



## NHMRC CEO Statement: Electronic Cigarettes (E-Cigarettes)

### Summary

Electronic cigarettes (e-cigarettes, also known as electronic nicotine delivery systems (ENDS) or electronic non-nicotine delivery systems (ENNDS)) are often marketed as a method to assist smokers to quit, or as a 'safe alternative' to conventional tobacco cigarettes. However, there is currently insufficient evidence to support claims that e-cigarettes are safe and further research is needed to enable the long-term safety, quality and efficacy of e-cigarettes to be assessed.

### Key messages

- E-cigarettes may expose users to fewer toxic chemicals than conventional tobacco cigarettes; however the extent to which this reduces harm to the user has not been determined.
- E-cigarettes may expose users to chemicals and toxins such as formaldehyde, heavy metals, particulate matter and flavouring chemicals, at levels that have the potential to cause adverse health effects.
- There is currently insufficient evidence to conclude whether e-cigarettes can assist smokers to quit. Smokers wishing to quit should consult the [Quitline](#) or their general practitioner.
- There is some evidence from longitudinal studies to suggest that e-cigarette use in non-smokers is associated with future uptake of tobacco cigarette smoking.
- Health authorities and policy-makers should act to minimise harm to users and bystanders, and to protect vulnerable groups such as young people, until evidence of safety, quality and efficacy can be produced.
- NHMRC is currently funding a number of studies into the safety and efficacy of e-cigarettes.
- Consumers should seek further information about e-cigarettes from reliable sources, such as the relevant [State or Territory Health Department](#) or [quit smoking services](#).

E-cigarettes are battery operated devices that heat a liquid (called 'e-liquid') to produce a vapour that users inhale. Although the composition of this liquid varies, it typically contains a range of chemicals, including solvents and flavouring agents, and may or may not contain nicotine. E-cigarettes have evolved as a product group since first entering the market, with products now ranging from early 'first generation' devices that resemble cigarettes, to second and third generation devices that enable users to modify characteristics of the device, such as adjusting the voltage.<sup>1</sup>

This wide variation in products, and the ability of users to customise their vaping experience, makes it difficult to assess the safety and efficacy of e-cigarettes as a group, because the results from research involving one particular product may not be applicable to all e-cigarettes or all users. However, by examining the evidence to identify common findings across a range of different products, or results that are replicated in a number of studies, it is possible to gain some insight into the efficacy of e-cigarettes, their potential harms, and areas where further research is required.

NHMRC recognises the need for high-quality research in this area and is currently funding a number of studies investigating the effects of e-cigarettes.

**The following information is provided to assist consumers and policy-makers in understanding the current evidence about the safety and efficacy of e-cigarettes. This information is current at the time of writing but is subject to change as more research becomes available.**

## Health and safety

### *Potential health risks*

It is widely believed that e-cigarettes are likely to be less harmful than tobacco cigarettes, because they expose users to fewer toxic chemicals.<sup>2,3,4</sup> However, there is insufficient evidence to quantify the reduction in risk when e-cigarettes are used instead of tobacco cigarettes.<sup>1,5</sup> Although a 2014 study reported that e-cigarettes are 95% less harmful than tobacco cigarettes,<sup>6</sup> this finding was based on opinion rather than empirical evidence, and concerns have been raised about potential conflicts of interest.<sup>7,8</sup> The World Health Organisation has stated that “no specific figure about how much ‘safer’ the use of these products is compared to smoking can be given any scientific credibility at this time.”<sup>1</sup>

E-cigarettes are not likely to be risk free, and may expose users to chemicals and toxins at levels that have the potential to cause health effects. These include solvents such as propylene glycol, glycerol or ethylene glycol, which may form toxic or cancer-causing compounds when vaporised.<sup>9,10,11,12,13,14,15,16,17</sup> Although these chemicals are typically found in lower concentrations than in tobacco cigarettes,<sup>3,4,10,15</sup> in some studies e-cigarettes and tobacco cigarettes were found to produce similar levels of formaldehyde,<sup>11,14</sup> which is classified as a cancer-causing agent.<sup>18</sup> E-cigarette liquids or vapour may also contain potentially harmful chemicals which are not present in smoke from tobacco cigarettes.<sup>1,11,19</sup>

While some of the chemicals in e-liquid are also used in food production and are generally considered safe when eaten, this does not mean that these chemicals are safe when inhaled as a vapour directly into the lungs. A number of studies have reported harmful effects when certain flavourings that are approved for use in food production, including cherry, cinnamon and popcorn flavours, are inhaled.<sup>20,21,22,23</sup> There is growing evidence to suggest that the long-term inhalation of flavourings used in most e-liquids is likely to pose a risk to health.<sup>1</sup>

Studies also show that e-cigarettes expose both users and bystanders to particulate matter (very small particles)<sup>16,24,25,26,27</sup> that may worsen existing illnesses or increase the risk of developing diseases such as cardiovascular or respiratory disease.<sup>28</sup> The World Health Organisation has warned that exposure to any level of particulate matter may be harmful and that levels of exposure should be minimised.<sup>29</sup>

E-cigarettes may also expose users to metals such as aluminium, arsenic, chromium, copper, lead, nickel and tin,<sup>3,15,30,31,32</sup> with these elements having been detected in e-liquid and in the vapour produced during use. In some cases these metals have been detected at levels greater than, or similar to, those found in tobacco cigarettes.<sup>1,30</sup>

### *Adverse events*

Studies that have tested e-cigarettes for use as a smoking cessation tool found that users of e-cigarettes typically experience a low rate of adverse events in the short term,<sup>33,34</sup> with mouth and throat irritation the most commonly reported symptoms. However, more serious adverse events have also been reported, with over 200 incidents of e-cigarettes overheating, catching fire or exploding reported to date in the US and UK alone.<sup>35</sup> In some cases, these events have resulted in life-threatening injury, permanent disfigurement or disability, and major property damage.

The rising popularity of e-cigarette use internationally has also corresponded with an increasing number of reported nicotine poisonings due to exposure to or ingestion of e-liquids.<sup>36,37,38,39,40,41,42</sup> The effects of exposure range from relatively mild, including irritation of the eyes and skin, nausea and vomiting,<sup>36,37,40</sup> to severe life-threatening illness,<sup>39</sup> and in some cases, death.<sup>36,38,42</sup>

### *Passive exposure*

A recent systematic review of 16 studies concluded that e-cigarette vapour has the potential to pose a health risk to bystanders, although the risk is likely to be lower than that posed by conventional cigarette smoke.<sup>43</sup> However, exposure to certain metals such as nickel and silver may be greater for e-cigarettes than tobacco cigarettes.<sup>43</sup> A 2016 study found that the most common symptoms reported by those passively exposed to e-cigarettes included respiratory difficulties, eye irritation, headache, nausea and sore throat or throat irritation.<sup>44</sup>

## Smoking cessation

Experts disagree about whether e-cigarettes may help smokers to quit, or whether they will become 'dual users' of both e-cigarettes and tobacco cigarettes. There is currently insufficient evidence to demonstrate that e-cigarettes are effective in assisting people to quit smoking<sup>1</sup> and no brand of e-cigarette has been approved by the Therapeutic Goods Administration (TGA) for this purpose. Although a 2016 systematic review conducted by the Cochrane Collaboration<sup>33</sup> found some evidence that e-cigarettes with nicotine may assist smokers to quit, the review authors had a low level of confidence in this finding, due to the small volume of evidence. The review also reported results from one study comparing e-cigarettes with nicotine replacement therapy, which found that both methods resulted in similar rates of smoking cessation at 6 months follow-up. However, the reviewers noted that more research is required to enable confidence in these estimates and that further research is likely to change the estimate of effect.<sup>33</sup>

Smokers wishing to quit are advised to consult their general practitioner. First-line treatments include a range of TGA-approved nicotine replacement therapies and prescription medications that have been tested for safety and efficacy. Support and information are also available from the Quitline (13 78 48) or via the Quit Now website ([www.quitnow.gov.au](http://www.quitnow.gov.au)).

## E-cigarettes and tobacco control policies

Concerns have been raised that the potential benefits of e-cigarettes in reducing harm to smokers may be outweighed by the risks that they may undermine tobacco control efforts. This includes the potential for e-cigarettes to provide a gateway to nicotine addiction or tobacco product use, or that they may renormalise smoking. The appeal of flavoured e-cigarettes to children and adolescents is also of concern, with studies reporting rapid uptake of e-cigarettes among adolescents in many countries, where trend data are available.<sup>45, 46, 47, 48, 49</sup> This provides some cause for concern given uncertainties about the long-term safety of e-cigarettes.

There is some evidence that e-cigarettes could act as a gateway into nicotine addiction or tobacco cigarette smoking. A number of longitudinal studies have reported an association between e-cigarette use in non-smokers and the uptake of tobacco cigarette smoking in the future.<sup>50, 51, 52, 53</sup> This association remained even when the studies controlled for other risk factors that might make people more likely to take up smoking. In some studies, the effect of e-cigarettes on future smoking behaviour was greatest among those who were otherwise at low risk of taking up smoking.<sup>51, 54</sup> A number of studies have also reported an association between e-cigarette use in non-users and future use of marijuana<sup>52</sup> or tobacco products such as hookahs, cigars or pipes.<sup>51, 55, 56</sup>

In view of the above concerns, the World Health Organisation has recommended that policy-makers act to prevent the initiation of e-cigarette use by non-smokers and youth, with special attention given to protecting vulnerable groups.<sup>1</sup>

## Manufacturing quality

The manufacturing quality of e-cigarettes is highly variable, with a number of issues relating to quality control reported in the literature. Labelling of e-cigarettes and e-liquids has been found to be incomplete or inaccurate.<sup>57, 58</sup> Products have been found to contain chemicals that were not listed on the label,<sup>57, 58, 59</sup> or to state incorrectly that they did not contain potentially toxic chemicals, despite analyses confirming their presence.<sup>60, 61</sup>

There may also be wide variation between the levels of nicotine declared on packaging and the amount contained in e-liquid.<sup>9, 58, 62, 63, 64, 65</sup> One study that compared identical models of e-cigarettes found that nicotine content varied by up to 20% when the products came from different manufacturing batches, with variation of up to 12% reported for products manufactured in the same batch.<sup>66</sup> Furthermore, some products that are labelled as nicotine free have been found to contain nicotine.<sup>11, 15, 57, 59, 62, 65, 67, 68</sup>

## Where can I get more information?

When seeking information about e-cigarettes online, it is important to look at websites that provide a reliable source of information, such as government websites or [quit smoking services](#). Information on websites sponsored by retailers or manufacturers may reflect a commercial interest in promoting the sale of certain products.

Similarly, when reading published research on e-cigarettes it is important to consider whether the authors of the research held any conflicts of interest that could potentially bias their findings, or whether the research was funded by an organisation with a financial interest in the outcomes, such as e-cigarette manufacturers.<sup>69</sup>

The following websites may provide further information of use to consumers:

### ***Evidence-based reports***

World Health Organisation – *Electronic Nicotine Delivery Systems and Electronic Non-Nicotine Delivery Systems (ENDS/ENNDS)*

[http://www.who.int/fctc/cop/cop7/FCTC\\_COP\\_7\\_11\\_EN.pdf](http://www.who.int/fctc/cop/cop7/FCTC_COP_7_11_EN.pdf)

### ***Information, fact sheets and FAQs from government departments***

ACT Health – *Electronic Cigarettes*

<http://www.health.act.gov.au/public-information/public-health/tobacco-and-smoke-free/electronic-cigarettes>

New South Wales Department of Health – *Electronic Cigarettes*

<http://www.health.nsw.gov.au/tobacco/Pages/electronic-cigarettes.aspx>

Product Safety Australia – *Electronic Cigarette Safety*

<http://www.productsafety.gov.au/news/electronic-cigarette-safety>

Therapeutic Goods Administration – *Electronic Cigarettes*

<https://www.tga.gov.au/community-qa/electronic-cigarettes>

Western Australia Department of Health – *Electronic cigarettes (e-cigarettes)*

[http://healthywa.wa.gov.au/Articles/A\\_E/Electronic-cigarettes-e-cigarettes](http://healthywa.wa.gov.au/Articles/A_E/Electronic-cigarettes-e-cigarettes)

State and Territory Health Departments – *Contact Details*

<http://www.health.gov.au/internet/main/publishing.nsf/Content/health-related.htm#state>

### ***Position statements***

Australian Medical Association – *Tobacco Smoking and E-cigarettes (2015) – The AMA Position*

<https://ama.com.au/position-statement/tobacco-smoking-and-e-cigarettes-2015>

Cancer Council Australia and The Heart Foundation – *Joint Position Statement on Electronic Cigarettes*

[http://wiki.cancer.org.au/policy/Position\\_statement\\_-\\_Electronic\\_cigarettes](http://wiki.cancer.org.au/policy/Position_statement_-_Electronic_cigarettes)

Public Health Association of Australia – *Statement by the Public Health Associations of Australia on Electronic Cigarettes*

<https://www.phaa.net.au/documents/item/704>

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