir:- which holds a liquid solution

- (*e-liquid* or *e-juice*) containing varying amounts of nicotine, flavorings.
- And other chemicals a heating element (atomizer)
- A power source (usually a battery)
- A mouthpiece that the person uses to inhale [4].

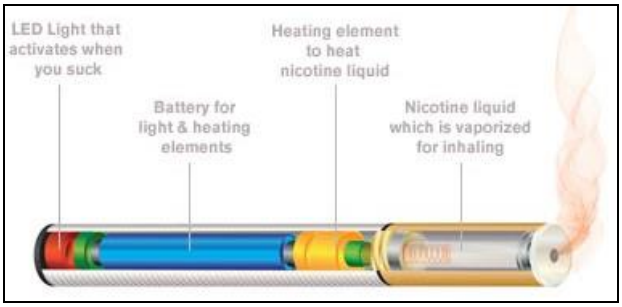

Fig 4: Various components of e-cigarette

4. How Do They Work

E-cigarettes do not burn anything and users do not light them. E-cigarettes work in much the same way as a smoke or fog machine. They use battery power (usually a rechargeable lithium battery) to heat a solution—usually containing nicotine, flavorings, and other chemicals—to the point that it turns into vapor. Much of whatever substances are in the vapor enter the bloodstream through the buccal mucosa, rather than the lungs. Devices typically have an on/off button or switch, an atomizer containing a heating coil, a battery, and an LED light, which is designed to simulate a burning cigarette. A sensor detects when a user takes a drag and activates the atomizer and light. Some of the devices can be charged with a USB cord. Because e-cigarettes don't burn anything, they don't have any smoke. They also don't have any tar, ash, carbon monoxide, or odor (except perhaps a faint, short-lived scent matching the flavor liquid chosen). But the issues of second-hand exposure and effects on air quality are still being investigated [5].

5. E-Cigarette Design and E-Liquid Constituents

A typical e-cigarette consists of a battery, a reservoir containing e-liquid (usually a mixture of propylene glycol, glycerol, nicotine, flavorants, and other additives), a microprocessor, an air flow sensor or activating button, and a heating element. The heating element is usually a wire or rod made from various metals (e.g., nickel, chromium, copper coated with silver). In many devices, when a user takes a "puff," an air flow sensor activates the flow of electricity to the heating element, which heats and aerosolizes some of the e-liquid. This aerosol is analogous to the mainstream smoke from a conventional cigarette. Numerous e-cigarette designs are currently on the market with new ones rapidly becoming available. E-cigarettes may contain undisclosed additives and new formulations are continually introduced into the market. U.S. regulation bans conventional cigarettes with characterizing flavors (not including menthol), such as pineapple, chocolate, and cherry. It is important to note that younger smokers exhibited a preference for flavored cigarettes [8]. E-cigarettes are often sold in flavored varieties including fruit andcandy flavors and, in a similar manner, the flavors may preferentially increase the product's appeal to younger smokers. Other additives may include ethyl alcohol, stabilizers, and non-nicotine pharmacologically active compounds.

5.1 Constituents of e-Cigarette Vapors

It is essential to understand the components of inhaled vapor produced by the e-cigarette atomization process, including nicotine and potential toxicants. Commercially available e-cigarettes are marketed with different levels of nicotine, and the distribution of inhaled levels remains unclear. E-Cigarettes require higher levels of suction to smoke than conventional cigarettes, and the amount and density of aerosol produced by e-cigarettes diminish progressively as puffs are taken. Serum levels of nicotine detected are heterogeneous and depend on the user and the device. Levels of carcinogens and toxins in e-cigarettes typically exceeded those measured in an FDA-approved nicotine inhaler, suggesting that FDA-approved devices may be a safer method of nicotine delivery. Czogala and colleagues measured the level of nicotine and other tobacco-related toxins from vapors exhaled by e-cigarette users in an environmental chamber [6].

5.2 E-Cigarette E-Fluid and Vapor Chemical Constituents

The nicotine content of the cartridge e-liquid from some brands revealed poor concordance of labeled and actual nicotine content.35–39 Simulated e-cigarette use revealed that individual puffs contained from 0 to 35 μg nicotine per puff.37 Assuming a high nicotine delivery of 30 μg per puff, it would take ≈30 puffs to deliver the 1 mg nicotine typically delivered by smoking a conventional cigarette. A puff of the e-cigarette with the highest nicotine content contained 20% of the nicotine contained in a puff of a conventional cigarette. Actual nicotine delivery from an e-cigarette would likely be affected by users' smoking behavior. An analysis of UK brand e- cigarettes and the resulting aerosol demonstrated that, across brands, nicotine content of the e-liquid in the cartridges was not significantly

correlated with the amount found in the resulting aerosol, indicating differences in the engineering characteristics of the device that strongly influence nicotine delivery even with a consistent puffing protocol analyzed the aerosol from 12 brands of e-cigarettes, a conventional cigarette, and a nicotine inhaler for toxic and carcinogenic compounds [7].

6. Technical problems and risk of overdose

Some e-cigarettes are of high quality design and manufacture, however, there are no government set standards for acceptable designs, contents and concentrations, purity, safety, and recommendations for safe use, and there is no convenient way for consumers to be able to access verified safety related data on individual products. Therefore, these products cannot be certified as "safe". *For example*:- if smokers pull too hard on the device, liquid may enter the mouth and nicotine contained in the liquid may be absorbed via the oral mucosa or involuntarily swallowed. Depending on the nicotine content, this may provoke symptoms of intoxication. If liquids contain nicotine, it can be absorbed through the skin [8].

In addition, electronic cigarettes do not extinguish naturally after about ten puffs like conventional cigarettes, but can be used for hundreds of puffs without a break. When using them as intended, consumers may therefore get a dangerous amount of nicotine by taking too many puffs, which may even result in serious symptoms of nicotine poisoning. According to the German Federal Institute for Risk Assessment and to press reports, there have already been cases of such poisoning. In extreme cases, inferior products can be very dangerous. In the U.S.A., an electronic cigarette exploded during use for unknown reasons causing severe facial injuries to the consumer [9].

7. Health Effect of E-Cigarette

Research so far suggests that e-cigarettes might be less harmful than cigarettes when people who regularly smoke switch to them as a complete replacement. The study showed that the e-liquids of certain cig-a-like brands contain high levels of nickel and chromium, which may come from the nichrome heating coils of the vaporizing device. Cig-a-likes may also contain low levels of cadmium, a toxic metal also found in cigarette smoke that can cause breathing problems and disease. More research is needed on the health consequences of repeated exposure to these chemicals [10].

7.1 Physiological observed in clinical studies effects

Nine studies evaluated the physiological effects of e-cigarette use. E-cigarettes are frequently marketed as 'safe' products. However, while the inhaled compounds associated with e-cigarettes may be fewer and less toxic than those from traditional cigarettes, data to establish whether e-cigarette use as a whole is less harmful to the individual user than traditional e-cigarettes are not conclusive.

7.2 The Impact of e-Cigarettes on Lung Function

In addition to the potential carcinogenic riskassociated with e-cigarette vapor, it is important to determine the effects of e-cigaretteuse on lung function. The add it ivesin the liquid nicotine cartridge (glycol derivatives) are similar to theatrical smokes and fogs. Although these data cannot be directly extrapolated to e-cigarette use, they highlight the potential acute and long-term effects of vapors similar to those. In a recent study of the effects ofe-cigarette vapor on lung function, in 30healthy smokers, use of e-cigarettes for5 minutes resulted in increased total respiratory impedance, respiratory flower sistance, and overall peripheral air wayresistance. In addition, e-cigarette use was associated with increasing oxidative stress as measured by lower levels of the fraction of exhaled nitric oxide. Flouris and colleagues examined the acute impact of active and passive e-cigarette vapor exposure on lung function in 15 smokers and 15 never-smokers. Although limited by small sample sizes, they suggest that e-cigarettes generate smalle racute effects on lung function than conventional cigarettes. Similar to cancer risk, there are no published data describing the long-term lung function or cardiovascular effects of e-cigarettes; ongoing surveillance, especially once-cigarettes are regulated and standardized, will be necessary [11].

7.3 How do e-cigarettes affect the brain

The nicotine in e-liquids is readily absorbed from the lungs into the bloodstream when a person uses an e-cigarette. Upon entering the blood, nicotine stimulates the adrenal glands to release the hormone epinephrine (adrenaline). Epinephrine stimulates the central nervous system and increases blood pressure, breathing, and heart ratePleasure caused by nicotine's interaction with the reward circuit motivates some people to use nicotine again and again, despite risks to their health and well-being [12].

7.4 The Impact of e-Cigarettes on the Cardiovascular System

Cardiovascular disease is the major cause of death among smokers1 and is responsible for as much has 30% of heart disease–related deaths in the United States each year.1 As smokers considered safer alternatives to help them quit, they started using e-cigarettes, in part, because they have "lower" levels of harmful constituents.19 Nevertheless, this notion should be reconciled in light of the high "sensitivity" of the cardiovascular system and evidence of a nonlinear dose-response relationship between tobacco exposure and development of cardiovascular disease On the other hand, relative to cigarette smoking, e-cigarette use caused a comparable and rapid increase in the number of circulating endothelial progenitor cells, which could be attributed to acute endothelial dys function and/or vascular injury.47 Given that platelets are key players in the development of cardiovascular disease— especially thrombosis and atherosclerosis—a recent in vitro study evaluated the effects of e-cigarettes on these cells [13].

7.5. What are the health effects of e-cigarettes? Are they safer than tobacco cigarettes?

Research so far suggests that e-cigarettes might be less harmful than cigarettes when people who regularly smoke switch to them as a complete replacement. But nicotine in any form is a highly addictive drug. Research suggests it can even prime the brain's reward system, putting vapes at risk for addiction to other drugs. Also, e-cigarette use exposes the lungs to a variety of chemicals, including those added to e-liquids, and other chemicals produced during the heating/vaporizing process [14].

7.6. Health effects related to specific components of electronic cigarettes

Eighteen reviewed publications evaluated the health effects related to specific e-cigarette components. e-cigarettes

include climate conditions, air flow, room number of users in the vicinity, type(s) and age of systems beingused, battery voltage, puff length, interval between puffs, characteristics (eg, age, gender, experience, health status).Additionally, particle size affects the site and effects of pulmonary absorption; details of e-cigarette aerosol particle size and absorption are unknown and likely vary depending on the product. Glycol and glycerol vapour are components of most e-cigarettes. Nicotine is readily absorbed through the airway, skin, mucous membranes and gastrointestinal tract. Acute exposure to inhaled nicotine may cause dizziness, nausea, or vomiting. Toxic reactions associated with dermal nicotine exposure have been described after spills of nicotine-containing liquids or occupational contact with tobacco leaves. Serious cases of nicotine poisoning due to cigarettes are relatively rare; spontaneous vomiting usually limits the absorption of swallowed tobacco [19]. E-cigarettes, however, may pose increased risk of nicotine toxicity due to the availability of high nicotine concentrations in the cartridges. There are reports of completed and attempted suicide by intravenous injection and oral ingestion of liquid nicotine intended for e-cigarette cartridges [15].

8. Observed physiologic effects associated with acute exposureto e-cigarettes or e-cigarette aerosols

- Mouth and throat irritation and dry cough at initial use, hough complaints decreased with continuing use.
- No change in heart rate, carbon monoxide (CO) level, or plasma nicotine level.
- Decrease in fractional exhaled nitric oxide (FeNO) and increase in respiratory impedance and respiratory flow resistance similar to cigarette use.
- No change in complete blood count (CBC) indicates.
- No change in lung function
- No change in cardiac function as measured with Echocardiogram.
- No increase in inflammatory markers [16].

9. What's "in" an e-cigarette and are the ingredients toxic?

Because e-cigarettes are relatively new to the global marketplace, little research exists garding the long-term effects and safety of their use, especially among habitual users. Some are as follows:

9.1. Vapor/refills

E-liquids may contain a variety of substances because they have been largely unregulated, but they generally include some combination of nicotine, propylene glycol, glycerin, and flavorings. In fact, up to 7000 flavors are available, including such kid-friendly flavors as chocolate, cherry crush, and bubble gum. When the refills do contain nicotine, users generally derive less of the substance from the electronic devices than they do from a conventional cigarette. Researchers found that individual puffs from an e-cigarette contained 0 to 35 μg nicotine per puff. Assuming an amount at the high end of the spectrum (30 μg nicotine), it would take about 30 puffs of an e-cigarette to derive the same amount of nicotine (1 mg) typically delivered by a conventional e-cigarette. The chemical make-up of the vapor and the biologic effects on animal models have been investigated using 42 different liquid refills. All contained potentially harmful compounds, but the levels were within exposure limits authorized by the FDA. These potentially dangerous chemicals include the known toxins form aldehyde, acrole in, and hydrocarbons. An inflammatory response to the inhalation of the vapors was demonstrated in mouse lungs; exposure to e-cigarette aerosol sreduced lung glutathione—an important enzyme in maintaining oxidation-reduction balance—to a degree similar to that of cigarette smoke exposure. Less of the enzyme facilitates increased pulmonary inflammation. In addition, human lung cells release pro-inflammatory cytokines when exposed toe-cigarette aerosols [17].

9.2. Harm to indoor air quality/-secondhand exposure

Even though e-cigarettes do not emit smoke, bystanders are exposed to the aerosol or vapor exhaled by the user, and researchers have found varying levels of such substances as formaldehyde, acetaldehyde, `isoprene, acetic acid, acetone, propanol, propylene glycol, and nicotine in the air. However, it is unclear at this time whether the ultra-fine particles in the e-cigarette vapor have health effects commensurate with the emissions of conventional cigarettes [18].

9.3. Cartridge refill ingestion by children

Accidental nicotine poisonings, particularly among children drawn to the colors, flavors, and scents of the e-liquids, have been problematic. In 2014, for example, over 3500exposures occurred and more than half of those were in children younger than 6 years of age. (Exposure is defined as contact with the substance in some way including ingestion, inhalation, absorption by the skin/eyes, etc; not all exposures are poisonings or overdoses). Although incidence has tapered off somewhat, the American Association of Poison Control Centers reports that there were 623 exposures across all age groups between January 1, 2016 and April 30, 2016.

9.4 Environmental impact of discarded e-cigarettes

Discarded e-cigarettes filling our landfills is a new and emerging public health concern. Their batteries, as do all batteries, pollute the land and water and have the potential to leach lead into the environment similarly, incompletely used liquid cartridges and refills may contain nicotine and heavy metals, which add to these risks.

9.5. Explosions

Fires and explosions have been documented with e-cigarette use, mostly due to malfunctioning lithium-ion batteries.25 Thermal injuries to the face and hand scan be significant.

9.6. Heavy metals

The presence of lead, cadmium, and nickel in inhaled e-cigarette vapor is another area of significant concern, particularly for younger people who might have long-term exposure.1 All 3 heavy metals are known to be toxic to humans, and safe levels of inhalation have not been established. Inhalation and/or ingestion of lead, in particular, can cause severe neurologic damage, especially to the developing brains ofchildren.26 Lead also results in hematologic dysfunction [19].

10. Health Implications of Cigarette Reduction in the Context of Dual Use

Among adults, reductions in cigarettes per day were observed in several of the clinical studies and in 1

population-based study4 among those who did not quit. Reduction in cigarettes smoked per day could have benefit if it promotes subsequent cessation, as has been found with NRT but this pattern has not yet been seen with e-cigarettes. In the cigarette reduction analyses presented in some of the studies, many participants were still smoking about half a pack cigarettes per day at the end of the study. Both duration (years of cigarette use) and intensity (cigarettes per day) determine the negative health effects of smoking. People who stop smoking at younger ages have lower age-adjusted mortality compared with those who continued to smoke later into adulthood. Findings for decreased smoking intensity have been less consistent, with some studies showing lower mortality with reduced daily cigarette consumption and others not finding a significant overall survival benefit [23] The 2014 report of the US Surgeon General concluded that "reducing the number of cigarettes smoked per day is much less effective than quitting entirely for avoiding the risks of premature death from all smoking-related causes of death. Use of electronic cigarettes by cigarette smokers to cut down on the number of cigarettes smoked per day is likely to have much smaller beneficial effects on overall survival compared with quitting smoking completely. This situation is particularly likely to exist for cardiovascular disease because of the highly nonlinear dose-response relationship between exposure to fine particles and the risk of cardiovascular disease. Light smoking, even 1 to 4 cigarettes per day, is associated with markedly elevated risk of cardiovascular disease. In addition, e-cigarettes deliver loads of fine particles similar to those of conventional cigarettes. The relative risk of death from lung cancer increases with years smoked and cigarettes per day, as well as pancreatic cancer and esophageal cancer. The relative risk of both lung cancer and bladder cancer levels off after a certain number of cigarettes per day, suggesting that above a certain intensity, the specific levels of exposure may not cause significant differences in risk for these cancers. Doll and Peto found a dose-response relationship between duration of smoking and number of cigarettes smoked per day and risk of lung cancer, with models suggesting the impact of duration to be greater than that of intensity. Overall, these data suggest that lung cancer mortality increases more with additional years of smoking than additional cigarettes per day. Thus, if dual use of e-cigarettes and cigarettes results in reductions in the number of cigarettes per day for current smokers, any reduction malignancy risk will be less than proportional to the reduction in cigarette consumption because of the (likely larger) importance of duration of smoking [20].

11. Health Effects for Teens

The teen years are critical for brain development, which continues into young adulthood. Young people who use nicotine products in any form, including e-cigarettes, are uniquely at risk for long-lasting effects. Because nicotine affects the development of the brain's reward system, continued e-cigarette use can not only lead to nicotine addiction, but it also can make other drugs such as cocaine and methamphetamine more pleasurable to a teen's developing brain [21]. Nicotine also affects the development of brain circuits that control attention and learning. Other risks include mood disorders and permanent problems with impulse control—failure to fight an urge or impulse that may harm oneself or others.

12. E-Cigarette Use by Youth

E-Cigarettes are increasingly popular among adolescents. Although they contain nicotine derived from tobacco, they are not yet subject to regulation as tobacco products, including the requirement that purchasers be a certain age. Some states have banned sale of e-cigarettes to minors, but they can get around that by ordering online. In addition to the unknown health effects, there is a concern that e-cigarette use may serve as a "gateway" or introductory product for youth to try other tobacco products, including conventional cigarettes, which are known to cause disease and lead to premature death [22].

13. Users of Electronic Cigarettes

13.1. Socio-demographic characteristics

Globally, electronic cigarettes (e-cigarettes) are apparently used primarily by smokers, smokers considering cessation as well as former smokers. By contrast, an analysis of data from the International Tobacco Control Four-Country Survey found that only 7.6 percent of all respondents (smokers from the U.S., the United Kingdom, Australia and Canada) had ever tried electronic cigarettes and 2.9 percent were current users at the time of the survey. In all countries studied, younger respondents with higher education and higher incomes tended to be more aware of e-cigarettes than other socio-demographic groups. Among those who were aware of e-cigarettes, younger female smokers, current smokers and daily smokers were more likely to actually try e-cigarettes than were former smokers [23].

14. Reasons for using e-cigarettes

Electronic cigarettes are primarily used for two reasons: As an alternative to smoking and as a smoking cessation aid. According to the ITC Four-Country Survey, almost 80 percent of respondents used e-cigarettes to reduce the health risks of tobacco smoking and three quarters of respondents stated using them to help them quit smoking. In an international survey conducted on the Internet with participants from 33 countries, 76 percent of participants stated using electronic cigarettes as an equal alternative to smoking. Further reasons reported included: the desire to quit smoking (7 percent), health reasons (6 percent), costs (3 percent) and avoiding smoking bans (3 percent). In another Internet survey conducted in Poland with 179 participating e-cigarette users, 41 percent of participants stated that they used electronic cigarettes because they are considered to be less harmful, and just as many used them to help them quit smoking.

15. User opinions

Many consumers believe that electronic cigarettes are helpful in an attempt to quit smoking: More than two thirds of users are using the products to cut down or quit smoking or to mitigate withdrawal symptoms. In an Internet survey involving 3,587 participants from more than five countries (U.S.A., France, United Kingdom, Switzerland, Canada and others), which used a questionnaire published on the Swiss smoking cessation website Stop-Tabak.ch, 77 percent of participants said they were using the e-cigarette to quit smoking or avoid relapsing; 79 percent want to reduce craving in a cessation attempt and 67 percent are using it to reduce withdrawal symptoms. There are also many young people who believe that e-cigarettes could be helpful to quit smoking. [24]

16. Effects of electronic cigarettes on desire to smoke and withdrawal symptoms

Electronic cigarettes can reduce craving and withdrawal symptoms. According to two Internet surveys, 70 to 90 percent of electronic cigarette consumers have less desire to smoke when using electronic cigarettes. About 70 to 80 percent of respondents also report that using electronic cigarettes reduces mood swings such as irritability, nervousness, restlessness or depressed mood as well as difficulty concentrating. Electronic cigarettes are more effective in reducing withdrawal symptoms in former smokers than in current smokers. It is remarkable that electronic cigarettes without nicotine also reduce craving and withdrawal symptoms, albeit to a slightly lesser extent than do nicotine-containing devices. The finding that not only electronic cigarettes with nicotine-containing liquids are capable of alleviating withdrawal symptoms but that nicotine-free products can do so, too suggests that the way in which electronic cigarettes are used, which strongly resembles that of conventional smoking, plays an important role for this effect. Apparently, the mere holding of the product, sucking at it and inhaling the aerosol already mitigate withdrawal symptoms. [25]

17. E-Cigarettes for Smoking Cessation

This study randomized 300 active smokers to one of three interventions: e-cigarette with 7.2 mg nicotine cartridge for 12 weeks, e-cigarette with 7.2 mg nicotine cartridge for 6 weeks followed by reduction to 5.4 mg cartridge for 6 more weeks, or e-cigarette with cartridge containing no nicotine for 12weeks. After completion of the 12-weekintervention phase, individuals were followed for an additional 40 weeks. During the observation phase, e-cigarettes were not provided, but participants were free to purchase them on their own. Similar to prior studies, participants were informed that e-cigarettes are a healthier alternative to conventional cigarettes and could be used as a substitute. The median number of conventional cigarettes smoked daily at 52 weeks was 7 to 10 lower than baseline in all three study groups. Interestingly, the reduction in daily cigarettes smoked did not significantly differ between the nicotine-containing cartridges and placebo cartridge at weeks 12 or 52 of follow-up. Exhaled carbon monoxide–confirmed quit rates at 52 weeks were 13% for the high nicotine group, 9% for the low nicotine group, and 4% for the placebo nicotine group. Together these data suggest that e-cigarettes can result in favorable modifications in smoking habits and trends in improved cessation rates among smokers not motivated to quit. An electronic cigarette company provided the e-cigarette supplies but did not have input in study design, data analysis, or presentation. However, caution must be taken in interpreting these data because the inclusion of a message that e-cigarettes represent a healthier alternative likely biased the smokers' use. The lack of equipoise in these studies regarding the harms and benefits of e-cigarettes is a major limitation to inferring efficacy of e-cigarettes as a harm reduction tool. The largest study investigating whether e-cigarettes are more effective than nicotine patches in achieving smoking cessation was recently published. One month and 3-month cessation rates also did not differ. E-Cigarettes with or without nicotine were as effective as nicotine patches in achieving 6-month smoking cessation. Notably, cessation rates were quite low in the study, reinforcing the challenges of achieving durable cessation in people with tobacco dependence. As seen previously, placebo e-cigarettes and nicotine-containing e-cigarettes resulted in similar cessation rates, suggesting that the [26].

17.1. Effects on Cessation of Conventional Cigarettes:-

E-cigarettes are promoted as smoking cessation aids, and many individuals who use e-cigarettes believe that they will help them quit smoking conventional cigarettes. The assumption that e-cigarettes will be as effective as or more effective than pharmaceutical NRTs has also motivated support for e-cigarettes among some public health researchers and policy makers formed the basis for some public policies on the regulation of e-cigarettes.

18. Health Implications of Cigarette Reduction in the Context of Dual Use

Among adults, reductions in cigarettes per day were observed in several of the clinical studies and in 1 population-based study4 among those who did not quit. Reduction in cigarettes smoked per day could have benefit if it promotes subsequent cessation, as has been found with NRT but this pattern has not yet been seen with e-cigarettes. In the cigarette reduction analyses presented in some of the studies, many participants were still smoking about half a pack cigarettes per day at the end of the study. The relative risk of death from lung cancer increases with years smoked and cigarettes per day, as well as pancreatic cancer and esophageal cancer The relative risk of both lung cancer and bladder cancer levels off after a certain number of cigarettes per day, suggesting that above a certain intensity, the specific levels of exposure may not cause significant differences in risk for these cancers. Doll and a dose-response relationship between duration of smoking and number of cigarettes smoked per day and risk of lung cancer, with models suggesting the impact of duration into be greater than that of intensity. Using participants from the Cancer Prevention Study II, Flanders et a found a greater increase in lung cancer mortality with a greater duration of cigarette smoking compared with a greater intensity of smoking. Overall, these data suggest that lung cancer mortality increases more with additional years of smoking than additional cigarettes per day. Thus, if dual use of e-cigarettes and cigarettes results in reductions in the number of cigarettes per day for current smokers, any reduction malignancy risk will be less than proportional to the reduction in cigarette consumption because of the (likely larger) importance of duration of smoking [27].

18.1. Can e-cigarettes help a person quit smoking?

Some people believe e-cigarettes may help lower nicotine cravings in those who are trying to quit smoking. However, e-cigarettes are not an FDA-approved quit aid, and there is no conclusive scientific evidence on the effectiveness of e-cigarettes for long-term smoking cessation. It should be noted that there are seven FDA-approved quit aids that are proven safe and can be effective when used as directed [28]. E-cigarettes haven't been thoroughly evaluated in scientific studies. For now, not enough data exists on the safety of e-cigarettes, how the health effects compare to traditional cigarettes, and if they are helpful for people trying to quit smoking.

18.2 Exposure risks for non-users

Five studies addressed exposure risks for non-users. E-cigarette refill cartridges may contain toxic amounts of nicotine. Nicotine from the aerosol or the liquid can remain on surfaces for weeks to months, and may react with ambient nitrous acid to produce TSNAs, leading to inhalation, ingestion, or dermal exposure to carcinogens. The primary indoor sources of ambient nitrous acid are gas appliances. Marketing information frequently includes a stated or implied claim that using e-cigarettes will help smokers quit or reduce e-cigarette use. Supporting data, however, are quite limited. Several small studies have demonstrated short-term reduction in cigarette smoking while using e-cigarettes. Smokers also report fewer withdrawal symptoms when using e-cigarettes while quitting. Many cigarette smokers also report attraction to e-cigarettes due to reduced cost, perceived reduced toxicity, and more freedom of use. Users acknowledge that e-cigarettes may 'not be completely safe' and are 'addictive' but believe they are safer and less addictive than cigarettes.37 Studies attempting to show efficacy of e-cigarettes as a cessation therapy have had mixed results, with generally low sustained cessation rates (self-reported or verified).Adverse events, when reported, were not serious. A summary of the reviewed surveys and studies is presented [29].

19. Product safety

To protect consumers, various measures need to be taken to establish product safety, including for long-term use of the product. The World Health Organization demands that manufacturers provide evidence of product safety and regulatory authorities should verify this evidence. Evidence of product safety requires the following measures, in particular

- Exact disclosure of ingredients of liquids on the packaging (purity, stability)
- Assessment of exposure to ingredients for short-term and long-term use of electronic cigarettes
- Toxicological evaluation of inhaled intake of all ingredients for short-term and long-term use
- Assessment of health risks associated with short-term and long-term use of electronic cigarettes
- Assessment of addictive potential of nicotine-containing products
- Assessment of exposure of third parties (second-hand exposure, passive vaping)

If electronic cigarettes were classified as medicinal products, the strict approval procedure in place for this type of product would ensure high safety standards of the products for consumers. Inso far as product safety standards demanded by the WHO are not covered by the approval procedure for medicinal products, such as assessment of second-hand exposure, these investigations must additionally be conducted by an appropriate scientific.[30]

20. Use in public places

Germany does not yet have a uniform regulation of e-cigarette use in public places. The Federal Government holds that e-cigarettes are generally subject to the Federal Non-Smoker Protection Act the Federal States of Baden-Württemberg, Hessenand Rhineland-Palatinateas well as in the draft law of 26 June 2012 for North Rhine-Westphalia amending the existing non-smoker protection law, electronic cigarettes are considered equal to conventional cigarettes as far as non-smoker protection is concerned. The German national railway company, Deutsche Bahn, also considers e-cigarettes subject to non-smoker protection regulations and prohibits use of e-cigarettes on their trains. The German Cancer Research Center supports equal treatment of e-cigarettes in non-smoker protection legislation. Article 8 of the WHO Framework Convention on Tobacco Control (FCTC), ratified by Germany, regulates protection from exposure to tobacco smoke. This provision should be made applicable to e-cigarettes as well. Since health risks for third parties due to exposure to emissions from e-cigarettes cannot be excluded at the present time and health protection and addiction policies should make smoking in public less normal, e-cigarettes should be treated the same as conventional cigarettes in matters of non-smoker protection. Moreover, it is only by treating them the same that we can ensure for existing non-smoker protection laws to be executed, because e-cigarettes imitate normal cigarettes in their appearance and handling, which would make effective control difficult due to their outward resemblance [31].

20.1 Youth protection

The German Cancer Research Center demands that e-cigarettes should be classified as medicinal products. The law does not generally prohibit that pharmacies dispense medicinal products to children and youth. For quality assurance, the Federal Union of German Associations of Pharmacists has issued an information sheet on the dispensing of medicinal products to children (last revised 2 March 2011). Hence, pharmacies are obliged to act with particular care when dispensing medicinal products to children and youth. In view of the fact that § 10 of the German Youth Protection Act prohibits the dispensing of tobacco products to children and youth, the same should apply to the dispensing of medicinal products to children and youth. If an adult sends a child or an adolescent to collect drugs, for example because of being bed-ridden, pharmacies should at least advise the adult of the availability of the pharmacy's delivery service by calling or sending a written note [32].

21. Product Awareness and Market Development

Awareness of the electronic cigarette in the population is high, particularly among smokers, although it continues to be a niche product that is not very widespread. However, sales have grown considerably over recent years. According to a survey conducted on behalf of the European Commission (Special Eurobarometer 385) in 2012, two thirds (69 percent) of Europeans had heard of electronic cigarettes. 46 percent also know what they are, while 23 percent are not really sure. Men and younger people (15-39 years old) are more likely to be aware of the products than are women and older people (over 55 years old). Highest awareness of the product is found in Finland (92 percent), Greece (90 percent), and Lithuania (88 percent). Most Germans (80 percent) have heard of the products and 57 percent also know what they are. Awareness of the devices is lowest among people in Sweden (34 percent) and Ireland (47 percent).According to various international studies, between 60 and over 80 percent of smokers are aware of electronic cigarettes [33].

22. Conclusion

From this article, we can see that the teens that are using e-cigarette as a safer alternative to conventional cigarettes, they are more prone to nicotine addiction. As they are starting nicotine ingestion in their earlier teen age, they are more severely addicted to nicotine. Their mental dependence on nicotine is very chronic. Due to this nicotine dependence, after sometime, they are starting using conventional cigarette along with e-cigarettes. So, double consumption of nicotine is there due to this dependence. So, if we are saying that the e-cigarettes are safer alternative to conventional cigarettes, we should do something that, the teens are unreachable to these devices. The few from them are:

- Electronic cigarettes, regardless of their nicotine content (including nicotine-free products), may only be marketed if they have been approved i.e. as medicinal products. This makes them subject to the necessary high safety standards.
- The e-cigarette body (atomizer etc.) should be classified as a medical device.
- E-cigarettes should not be dispensed to children and youth, not even if classified as medicinal products.
- Non-smoker protection legislation should generally treat e-cigarettes equal to conventional cigarettes.

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