

# *Clearing the Air:*

A systematic review  
on the harms and benefits  
of e-cigarettes and  
vapour devices

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## Executive Summary

*Clearing the Air* is a Canadian Institutes of Health Research funded knowledge synthesis project that examines the debate around vapour devices (e-cigarettes) through a synthesis and evidence review. In the literature search we queried 15 databases and retrieved 1,622 journal articles through April 26, 2016. This library was searched for articles on cessation, youth use, second-hand exposure, and the toxicity of vapour devices compared to cigarettes. In a number of instances, the research studies provided conflicting data. The overriding caveat for evaluating the findings is that the plethora of different devices and liquids means that the findings of a particular study may not be generalizable to other devices.

Regarding cessation with vapour devices, the limited number of studies to date do not allow for a definitive judgement about their efficacy for cessation. However, evidence from higher quality studies is encouraging, and many researchers found an appreciable number of vapour device users are quitting tobacco. The research is mixed as to whether vapour device use had an effect on the desire or ability of those who smoke to quit tobacco use, but based on the preponderance of findings, it is clear that claims for a negative impact on cessation are unjustified. Newer models (for example, tank systems) provide more effective nicotine delivery, and with earlier models rapidly falling out of favour, studies on earlier devices could be reasonably excluded in evaluations of vapour device use for cessation.

A key issue around vapour devices is the concern that youth use of vapour devices could lead to their uptake of tobacco products. This does not appear to be occurring as tobacco use in the US, Canada, and other countries is declining significantly among 12 – 19 year olds as vapour device use is increasing. Two independent regression analyses provide solid evidence against a gateway effect. Comparing rates of youth tobacco use in US states with and without bans on sales to minors, where adolescents had access to vapour devices, the prevalence of tobacco use was lower. In addition, addiction may not always be a factor as 23% - 72% of teens have reported consuming non-nicotine liquids. Based on the studies, we suggest a common liabilities model with vapour device use and tobacco use driven by the same psycho-social factors, particularly adolescent sensation seeking and the influence of family and peers who are themselves tobacco users.

Another critical issue is the potential risks from second hand exposure to vapour. Several studies found that vapour did produce a measureable absorption of nicotine in bystanders, but it is not yet clear how to frame the extent of risk from transient exposure to nicotine. Tests determined that second hand vapour is far less toxic than cigarette smoke, often by several orders of magnitude, and that it does not contain carbon monoxide or volatile organic compounds. Yet more testing is urgently needed to clarify the conflicting findings on the emissions of particulate matter, polycyclic aromatic hydrocarbons, and metals, and to determine the levels of passive exposure that may put vulnerable populations at risk, such as children and persons with smoke-sensitive morbidities.

Comparing the emissions of vaping to smoking, the studies are very encouraging for the potential of vapour devices for tobacco harm reduction. Vapour devices do not deliver tar, and emissions do not contain 61 of 79 cigarette toxins. Vaping produced exponentially lower levels of cancer causing agents, tobacco-specific nitrosamines, and volatile organic compounds. Nevertheless, the reduction in emissions most likely differs between products and may be influenced by user behaviours. Unfortunately, no independent research has measured vapour device emissions of 1,3-butadiene (BDE), the highest source of cancer risk in cigarettes. The lower level emissions of metals and particulate matter remain of concern, and could possibly be addressed by manufacturing standards or improvements in product design.

Based on our systematic reviews of literature published up to April 2016, we conclude with the following four observations:

1. Overall, there is encouraging evidence that vapour devices can be at least as effective as other nicotine replacements as aids to help tobacco smokers quit.
2. There is no evidence of any gateway effect whereby youth who experiment with vapour devices are, as a result, more likely to take up tobacco use. The available evidence is that tobacco use by youth has been declining while use of vapour devices has been increasing.
3. Second hand exposure to vapour is more transient than exposure to tobacco smoke. However, it has been shown to create measurable but small exposure to nicotine and no significant exposure to carcinogens such as found in tobacco smoke. It is unclear whether low level nicotine exposure poses any risk to health.
4. Vapour from e-cigarettes contains substantially fewer toxicants than does smoke from regular tobacco cigarettes, however there has been insufficient research regarding some significant carcinogens that may still be present.

In conclusion, we recommend that Canadian regulation of vapour devices be driven by best available evidence with a view to supporting improved public health outcomes. Policy should not be driven by ungrounded fears of a 'gateway effect' but, rather, be geared towards helping tobacco smokers quit and ensuring that only the safest devices are legally available, thereby reducing harm for both direct and second hand exposure.

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