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Author(s)	Ben Y.F. Fong, Rachel W.N. Mak
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## **The Efficacy of Employing Electronic Cigarettes in Smoking Cessation**

**Ben Y.F. FONG**

School of Professional Education & Executive Development/  
College of Professional & Continuing Education  
The Hong Kong Polytechnic University  
Kowloon, Hong Kong  
yffong@speed-polyu.edu.hk

**Rachel W.N. MAK**

School of Professional Education & Executive Development/  
College of Professional & Continuing Education  
The Hong Kong Polytechnic University  
Kowloon, Hong Kong  
yan0935@hotmail.com

### **ABSTRACT**

Electronic cigarettes (e-cigarettes) have become progressively ubiquitous in smokers and their roles of smoking cessation give rise to much controversy. With reference to the increasing prevalence of e-cigarettes use, the paper aims to examine the efficacy of e-cigarettes in quitting smoking and to make recommendations to existing policies. Health impacts of e-cigarettes are still not being proven in the long-term and cessation effectiveness is not well established. However, e-cigarettes constitute a gateway to cigarette smoking, nicotine addiction as well as dual use of e-cigarettes and traditional tobaccos among smokers and youth population. Current policies on e-cigarettes in Hong Kong pose certain grey areas. The Government should put greater efforts into regulatory measures regarding the sale and promotion of e-cigarettes. Increased public education is also important in order to safeguard public health of the community.

**KEYWORDS:** Electronic cigarettes, E-cigarettes, Cigarette smoking, Smoking cessation, Quit smoking

## 1 INTRODUCTION

Cigarette smoking remains the most significant modifiable risk factor in health promotion, accounting for the major cause of smoking-associated diseases and preventable death (Cahill, Lancaster and Perera, 2013). Globally, over 1.1 billion people smoke cigarettes (World Health Organization [WHO], 2018). In Hong Kong, according to the Thematic Household Survey conducted in 2015, there were approximately 691,600 current smokers and around one third of them (30.8%) had endeavoured to quit smoking but failed (Census and Statistics Department, 2015). In recent times, the prevalence of electronic cigarettes (e-cigarettes) smoking has been gradually raising among smokers. It involves an electronic vaporization system to aerosolize the propylene glycol combined with or without nicotine and added flavours.

### 1.1 Prevalence of Electronic Cigarettes

#### 1.1.1 Western Countries

Based on the National Health Interview Survey, people who have used e-cigarettes sharply elevated from 3.3% to 12.6% in 2010 and 2014 respectively in the United States. Furthermore, among people who regularly adopt e-cigarettes, young adults have a relatively higher rate than the elder population (Centres for Disease Control and Prevention [CDC], 2015). Moreover, national surveys have demonstrated that the majority of smokers (85%) use e-cigarettes to quit smoking in Western countries as they perceived e-cigarettes as healthier, compared with traditional cigarettes (Adkison et al., 2013; Gravely et al., 2014). Other reasons for more e-cigarette use include marketing and the regulation of e-cigarettes among countries.

#### 1.1.2 Asian Countries

The prevalence of usage of e-cigarettes in Hong Kong is 2.3% (Jiang et al., 2016), which is close to that of Taiwan (Chang et al., 2017) and China (Chinese Centre for Disease Control and Prevention, 2015). A study has indicated that lower prevalence rate maybe due to fewer aggressive marketing activities than in many western countries (Wang et al., 2015). On the other hand, local newspaper articles have included more information regarding the adverse effects of e-cigarettes and the advocacy for legislation, not the advantages of using e-cigarettes (Cheung, 2016).

### 1.2 Safety and Efficacy of Electronic Cigarettes in Smoking Cessation

Information about the safety and efficacy of e-cigarettes in smoking cessation is insufficient. To date, evidence supporting the effectiveness of e-cigarettes in smoking cessation is still weak because there are only a few high quality and well-established researches in this area and the long-term effect of e-cigarettes remains “unknown”. This paper attempts to answer the question whether e-cigarettes are effective in quitting smoking. It is hypothesized that e-cigarettes are ineffective in quitting smoking.

## 2 ELECTRONIC CIGARETTES IN SMOKING CESSATION

A population-based study exploring whether smokers who adopted e-cigarettes possess a greater likelihood to become successful in quitting smoking than the non-e-cigarette users has concluded that smokers using e-cigarettes have a greater risk of incapability to quit (Al-Demy et al., 2015). In addition, two other studies have conducted online longitudinal surveys with 1-year follow up to investigate the relationship between e-cigarettes adoption and cessation. One study has concluded that e-cigarettes are not linked to a higher rate of cessation or decreased quantity in smoking cigarettes (Grana, Popova, & Ling, 2014). The other paper has revealed both regular use and non-daily adoption of e-cigarettes is not associated with cessation (Brose et al., 2015). These web-based surveys have selection biases

since online network adoption is associated with socioeconomic status as well as age. Nonetheless, their findings tend to be more generalizable as the sample is not recruited from self-selected populations.

On the contrary, a few literatures have shown that e-cigarettes could be efficacious in cessation. A randomized controlled trial (RCT) to examine whether e-cigarettes with or without nicotine are more efficacious compared with nicotine patches has demonstrated that all methods lead to similar outcomes, with a slightly higher rate of success in using e-cigarettes to support smokers to stop smoking (Bullen et al., 2013). Caponnetto et al. (2013) performed a RCT to study the effectiveness of e-cigarettes with two levels of nicotine and without nicotine in quitting. Their paper concluded that usage of e-cigarettes with or without nicotine had a positive influence on cessation. However, the study did not involve a control group that is not using e-cigarettes. Thus, statistical analysis may not be significant because of lower internal validity and the results about causal relationship become less conclusive. Furthermore, a cross-sectional study has indicated that smokers who used e-cigarettes were 60% higher to report success in cessation than those who depended on non-prescription nicotine replacement therapies (NRT) or no aids (Brown et al., 2014).

### **3 SMOKING CESSATION MODALITIES**

The common methods of smoking cessation in Hong Kong, including counselling, hotline services, medications and acupuncture, are examined in terms of quit rate. In particular, efficacy of NRT is compared with that of e-cigarettes in smoking cessation.

#### **3.1 Behavioural Therapy**

Behavioural therapy is provided through physicians, counsellors or other healthcare professionals in smoking cessation clinics. The Hospital Authority (HA), Department of Health (DH), Tung Wah Group of Hospitals, Pok Oi Hospital and some private doctors provide a great variety of smoking cessation services in Hong Kong (Tobacco Control Office [TCO], 2016a). Counselling and information are provided through the Smoking Cessation Hotline of DH and the Quitline of HA. Behavioural counselling can be conducted in the form of individual or group context. There are 4 sessions within 8 to 12 weeks. Certain individuals are successful in stopping smoking because, given the provision of concise advice by practitioners, the likelihood of smoking cessation is greater than without professional support (Stead et al., 2013).

#### **3.2 Pharmacotherapy**

Some smokers are highly addictive to nicotine. They can benefit from pharmacotherapy to deal with the physiological effects. The medications generally include two classifications, NRT and non-nicotine pharmacotherapy. Pharmacotherapy can double or even triple the chance of success in smoking cessation and maximum rate of cessation can be accomplished when it is integrated with cessation support (WHO, 2008). The quit rate is found to be 35.1% in week 26 when combining counselling and medications (Ho et al., 2016). Furthermore, acupuncture is an alternative therapy for smoking cessation. It is commonly accepted in Hong Kong and the cessation rate is 18.4% at week 52 (Wang et al., 2016).

#### **3.3 Electronic Cigarettes Versus Nicotine Replacement Therapy**

NRT is normally delivered in diverse formats such as gums, patches, oral inhalers as well as lozenges (TCO, 2016b). There is no scientific evidence to show e-cigarettes are more efficacious than NRT in smoking cessation outcomes. Two RCTs using old-fashioned e-cigarettes devices with nicotine presented have demonstrated success rates in quitting slightly higher than the licensed NRT products. Smokers who employ e-cigarettes are approximately 1.5-fold more probable than NRT users to stop smoking (Brown et al., 2014). The quitting

rate among e-cigarettes and NRT group were 7.3% and 5.8% respectively (Bullen et al., 2013).

However, the findings can simply give a small portion of the answer since more trials have to be conducted on the modern products because of advanced technology and the pace of its evolution. Hence, the quantity and design of e-cigarette products must be taken into consideration in order to make a plausible conclusion, particularly in the absence of adequate comparative studies.

## **4 HEALTH IMPACTS OF ELECTRONIC CIGARETTES**

At present, neither experimental nor observational studies have investigated the long-term adverse health outcomes of e-cigarettes since they have not been extensively used for a long enough period for evaluation. The aerosol of particulate matter generated from e-cigarettes has a similar concentration with traditional cigarettes. Inhalation of these ultrafine particles in a certain amount would give rise to health risks. For example, the use of e-cigarettes for twelve months is related to a higher cardiovascular risk (Moheimani et al., 2017).

### **4.1 Pulmonary Effects**

Subsequent to the inhalation of e-cigarettes vapour, several short-term negative health influences on the lungs are noted. Using e-cigarettes for five minutes can lead to immediate pulmonary effects akin to cigarettes smoking, for instance, increase in airway resistance as well as oxidative stress in healthy smokers (Vardevas et al., 2012). Accordingly, individuals with chronic lung diseases including asthma, emphysema, and chronic bronchitis are of great concern when using e-cigarettes, due to a larger clinical influence. Moreover, e-cigarettes with or without nicotine have an impact on instant decrease in exhaled nitric oxide among smokers, and this explicates e-cigarettes usage can affect the pulmonary functions (Marini et al., 2014).

### **4.2 Cardiovascular Effects**

Hypertension is one of the major cardiovascular risk factors. In addition to the impacts on lung functions, use of e-cigarettes can result in increased heart rate and blood pressure, but to a lesser extent than cigarette smoking (Yan and D’Ruiz, 2015). An elevated heart rate among people with cardiovascular disease is a predictor of mortality. Furthermore, certain patterns of employing e-cigarettes are correlated with abundant nicotine absorption, and therefore generating plasma nicotine concentrations in parallel with conventional cigarette smoking (Vansickel and Eissenberg, 2012). This could give an explanation of increased risk for hypertension as tiny nicotine particles from the vapour enable rapid and efficacious transfer into the blood.

## **5 RENORMALIZATION OF SMOKING**

Renormalization effect is regarded as the likelihood that everything allows smokers captivated by e-cigarettes, which facilitate the appeal of smoking itself and persistently maintain the smoking epidemic (WHO, 2014). E-cigarettes strive for imitating the individual experience and population performance of smoking. However, it is satirical that the attractiveness of e-cigarettes relies upon persistent stigmatization of conventional cigarettes (Fairchild, Bayer and Colgrove, 2014).

Renormalization of smoking is presented in various forms. “Vaping”, a popular term for e-cigarettes use, is adopted by some e-cigarettes companies in Western countries to advertise their products. Such marketing tactics used on e-cigarettes could pose a grave threat

to effective public health campaigns in smoking cessation as a cultural norm. The advertisement of e-cigarette without nicotine is currently not regulated in Hong Kong as in foreign countries such as Australia and Canada (TCO, 2012).

Promotion of e-cigarettes highlights the efficacy in quitting smoking and fewer harmful effects compared to conventional cigarettes. However, the utilization of e-cigarettes would cause a relapse in former smokers and hamper other smokers to give up the smoking habit, thus rising cigarettes consumption as well as associated harmful health effects (Datran and Glanta, 2014).

### **5.1 Dual Use of Traditional Cigarettes and Electronic Cigarettes**

It has been demonstrated that e-cigarettes, with or without nicotine, could be efficacious in cessation and have similar effect of quitting to nicotine patches without medical support in real-life settings, potentially assisting certain smokers to shift entirely from traditional cigarettes to e-cigarettes (Bullen et al., 2013; Brown et al., 2014). Nevertheless, for a sizeable number of smokers, using e-cigarettes will lead to reduction in cigarette consumption instead of cessation. Consequently, this will bring about the dual use of e-cigarettes as well as traditional cigarettes. Considering negative health effects resulting from smoking, dual use appears to generate relatively fewer favourable outcomes on the overall survival than total smoking cessation (The United States Department of Health and Human Services, 2014).

### **5.2 A Gateway to Smoking and Nicotine Addiction**

The gateway hypothesis has been examined comprehensively with regard to substance use. This idea has reappeared in the context of e-cigarettes. There are some issues accompanied by the renormalization of smoking, in which e-cigarettes may contribute to a gateway to smoking as well as nicotine addiction. A majority of e-cigarette users smoke conventional cigarettes simultaneously according to a South Korea survey, suggesting e-cigarettes use could encourage a new phenomenon of nicotine addiction (Lee, Gran, & Glanta, 2014). Moreover, a study investigating concomitant e-cigarettes use and cigarette smoking of juveniles has concluded a heavier cigarette consumption and higher unsuccessful cessation rate (Leventhal et al., 2015). From these findings, e-cigarettes present a similar gateway to smoking and nicotine addiction.

### **5.3 Harm Reduction Model to Addiction**

Harm reduction advocates suggest smoking belongs to a portion of culture and thus a smoke-free environment is impractical. They further argue that the healthcare community should endeavour to allow smoking safer by utilizing an alternative product rather than changing the behaviour to terminate its usage (McNeil and Munafò, 2013). Since e-cigarettes exclude most of the carcinogens and toxins generated from conventional cigarettes, these advocates propose that e-cigarettes should be popularized as a finer substitute in order to fulfil the nicotine need. They also believe myriads of smokers would shift and ultimately succeed in dealing with addiction to nicotine, thus reducing the associated health impacts.

On the other hand, opponents highlight the scanty of adequate scientific evidence regarding the safety and efficacy of e-cigarettes to be used as a quitting method. They claim that e-cigarettes do not show any benefits to health and the harm reduction approach can result in a compensatory puffing behaviour among e-cigarette users. Therefore, smokers who shift to e-cigarettes could adjust their puffing behaviour by using e-cigarettes more frequently or longer puffs, therefore raising their nicotine absorption for compensation (Beridge, 2014). In view of this, the concept of harm reduction dilutes and undermines the primordial idea, which is the end to nicotine addiction through quitting smoking.

## **6 REGULATORY FRAMEWORK ON ELECTRONIC CIGARETTES**

At present, although there are various legislations on tobacco control and the Hong Kong Government claims that regulation associated with medical products as well as tobacco products also applies to e-cigarettes, but the existing rules do not really address directly to e-cigarettes. Therefore, the existing policies on e-cigarettes carry some level of “uncertainty and grey area”.

### **6.1 Current Legislation Related to Electronic Cigarettes**

According to the Smoking (Public Health) Ordinance (Cap. 371), “no person shall smoke or carry a lighted cigarette, cigar or pipe in a no-smoking area” is stated under section 3. With reference to the definition of the Ordinance, “smoke” refers to “inhaling and expelling the smoke of tobacco or other substance.” It does not categorically state in a clear manner whether the adoption of e-cigarettes is identical to smoking cigarettes. Nonetheless, the Secretary for Food and Health’s reply to a Legislative Councillor in 2014 clearly confirmed that “smoking of e-cigarettes or similar products in a statutory no-smoking area constitutes an offence” (GovHK, 2014).

### **6.2 “Grey Area” in Policy**

In Hong Kong, e-cigarettes with nicotine are regulated as pharmaceutical products under the Pharmacy and Poisons Ordinance (Cap. 138) and must be registered with the Government prior to sale and distribution. According to the records of DH, up until January 2017, none of the e-cigarettes with nicotine have registered as pharmaceutical products and nobody has registered for a license to sell them in Hong Kong (GovHK, 2017). However, these statistics do not imply that e-cigarettes with nicotine are non-existent in the local market.

People can purchase e-cigarettes with nicotine conveniently via Internet like “taobao.com”. Additionally, the selling of e-cigarettes without nicotine is not regulated under the existing legislation. Hence these products are available to the public without age restrictions. There are e-cigarettes that label the goods as “nicotine-free” in the package, thus bypassing the rules, and are readily obtainable in some local shops as well as through Internet and social networks. There is no regulation to demand the producers to include ingredients labels on the packing of e-cigarettes. Even though the manufacturers assert that the liquid does not contain nicotine, the potential adverse health effects from certain toxic substances and flavouring agents must not be overlooked. It is a public health alarm that such “grey area” in the Ordinance of not regulating the sale and distribution of e-cigarettes without nicotine also occurs in some foreign countries including Japan, Australia and Canada (Cheung et al., 2017).

### **6.3 Public Health Implications**

As the marketing of e-cigarettes without nicotine is not regulated, the e-cigarette industry has been positively advertising the devices with some major marketing tactics such as diverse flavours, lower price and less hazardous than traditional cigarettes as well as celebrity use. These marketing strategies are akin to those utilized by the tobacco industry in the past.

Worse still, the adolescent population are especially targeted, making e-cigarettes a potential gateway to smoking and nicotine addiction in the young generation, and resulting in a threat to public health in Hong Kong. E-cigarettes contain approximately 8,000 various flavours, such as fruits, vanilla and bubble gum etc. (WHO, 2014). Such flavouring, particularly the sweet and cooling flavours, plays a crucial part and is a selling point that appeals to teenagers and eventually encourages them to start smoking (Kim et al., 2016).

Social media including Facebook and Twitter are also commonly utilized to reach the youth population.

Another public health concern is the promotion of e-cigarettes without nicotine by manufacturers, highlighting the efficacy in achieving unproven cessation outcomes and less harm than conventional cigarettes. Such misleading claims will persuade the smokers to shift from cigarettes smoking to e-cigarettes, or leading to dual use. Furthermore, celebrities are frequently used to promote the idea of “glamour” with e-cigarettes (Hong Kong Council on Smoking and Health, 2016). These marketing practices may normalize the smoking behaviour within the community, resulting in adverse public health implication to the entire population.

## **7 TIGHTEN UP REGULATORY MEASURES AND PUBLIC EDUCATION**

Currently, enactment of legislation on the sale, distribution, and advertising of e-cigarette products is still under consideration. Thus, the Government should put further regulatory efforts into these regulatory measures, and, at the same time, increase public education in order to safeguard the health of the public at large.

### **7.1 Restricting the Sale of Electronic Cigarettes**

The sale of conventional cigarettes but not e-cigarettes to minors is currently banned in Hong Kong. While the traditional cigarettes are generally sold on the newspaper racks and in convenience shops, e-cigarettes are available through the Internet or as some stylish products in retail stores, which can be accessed by teenagers. Laws prohibiting e-cigarette sale by retailers to minors are therefore strongly urged, and they must be identical to those imposed on traditional cigarette sales. Government should also require the e-cigarette manufacturers to label the ingredients and to display health warnings, such as the potential short-term and long-term adverse health effects, on the packaging, even though they are nicotine-free.

### **7.2 Prohibiting the Promotion of Electronic Cigarettes**

With respect to cigarettes, the Ordinance (Cap. 371) prohibits the exhibition of tobacco advertisement in printed publications, in public places, by film, or on the Internet (TCO, 2012). The same regulatory measures should be equally applicable to e-cigarettes and related products. Hence, publicizing and promotion of the e-cigarettes must be stopped, particularly when unproved health and cessation claims are made. Close surveillance on the marketing of e-cigarettes is necessary even before the implementation of new regulations on e-cigarettes, in order to reduce the gateway phenomenon to cigarette smoking among the youngsters. In addition, the Government should take immediate actions to curb misleading information that are “successfully” appealing to the youth population through online access.

### **7.3 Boost Publicity and Public Education**

While the local anti-smoking campaigns have constantly educated the public regarding the potential risks and hazard of conventional cigarette smoking, adverse health effects of e-cigarettes may not be well recognized in the population (Koplan, An, & Lam, 2010). In view of the rapid development and community infiltration of e-cigarette products, the latest evidence with regard to the potential harmful effects of e-cigarettes must be continuously highlighted in public health education campaigns. The campaigns should target at the youth population, particularly in schools and higher education institutions. These young people “wrongly” perceive e-cigarettes as less hazardous when compared with traditional cigarettes (Leung et al., 2018). Moreover, parent engagement will lead to a more successful outcome in preventing health-risk behaviors in schools (CDC, 2012).



## 8 CONCLUSION

E-cigarettes have become progressively ubiquitous among local and foreign smokers in recent times. Nevertheless, the effects of e-cigarettes in terms of long-term health impacts have not yet been proven while cessation effectiveness is unconvincing. In the meantime, e-cigarettes constitute a gateway to cigarette smoking, nicotine addiction and dual use of traditional cigarettes and e-cigarettes among smokers and youngsters. Accordingly, e-cigarettes cannot be regarded as an efficacious means for quitting smoking at this stage. The findings in this paper should underpin a powerful support for the Hong Kong Government and policy makers to proceed with tighter regulation on e-cigarettes. The study also provides a clear direction for healthcare professionals to educate the public the harms from the application of e-cigarettes. There is an urgent need for vigorous research on e-cigarettes to generate more scientific evidence.

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