

Review Article

Efficacy and Safety of Electronic Cigarettes for Smoking Cessation: A Critical Approach

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Key words:

Electronic cigarette, smoking, smoking cessation, nicotine.

Manuscript received:

July 10, 2015;

Accepted:

August 17, 2015.

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Cigarette smoking accounts for more deaths and diseases worldwide than any other modifiable risk factor. Indeed, smokers have a two- to fourfold increased risk for developing coronary artery disease and stroke.¹⁻³ There is also a 25-fold increased risk of lung cancer.⁴ In addition, numerous respiratory illnesses, congenital malformations, immune dysfunctions and other co-morbidities are seen more frequently in smokers than non-smokers.⁵

Quitting smoking is extremely difficult for most smokers, since nicotine is highly addictive and cessation is associated with withdrawal symptoms. To cope with withdrawal symptoms and to obtain relief, both psychosocial counseling and pharmacotherapy are effective methods, but they are most effective when used together. The first-line pharmacological substances licensed to aid smoking cessation are nicotine replacement therapy, bupropion and varenicline. All these medications are considered effective and appropriate smoking cessation strategies.^{1,6}

Electronic cigarettes (e-cigarettes) have the potential of targeting the access of nicotine to the brain and thereby to prevent the nicotine reinforcing effects.^{7,8} Proponents of e-cigarettes insist that e-cigarettes are healthier than traditional tobacco products and are an effective smoking cessation tool. Their supporters

argue that some electronic nicotine delivery systems show considerable promise in the fight against tobacco-related morbidity and mortality. Others, however, express concerns related to the lack of knowledge regarding the long-term effects of e-cigarette use, the evidence of toxic chemical content, the increasing e-cigarette use rates among young people, and, finally, the lack of government regulation, consumer protection requirements, and product quality standards.

Considering the frequent use of e-cigarette smoking together with concerns for public health, the aim of this review article is to highlight the efficacy for smoking cessation and the potential hazards of e-cigarette smoking.

Methods

For this systematic review we searched the PubMed electronic database until June 2015 using as main keyword the term “electronic cigarette”, as well as related keywords (e-cigarette, electronic nicotine delivery systems). We retrieved a total of 114 publications relevant to research on e-cigarette safety/risk profile. The validity and strength of each study were determined based on a qualitative assessment of study objectives, methods and population. In total, 20 original papers and 8 review articles and statements relevant to

research on e-cigarette safety/risk profile are cited in this review article.

What is the e-cigarette?

The electronic nicotine delivery systems incorporated in e-cigarettes are devices in which liquid nicotine is heated by a battery, transformed into an aerosol (often called “vapor”), and inhaled by the user.^{7,9} Unlike traditional cigarettes or other combustible tobacco products, e-cigarettes do not contain tobacco, and because nothing is burned they emit no smoke. It is estimated that the e-cigarette devices and liquid used deliver one third to one fourth the amount of nicotine of smoking one standard cigarette after 5 minutes of use (Figure 1).¹⁰ New-generation e-cigarette devices are more efficient in nicotine delivery but still deliver nicotine much more slowly than tobacco cigarettes. It should be noted, however, that e-cigarette users do not “smoke” in 5-minute sessions (as with a regular cigarette) but may do so over an extended period of time, thus potentially absorbing large amounts of nicotine.

Since their initial manufacture in 2003, there has been rapid growth and evolution in the types, design,

and overall engineering characteristics of e-cigarettes. This has resulted in a large degree of product variability in size, potential nicotine concentrations, and e-liquid formulations. There have also been changes in the electrical circuitry (e.g. heating element or atomizer) and battery life that allow for more liquid delivery, adjustments in flavor, and longer device use. Ongoing product development and evolution are likely to continue; therefore, regulatory policies will be important to ensure appropriate quality control.^{7-9,11}

E-cigarettes among young individuals

The use of e-cigarettes among young people is growing. The number of high school students who never used tobacco but had tried e-cigarettes tripled between 2011 and 2013. Some argue that this percentage is higher if non-cigarette nicotine delivery devices, such as electronic hookahs or “vape pipes”, are included in the count.⁵

There is also concern among public health advocates that e-cigarettes could increase nicotine addiction and serve as a gateway to the use of tobacco products, particularly among the young. Indeed, although this is debated in the literature, evidence sug-

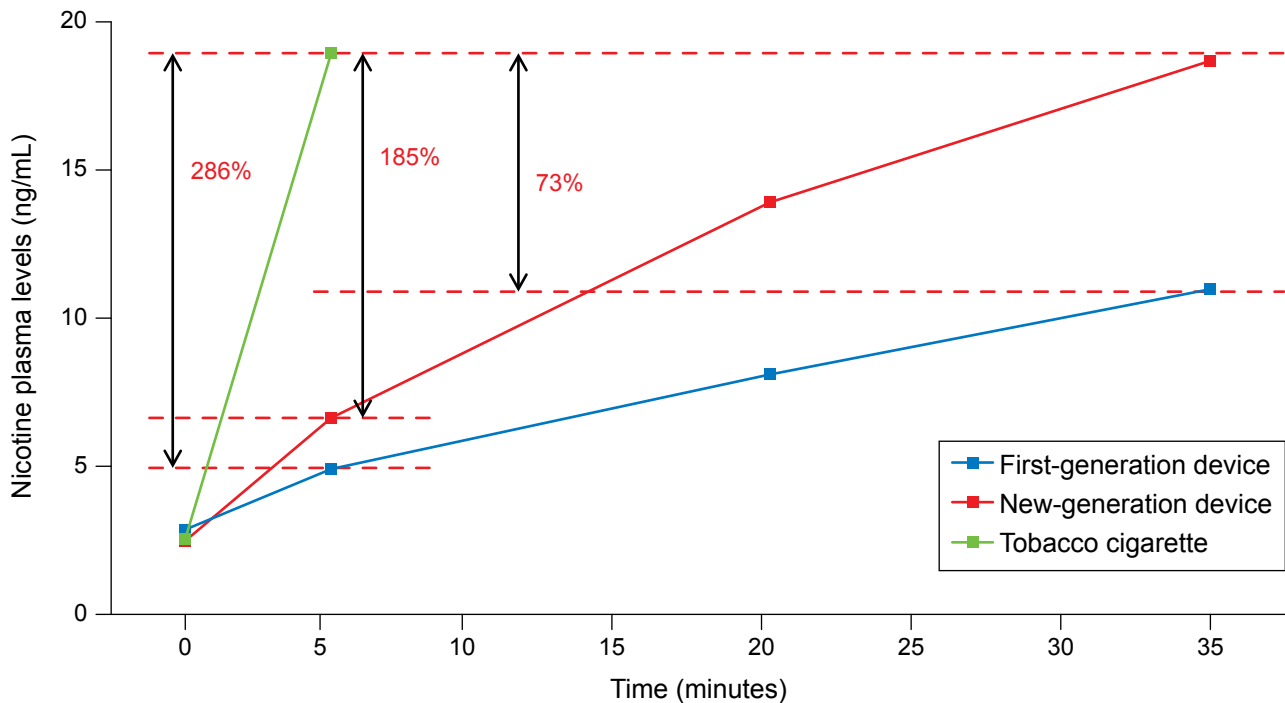


Figure 1. Comparison between tobacco cigarette and e-cigarette devices regarding nicotine levels. After 5 minutes of e-cigarette use, plasma nicotine levels were substantially lower compared to smoking one tobacco cigarette (almost 3-fold lower for new- and 4-fold lower for first-generation devices). Plasma nicotine levels are equal between tobacco cigarette use at 5 minutes and new generation e-cigarette device at 35 minutes. (Data from Farsalinos et al¹⁰ with permission.)

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