

# Electronic cigarettes: Do we know the benefits vs the risks?

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[Roy Purssell, MD](#)

Electronic cigarettes (e-cigarettes) are products that deliver an aerosol by heating a solution typically containing nicotine in propylene glycol or glycerol with flavoring agents. Controversy and debate continue around the potential benefits and harms of these devices.

## A review of the literature

Proponents of e-cigarettes claim that use of these devices will result in significant harm reduction and that they can be effective in promoting smoking cessation. Proponents also claim e-cigarettes are safer than conventional cigarettes because e-cigarette vapor contains lower levels of toxins than smoke from conventional cigarettes.[1] However, results of research are conflicting and inconclusive on whether e-cigarettes are effective in promoting smoking cessation.

A recent large cross-sectional study showed that e-cigarette users were more likely to report abstinence than either those who used nonprescription nicotine replacement therapy or a no-smoking cessation aid.[2] On the other hand, several population-based studies have failed to show any benefit from the use of e-cigarettes as aids to smokers in smoking cessation.

There have been several cross-sectional and longitudinal studies evaluating the association between using e-cigarettes and quitting conventional cigarettes.[3-5] However, several studies did not control for the level of nicotine dependence. Smokers who are more dependent could be more willing to try e-cigarettes and may have more difficulty quitting, leading to the finding that e-cigarette use is associated with a lower quit rate.

Clinical trials on the efficacy of e-cigarettes for smoking cessation have also been completed.[6-7] All studies found statistically significant reductions in the number of conventional cigarettes smoked. However, they did not find effects of e-cigarette use on quitting smoking altogether beyond what is seen in unassisted or low-assistance studies of smokers using nicotine replacement therapy to quit. Furthermore, methodological considerations, including an underpowered primary analysis in one study, limit the robustness of these results.

Most of the limited research to date indicates that use of e-cigarettes leads to lower use of conventional cigarettes and dual use of e-cigarettes and conventional cigarettes. However, both the duration and intensity of cigarette use determine the health effects of smoking. 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.[8] E-cigarette use may delay smoking cessation. Therefore, at this point, no conclusion can be drawn about the effectiveness of e-cigarettes for smoking cessation.

## **Health risks**

On 27 March 2009, Health Canada released a product safety advisory with the following information:

Health Canada is advising Canadians not to purchase or use electronic smoking products, as these products may pose health risks and have not been fully evaluated for safety, quality, and efficacy by Health Canada... Electronic smoking products, including their nicotine cartridges, must be kept out of the reach of children at all times, given the risk of choking or nicotine poisoning. Nicotine is hazardous to the health and safety of certain segments of the population such as children, youth, pregnant women, nursing mothers, people with heart conditions, and the elderly.[9]

Despite this advisory, e-cigarettes are readily available online and through retail outlets.

Nicotine is a potent toxin and the refill liquids for e-cigarettes contain high concentrations, posing a significant risk of poisoning. Vomiting is common with small exposures, and seizures, ataxia, neuromuscular blockade, respiratory failure, and death can occur with larger doses. From September 2010 to February 2014, poison control centres in the US received 2405 e-cigarette exposure calls. In comparing the number of calls received in February 2013 with February 2014, there were 70 calls received in the former and 215 in the latter, an increase of over 300%. More than half of these calls involved young children.[10] In BC, the Drug and Poison Information Centre received 14 e-cigarette liquid exposure calls between 1 July 2013 and 30 June 2014. Half of these calls involved children younger than 4 years old. Fortunately, no patient developed serious toxicity.

There is evidence that e-cigarettes will be a gateway to conventional cigarette use in young people by exposing them to nicotine[11-12] and by normalizing smoking behavior in society.[13] Nicotine is a highly addictive substance with negative effects on brain development, which is undergoing change in adolescence.[14] E-cigarette companies have invested in large advertising campaigns and use of e-cigarettes in youth is increasing. Between 2011 and 2012, the proportion of high school students who had tried e-cigarettes doubled from 4.7% to 10%.[15]

## **Going forward**

Carefully conducted studies are needed to determine the effectiveness of e-cigarettes compared to other nicotine replacement strategies in aiding smoking cessation. However, by waiting for more information it may be too late to prevent significant harms from these products. The rapid increase in the use of these products by youth and the dramatic increase in nicotine poisoning in children are particularly concerning.

The sale of e-cigarettes containing nicotine is currently illegal in Canada under the Food and Drugs Act regulations. The CMA has developed a position statement calling for ongoing research into the potential harms and benefits of e-cigarette use. In addition, in the absence of solid evidence of harms or benefits, the CMA believes e-cigarettes containing nicotine should not be authorized for sale in Canada. It also recommends a ban on the sale of all e-cigarettes to Canadians younger than the minimum age for tobacco consumption in their province or territory.

The International Union against Tuberculosis and Lung Disease has issued a position statement indicating that the preferred option is to regulate e-cigarettes as medicine rather than as tobacco products. This approach will be taken in the UK. This is a reasonable course of action for a product that delivers a highly addictive substance with negative effects on brain development and can cause serious poisoning. Policies and regulations should be enacted now to protect vulnerable children and youth.

--Roy Purssell, MD

Chair, Emergency Medical Services Committee

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