

E-Cigarettes: Harmless substitute to conventional smoking or a devil in disguise?

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Abstract

Smoking tobacco through cigarette use kills around six million people each year worldwide and is one of the biggest public health threats the world has been facing. Electronic-cigarette (E-cigarette) use is marketed as being a healthier substitute to traditional cigarette smoking and is also used as a smoking cessation tool. It is commonly believed that e-cigarette use might be a harmless substitute to conventional smoking and has no long term debilitating side-effects. E-cigarettes were introduced in 2007 and they seem to be getting day by day and the prevalence of their use has rapidly increased. Awareness and trial use of e-cigarettes has almost doubled in most countries from 2008 to 2012. Since late 2013, there have been different varieties of e-cigarettes. Some are with nicotine, while others are nicotine-free. E-cigarettes are becoming an emerging public health concern as they gain popularity worldwide. The health concerns are due to the ingredients found in the e-cigarettes. FDA has reported that e-cigarettes may contain carcinogens and toxic chemicals, such as nitrosamines and diethylene glycol, which can cause harmful effects on humans. There is a need for more in-depth studies on not only the constitution of e-cigarette products, but also to ascertain whether these produce significant harmful health effects to their users in the short term or in the long run. Till then, the users need to be wary of the potential threat these e-cigarettes may pose.

Keywords: Cigarettes; E-cigarettes; Conventional smoking

Introduction

Smoking tobacco kills around six million people each year worldwide.⁽¹⁾ This has the proportions of a pandemic and is one of the biggest public health threats the world has been facing. 1 person dies every six seconds from tobacco related disease which equates to 10 people every minute.⁽²⁾ It has been estimated that In Canada alone tobacco use kills approximately 50,000 Canadians annually, primarily from cardiac disease, lung cancer and respiratory illnesses such as Chronic Obstructive Pulmonary Disease (COPD).⁽³⁾ There is scientific evidence that even nonsmokers exposed to tobacco smoke (passive smoking) have a greater incidence of cancer, cardiovascular disease and respiratory disease.^(3,4)

Electronic-cigarette (E-cigarette) use is by and large marketed and advocated as being a healthier substitute to traditional cigarette smoking.⁽⁵⁾ It is also used as a smoking cessation tool and a means to avoid indoor smoking restrictions.^(6,7) Since no tobacco is burned in an e-cigarette, inhaling nicotine in vapor form potentially provides a safer alternative to smoking since it eliminates the harmful tars and carbon monoxide.⁽⁸⁾ E-cigarettes may therefore have a role to play in smoking cessation programs individually and on community levels.⁽⁹⁾ However there is a counter argument that the use of e-cigarettes might predispose people towards starting conventional smoking later.

Since they were introduced in the year 2005, there has been ongoing debate regarding how they should be regulated. This is mostly because of reservations regarding how harmful they might be to human health. There has also been an enormous rise in their popularity

since their origin, with the total worldwide market expected to reach \$3.5 (U.S) billion by the end of 2015 and it is expected to exceed \$10 billion by 2017.^(10,11) It is believed that e-cigarette use might be a harmless substitute to conventional smoking and has no long term debilitating side-effects. A major difference between e-cigarettes and conventional cigarettes is that e-cigarette users are exposed to toxicants via inhalation of a heated aerosol (or by burning the tobacco contained in e-liquids), while conventional cigarette smokers are exposed via inhalation of the smoke produced by burning the tobacco.^(12,13)

The World Health Organization not expecting reports on the long-term health consequences of these devices for decades.⁽¹⁴⁾ This is resulting in decisions about how they should be regulated being based on insufficient data on composition analysis and exposure estimates.⁽¹⁵⁾ This has led to countries taking a variety of approaches to regulate their use with some following the precautionary principle and banning the sale of e-cigarettes altogether, while others regulating or planning to regulate them either as either medical devices or tobacco products.^(15,16) The regulatory framework for e-cigarettes varies widely by each country. Due to the prevailing and generalized lack of government or stringent regulatory oversight of these products, nearly more than 500 brands and 7000 flavors of e-cigarettes are available on the market currently. This is regrettably without a Food & Drug Administration (FDA) evaluation determining what is in them and how they may affect human health. According to the World Health Organization (WHO), neither the safety of e-cigarettes nor their efficacy in

smoking termination programs has been scientifically established to date.⁽¹⁷⁾ The studies available that have focused on the constituents, physiological effects, health risks and benefits of e-cigarettes vary in terms of their practical carefulness, including sample sizes, enrollment techniques, and control for possible confounding variables. In October 2014, the WHO Framework Convention on Tobacco Control recognized the need for the regulation of e-cigarettes along the lines of policies relating to other tobacco goods, including prohibiting or restricting promotion, sponsorship and advertising.⁽¹⁸⁾ In Canada, electronic smoking products containing nicotine are regulated under the Food and Drugs Act.⁽¹⁹⁾ Market authorization is required for all of these products prior to being imported, advertised or sold in Canada; to date, no e-cigarette product has received such market approval. Therefore, the marketing and sale of e-cigarettes containing nicotine, including e-liquid, is illegal. However, e-cigarettes that do not contain nicotine and do not make health claims are sold legally in mainstream retail outlets.⁽²⁰⁾ Overall, e-cigarettes with and without nicotine are widely available in Canada.

Composition of e-cigarettes

E-cigarettes work on the principle that a micro-electrical circuit is activated by drawing on the mouthpiece. E-cigarettes contain replaceable cartridges, with each puff; this solution is heated and vaporized, to create a visible mist without smoke.⁽¹⁴⁾ Since late 2013, there have been different varieties of e-cigarettes. Some are with nicotine, while others are nicotine-free. Nicotine containing e-cigarettes vary in different nicotine concentrations in the solution used to generate the nicotine aerosol (e-liquid), they vary in volume of solution in the product, differ in carrier compounds.⁽²¹⁾ Nicotine containing e-cigarettes also contain ingredients such as propylene glycol, glycerol, ethylene glycol and polyethylene glycol.⁽¹⁴⁾ It has been noted that nicotine content of some brands do not match the actual nicotine content of the brand.⁽²²⁾ Some studies also show that some products claim to be nicotine-free is not and others that claim to contain nicotine do not. To promote e-cigarette use and make it especially popular among young users, different flavors are added to it.

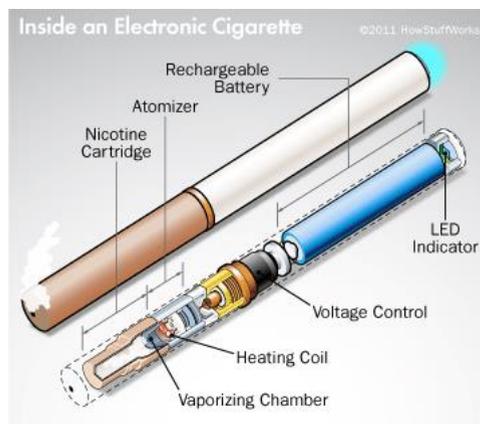


Fig. 1: Components of an E-cigarette

Marketing and media research

E-cigarettes hold a competitive advantage over conventional tobacco cigarettes in terms of advertising and marketing. This is because The Public Health Cigarette Smoking Act of 1970, the Tobacco Master Settlement Agreement of 1998, and the Family Smoking Prevention and Tobacco Act of 2009 prohibits the advertising marketing, and promotion of tobacco cigarette products on television, in print media, sporting events and music festivals. Conversely, there is rapid expansion of e-cigarette marketing on a variety of media channels, including the internet and traditional platforms. Since 2009, e-cigarettes have been marketed by celebrities. A research conducted by RTI international showed that e-cigarette advertising expenditures tripled in the United States from \$6.4 million in 2011 to \$18.3 million in 2012. Many e-cigarette makers promote their product as a healthier alternative to conventional smoking,⁽²³⁾ marketing them as a method to quit conventional tobacco smoking and use.⁽¹⁴⁾ Psychological studies suggest that viewing the commercials for e-cigarettes induce the thought and urge to smoke.⁽²⁴⁾

Prevalence of e-cigarette use

In USA e-cigarettes were introduced in 2007 and they seem to be getting day by day and the prevalence of their use has rapidly increased. Awareness and trial use of e-cigarettes has almost doubled in most countries from 2008 to 2012. Although men seem to know more commonly about e-cigarettes but they are getting popular among women as well. A study has showed that the use of e-cigarettes have quadrupled among US adults from 2009 to 2010.⁽²⁵⁾ Different studies conducted on use of e-cigarettes among adults showed that its use is highest among current smokers followed by former smokers with less use among non-smokers.⁽²⁶⁻²⁸⁾ A consumer based survey of US adults 18 and older was conducted in 2010-2011, in which 6% of all adults and 21% of current conventional smokers that they have never used e-cigarettes.⁽²⁷⁾ In the US, a recent estimate indicates that around 32% of current

smokers have tried an e-cigarette.⁽²⁹⁾ Although data for Canada is very limited, a study of current and former adult smokers shows that 10% people had tried e-cigarettes between 2010 and 2011.⁽³⁰⁾ It seems, the use of e-cigarettes remains substantially higher among current and former smokers, compared to non-smokers. Despite the increase in rates of trying e-cigarettes, rates of current e-cigarette use among non-smokers is substantially lower.⁽²⁶⁾

In 2013 a study with 1095 Canadians was conducted and the subjects were categorized into three groups: 1. Young non-smokers, aged between 16-24 years. Young smokers aged between 16-24 years and 3. Older smokers aged 25 years and older.⁽³⁰⁾ It was found that approximately 10% of younger non-smokers, 42% of younger smokers and 27% of older smokers had tried e-cigarettes. Among those who had tried e-cigarettes, nearly 10% of younger non-smokers, 46% of younger smokers and 43% of older smokers informed that they had tried an e-cigarette that contained nicotine.⁽³⁰⁾ Another study has provided evidence that there is increase in use of e-cigarette in youth who have never smoked before.⁽³¹⁾ Similarly recent Centre of Disease Control (CDC) report shows that use of e-cigarettes tripled from 2013 to 2014 in US in youth even in those who have never smoked before.⁽³²⁾

Does e-cigarette use affect conventional cigarette smoking?

There is a common notion that e-cigarettes are used as a harmless substitute for conventional cigarette smoking. Several studies have tried to scrutinize the correlation between the use of e-cigarettes and smoking status by surveying regular e-cigarette users.^(33,34) In a longitudinal design study,⁽³³⁾ it was found that users consistently report that e-cigarettes helped them to quit or reduce their smoking. However, in another longitudinal study of a general population sample, e-cigarette users at baseline were no more likely to have quit permanently at a 12-month follow-up despite having reduced their cigarette use.⁽²⁶⁾

In a study conducted by Etter and Bullen,⁽³³⁾ a sample of e-cigarette users engaged from web sites dedicated to e-cigarettes and smoking cessation were followed. 72% of these were former smokers at baseline. At the 1-year follow up, 6% of former smokers who were daily e-cigarette users at base-line reverted to cigarette smoking, and almost 92% of the former smokers using e-cigarettes daily at baseline were still using e-cigarettes daily at follow-up. Among the 36 dual users of conventional cigarettes and e-cigarettes at baseline, 44% had stopped smoking after 1 year. A 2014 article in the Journal of the American Medical Association (JAMA) and 2014 study in Nicotine & Tobacco Research both found that e-cigarette use was associated with a greater likelihood of intending to smoke conventional cigarettes.^(35,36)

Effects of e-cigarette use on health

E-cigarettes are becoming an emerging public health concern as they gain popularity worldwide. The perception that e-cigarettes pose little health risk is so ingrained that some smokers are switching from cigarettes to e-cigarettes. The safety of e-cigarettes is uncertain, but advertising and public opinion is that they are less harmful than tobacco smoking. However, insufficient data is available about their health effects. The risks involved with their regular use are uncertain due to the significant variability between vaporizers and in quality of their liquid ingredients and thus the contents of the aerosol delivered to the user.⁽³⁷⁾ Form the very limited evidence that is available, it is suggested that e-cigarette use is probably safer than smoking conventional cigarettes.⁽³⁸⁾ One study suggested that their safety risk is similar to that of smokeless tobacco, which has about 1% of the mortality risk of traditional cigarettes.⁽³⁹⁾

The health concerns are due to the ingredients found in the e-cigarettes. FDA has reported that e-cigarettes contain carcinogens and toxic chemicals, such as nitrosamines and diethylene glycol, which can cause harmful effects on humans.⁽⁴⁰⁾ Exposure of propylene glycol can cause irritation of eye and respiratory tract. In addition, prolonged and repeated exposure can affect central nervous system behavior and spleen.^(14,40) When propylene glycol is heated and aerolised it produces propylene oxide and according to International Agency for Cancer Research (IACR) this is carcinogenic.⁽¹⁴⁾ It is not the nicotine that is responsible for the toxicity. Toxicity is related to the quality, concentration and amount of flavors used. E-cigarette toxicity is affected by the design features in the delivery device, type and source of ingredients used in the product, and the manufacturing and quality control measures employed by the manufacturer. Additional parameters that affect the toxicity profile of e-cigarettes may also be identified through in-depth research.⁽⁴¹⁾

Conclusion

Although there is a ban on nicotine-containing e-cigarettes in Canada, the current studies and literature indicate that their use has increased among smokers and non-smokers. The use of e-cigarettes in Canada seems to be less prevalent than the UK, matching more closely to USA. However, comparisons and data collection across countries are complicated by diversity in the samples obtained and survey methodology employed. The perception that e-cigarettes are a harmless substitute to conventional smoking with no immediate or long term effect is leading to more non-smokers being enticed towards using them. Young people in general, younger smokers and males in comparison to females seem to be more likely to use e-cigarettes. Education levels do not seem to affect the use or non-use of these products. There is a need for more in-depth

studies on not only the constitution of e-cigarette products, but also to ascertain whether these produce significant harmful health effects to their users in the short term or in the long run. Till then, the media and public needs to be wary of the significant threat these e-cigarettes may pose to the under-informed public who are getting lured into using them due to possible incorrect advertisement claims.

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