



## Vaping products including e-cigarettes

Evidence summary, current as of January 30, 2023

### Purpose

This document provides healthcare providers working in primary and cancer care a brief evidence summary on vaping products, including e-cigarettes. It addresses the observed and potential health impacts of vaping products, including the development of vaping dependence, vaping's impact on youth smoking rates and vaping as a smoking cessation aid.

### Key messages

- The risk of cancer, cardiovascular diseases and other long-term health impacts associated with vaping are uncertain.
- People who have never smoked should not vape.
- Vaping generates direct toxic exposures, but at lower levels than tobacco smoke.
- Anyone who currently vapes or has vaped in the past should monitor themselves for respiratory symptoms (e.g., cough, shortness of breath, chest pain) and seek medical attention if they have concerns about their health.
- Evidence supports that vaping nicotine can lead to symptoms associated with dependence.
- Vaping may increase the likelihood of youth and young adults trying tobacco cigarettes.
- No vaping products have been approved by Health Canada for use as a smoking cessation aid.
- Evidence for vaping as a smoking cessation aid continues to develop; vaping is not currently recommended as an approved smoking cessation in Canada.
- Vaping might be beneficial for adult smokers who find it hard to quit using recommended smoking cessation aids.
- Medications (e.g., varenicline, nicotine replacement therapy, bupropion) and counselling either alone or in combination continue to be recommended as the standard treatment options for smoking cessation.

### Approach

A limited number of published reviews deemed to be comprehensive and relevant have provided the basis for this summary. These reviews are broadly referenced among Ontario Health's (Cancer Care Ontario) scientific partners. A search in PubMed was also conducted to identify newer, similarly comprehensive reviews, such as Cochrane reviews. This summary was first released in January 2020 and was updated in January 2023 to reflect the latest evidence and policies.

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## Background

Vaping products, including e-cigarettes, commonly contain nicotine and are used as an alternative to smoking tobacco. Vaping is a mode of delivery that does not produce smoke: devices heat a solution or substance, typically held in a replaceable cartridge, to a temperature that is below the point of combustion. The heated solution or substance produces an aerosol that can be inhaled or "vaped." As a result, vaping does not generate the toxic by-products of combustion that are responsible for most of smoking's toxicity.<sup>1</sup>

The main substances in vaping solutions are vegetable glycerine and/or propylene glycol, which are commonly mixed with flavourings along with nicotine.<sup>2</sup> Vaping devices may also be designed to heat other substances, dried cannabis or cannabis oils.<sup>2</sup> The long-term safety of inhaling aerosols from these substances is uncertain.

## Vaping in Ontario

Vaping products that contain nicotine, are legal for sale in Canada to people ages 19 and older. Regulations introduced in 2021 prohibit the sale of high nicotine products, limiting concentrations to 20 mg/mL or less.<sup>3</sup>

The *Smoke-Free Ontario Act, 2017* prohibits vaping any product in the same places where smoking is prohibited, restricts the display of vaping products in retail settings and bans the sale or supply of vaping products to anyone under the age of 19.<sup>4</sup> Retail stores that are not specialty vape stores are banned from displaying or promoting vaping products and may not sell flavoured products, except for menthol, mint or tobacco flavours. People under the age of 19 are not permitted to enter specialty vape stores.<sup>4</sup>

In 2021, about 13 percent of adults aged 25 and older reported ever having tried vaping, but only four percent reported having vaped in the past 30 days.<sup>5</sup> In comparison, 29% of youth aged 15 to 19 reported having ever tried vaping, and 13 percent reported having vaped in the past 30 days.<sup>5</sup> A study of vaping prevalence among youth in Canada, England and the United States suggested that there was a substantial increase in vaping among youth in Canada and the United States, from 2017 to 2019.<sup>6</sup>

## Observed and potential harms

### Health effects including chronic diseases

As substances are heated in a vaping device, some toxic substances (including known carcinogens), such as acrolein, formaldehyde and fine particulate matter, are produced, but at substantially lower levels than with tobacco smoke.<sup>1</sup> A few small clinical studies and animal models examining vaping substances found that they can cause DNA damage.<sup>1</sup>

In 2018, the National Academies of Sciences, Engineering, and Medicine from the United States noted that the long-term health impacts of vaping, including the risk of cancers and chronic disease, are uncertain,

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although the evidence continues to evolve.<sup>1</sup> In a 2019 review, a small number of cross-sectional studies found that youth and adults who vaped had an increased risk of respiratory symptoms, such as chronic coughing, phlegm and asthma exacerbations.<sup>7</sup> In addition, a 2022 meta-analysis indicated an association between vaping and increased risk of myocardial infarction,<sup>8</sup> and additional studies have found associations between dual use (using both e-cigarettes and combustible cigarettes) and increased risk of both myocardial infarction and cardiovascular disease.<sup>8-11</sup>

From September 2019 to August 2021, an outbreak of vaping-associated lung illness was investigated in Canada, with a total of eight confirmed and 12 probable cases reported to the Public Health Agency of Canada (PHAC).<sup>12</sup> Although the investigation did not find a likely cause for the outbreak, this demonstrates that the long-term health effects of vaping are still unknown.<sup>12</sup> PHAC continues to advise anyone who vapes or has vaped in the past to seek medical attention if they have developed a cough, shortness of breath, chest pain or a general feeling of being unwell.<sup>12</sup>

A rapid review from Public Health Ontario, *Vaping and COVID-19 – What we know so far*, noted the limited availability of studies but that there is evidence of the impact of vaping on lung function, which might potentially increase the risk of COVID-19 infection and/or severity of COVID-19 outcomes.<sup>13</sup>

In terms of second-hand exposure, vaping increases airborne concentrations of particulate matter and nicotine in indoor environments and, therefore, exposure to bystanders. However, concentrations of particulate matter and nicotine are lower with vaping than tobacco smoking.<sup>1</sup> Because many vaping products contain nicotine, the health risks associated with using nicotine must also be considered. Nicotine is highly addictive and can increase the risks of cardiovascular events (e.g., heart attack, stroke) in people with pre-existing cardiovascular disease.<sup>1</sup> Evidence from animal studies has found nicotine to harm the development of brain circuits related to attention, learning and susceptibility to addiction in developing brains.<sup>14</sup>

Other safety concerns or potential hazards associated with vaping devices include faulty batteries, which can cause explosions leading to blast injuries. Poisoning can also occur if skin is exposed to too much nicotine or if children accidentally ingest vaping substances.<sup>15</sup>

## **Risk of dependence and concurrent smoking in youth**

There is substantial evidence that vaping nicotine can lead to symptoms associated with dependence (e.g., cravings, using e-cigarettes more than intended), and that vaping may increase the likelihood of youth and young adults trying tobacco cigarettes.<sup>1</sup> A few studies suggest that youth and young adults who vape may go on to smoke cigarettes more frequently and use a greater number of cigarettes.<sup>1</sup> In the 2020 Canadian Community Health Survey, 66 percent of adolescents age 12 to 17 who reported having at least once smoked a whole cigarette and reported having tried vaping, reported that they had vaped before trying cigarettes.<sup>16</sup> Another study suggested that increased vaping from 2017 to 2018 has coincided with a considerable increase in Canadian youth who smoke tobacco.<sup>17</sup> In addition, a 2017 Canadian survey found that youth who reported

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using cannabis and youth who reported using alcohol in the past 12 months were more likely to have used e-cigarettes in the past 30 days.<sup>18</sup>

## Vaping as a smoking cessation aid

Health Canada has not authorized any vaping products to be promoted as smoking cessation aids.<sup>3</sup> Evidence for vaping as an effective smoking cessation aid is inconclusive according to reviews from the Smoke-Free Ontario Scientific Advisory Committee,<sup>19</sup> Public Health Ontario,<sup>20</sup> the Ontario Tobacco Research Unit (OTRU),<sup>21</sup> and the National Academies of Sciences, Engineering and Medicine in the United States.<sup>1</sup> More recently, a 2022 Cochrane review concluded there is substantial evidence that nicotine e-cigarettes increase quit rates compared to nicotine replacement therapy, and moderate evidence that nicotine e-cigarettes increase quit rates compared to non-nicotine e-cigarettes.<sup>22</sup> However, there is insufficient evidence whether long-term serious adverse effects are similar across all groups.<sup>22</sup>

OTRU has suggested that while evidence on the use of vaping products as a cessation aid continues to develop, their lower level of toxicity may be helpful as a harm reduction strategy for adult smokers who have had trouble quitting.<sup>23</sup> However, OTRU notes that many smokers who use e-cigarettes also smoke tobacco cigarettes and therefore remain at risk of smoking-related illnesses.<sup>23</sup>

Public Health England suggests that the availability of vaping products has helped a substantial number of smokers in England successfully quit smoking.<sup>24</sup> The smoking cessation service, provided through the United Kingdom's National Health Service, provides advice on how to use vaping products to quit smoking.<sup>25</sup>

In other jurisdictions, the Victoria State Government's quitline in Australia recommends that nicotine vaping products, available only by prescription in Australia, be considered for smoking cessation only if first-line treatment has repeatedly been unsuccessful.<sup>26</sup> In the United States, in May 2022, the Food and Drug Administration issued an approval of one brand of e-cigarettes, allowing it to be marketed for smoking cessation.<sup>27</sup>

## Additional resources

Resources are available from [Health Canada](#) that can help health professionals advise patients and the general population on the health effects of vaping.

The Training Enhancement in Applied Counselling and Health (TEACH) Project has free webinars on vaping intended for health professionals to increase their knowledge. The webinars can be found on the [TEACH archive](#).

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