e-Cigarettes - the discussion so far

An electronic cigarette (e-cigarette) is a battery-operated device that emits doses of vaporised nicotine, or non-nicotine solutions, for the user to inhale. Also known as e-cigs, electronic nicotine delivery systems, vaporiser cigarettes, and vape pens, personal vaporisers are often marketed as a way to stop or cut down on smoking.

Many health professionals are very cautious about the benefits of e-cigarettes in smoking cessation. According to the Australian Medical Association (AMA):

> *The evidence on e-cigarettes, and their role in cessation and the risk they pose to young people, is not conclusive. For this reason, the Australian Medical Association (AMA) supports a precautionary approach. We recognise that, where there is potential to do harm, caution must be exercised.*
>
> *This view is shared by a range of health and medical organisations: Cancer Council Australia, Cancer Australia, the Heart Foundation and the Thoracic Society of Australia and New Zealand, to name a few.* [1]

However, in its *Report on the Inquiry into the Use and Marketing of Electronic Cigarettes and Personal Vaporisers in Australia*, the House of Representatives Standing Committee on Health concludes that:

> *Considering the potential to reduce the devastating burden of tobacco related disease in people with SMI [severe mental illness], we believe there is strong justification for amending the laws of Australia and New Zealand to allow improved access to low concentrations of nicotine for use in e-cigarettes.*
>
> *While nicotine-free e-cigarettes and refill liquids are readily accessible, nicotine liquid is not available for purchase except illegally through an unregulated black market The current laws which restrict access to much less harmful options such as nicotine-containing e-cigarettes, while the most harmful nicotine product (tobacco cigarettes) remains widely accessible, are unscientific and raise serious ethical concerns.*
>
> *We have therefore formed the conclusion that nicotine e-cigarettes should be available as a consumer good to Australians, subject to regulations which will limit their appeal to non-smokers and young people.* [2]

Despite this conclusion, there is new and compelling evidence for caution. A new study from the University of Tasmania[3] has found that heated tobacco devices and e-cigarettes harm the lung cells which protect the airways, just as cigarette smoke does. They can damage lung cells and destroy lung tissue leading to fatal diseases such as chronic obstructive pulmonary disease, lung cancer and pneumonia, and can increase the risk of developing asthma, including in unborn children. The study found that cigarette smoke and the vapour from 'heat-not-burn' tobacco devices (such as the IQOS) were highly toxic to the cells at both lower and higher concentrations, while e-cigarette vapour was toxic mainly at higher levels.

A notable heat-not-burn tobacco device is the 'IQOS', from multinational tobacco company Philip Morris, the latest version ('IQOS 3') having released in multiple countries in late 2018[4]. The device is a hybrid between eCigs and traditional cigarettes. It uses disposable tobacco 'sticks' which are heated to give off an aerosol, but do not burn. Specifically, these tobacco sticks ('HeatSticks'), according to Philip Morris, contain processed tobacco along with a phew other components, including water,

1 'AMA responds to e-cigarettes debate - MJA InSight 3, 29 January 2018 | doctorportal' n.d., viewed 26 November 2018, <https://www.doctorportal.com.au/mjainsight/2018/3/ama-responds-to-e-cigarettes-debate/>.

2 House of Representatives Standing Committee on Health, Aged Care and Sport 2018, Report on the Inquiry into the Use and Marketing of Electronic Cigarettes and Personal Vaporisers in Australia, Canberra, <http://parlinfo.aph.gov.au/parlInfo/download/committees/reportrep/024115/toc_pdf/ReportontheInquiryintotheUseandMarketingofElectronicCigarettesandPersonalVaporisersinAustralia.pdf;fileType=application%2Fpdf>.

3 Sohal, SS et al. 2019, 'IQOS exposure impairs human airway cell homeostasis: direct comparison with traditional cigarette and e-cigarette', ERJ Open Research, vol. 5, no. 1, pp. 00159–02018, viewed 12 February 2019, <https://openres.ersjournals.com/content/5/1/00159-2018>.

4 IQOS 3 and IQOS 3 Multi Global Launch n.d., viewed 12 February 2019, <https://www.pmi.com/media-center/news/iqos-3-and-iqos-3-multi-global-launch>.

glycerin and cellulose fibers. To date, most of the studies on IQOS have been conducted by Philip Morris, and much more research is needed by independent researchers, who are not associated with the company, to determine the safety of the product.

Recently, Arūnas Vinčiūnas, Head of Cabinet to the EU Health Commissioner, made the point:

> *There are scientific reports saying that e-cigarettes are less harmful than cigarettes, but it's still tobacco.*
>
> *You can drink less poison, but it is still poison in the end.*[5]

e-Cigarettes and young people

While e-cigarettes may help existing smokers to give up smoking, there is concern that young people are starting to 'vape' for its own sake, and not to replace tobacco use.

In December 2016, the U.S. Surgeon General issued a report[6] that made a number of conclusions and findings about the use of e-cigarettes among youth. These included that the flavours in e-cigarettes are one of the main reasons young people use them, that e-cigarette aerosol is not safe – mainly because it is not regulated - and that e-cigarette use is strongly associated with the use of other tobacco products among youth and young adults.

A *Medical Journal of Australia* article[7] also raised concerns that e-cigarettes may act as a gateway to tobacco smoking. The authors argued that any move to regulate e-cigarettes in Australia must take this risk into account.

Other research links the use of e-cigarettes in young people to tobacco use, with a Scottish study of 2017 [8] concluding that young never smokers are more likely to experiment with cigarettes if they have tried an e-cigarette. Causality cannot be inferred but continued close monitoring of e-cigarette use in young people is warranted.

Regulation of the e-cigarette industry

Given the rapid growth of the e-cigarette industry, the increase in the unregulated manufacturing of e-liquids in China and their questionable impact on health, there has been mounting pressure to regulate them in line with traditional tobacco products. Furthermore, according to Brown and Cheng:

> *Although e-cigaretes share a basic design, engineering variations and user modifications result in differences in nicotine delivery and potential product risks. e-Cigarette aerosols may include harmful and potentially harmful constituents. Battery explosions and the risks of exposure to the e-liquid (especially for children) are also concerns. Additional research will enhance the current understanding of basic e-cigarette design and operation, aerosol production and processing, and functionality. A standardised e-cigarette testing regime should be developed to allow product comparisons.*[9]

Regulations need to balance the risks of e-cigarettes with their potential benefits – and achieve key aims of reducing smoking and continuing to avoid uptake of e-cigarettes by non-smokers. This requires keeping them under regular review and evaluating their impact.[10] Suggested regulations include:

- Restrictions on their sale to minors.
- A ban on vaping in public places.
- Testing and labelling requirements.
- Restrictions on advertisements and online selling.
- Regulation and standardisation of flavourings, which are not identified on labels, and can be a combination of volatile and potentially toxic chemicals.

Evaluation of e-cigarettes

e-Cigarettes haven't been thoroughly evaluated in scientific studies and there is currently not enough existing data on their safety, how the health effects compare to

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6 U.S. Department of Health and Human Services 2016, 'E-Cigarette Use Among Youth and Young Adults: A Report of the Surgeon General', , p. 298.

7 Wolfenden, L, Stockings, E, & Yoong, SL 2017, 'Regulating e-cigarettes in Australia: implications for tobacco use by young people', The Medical Journal of Australia, vol. 208, no. 1, p. 89, viewed 26 November 2018, <https://www.mja.com.au/journal/2018/208/1/regulating-e-cigarettes-australia-implications-tobacco-use-young-people>.

8 Best, C et al. 2018, 'Relationship between trying an electronic cigarette and subsequent cigarette experimentation in Scottish adolescents: a cohort study', Tobacco Control, vol. 27, no. 4, pp. 373–378, viewed 26 November 2018, <https://tobaccocontrol.bmj.com/content/27/4/373>.

9 Brown, CJ & Cheng, JM 2014, 'Electronic cigarettes: product characterisation and design considerations', Tobacco Control, vol. 23, no. suppl 2, pp. ii4–ii10, viewed 12 February 2019, <https://tobaccocontrol.bmj.com/content/23/suppl_2/ii4>.

10 McNeill, A et al. 2018, Evidence review of e-cigarettes and heated tobacco products 2018, Public Health England, London.

traditional cigarettes and if they are helpful for people trying to quit smoking. One problem in evaluating e-cigarettes is that they can vary greatly in their design, nicotine concentration (ranging from none to relatively high levels), flavourings, and other compounds emitted.

Currently, it is assumed that the levels of potentially toxic chemicals emitted are lower than those from tobacco cigarettes, but this is not clear as there is so much variability and the extent of risk reduction is presently unknown.

Another problem with evaluation of e-cigarettes is inconsistency in the quality of research. An article reviewing studies across a number of countries, including Australia, found that:

> *Only a small proportion of studies seeking to address the effect of e-cigarettes on smoking cessation or reduction meet a set of proposed quality standards. Those that do are consistent with randomized controlled trial evidence in suggesting that e-cigarettes can help with smoking cessation or reduction.*[11]

Generally, most research so far suggests that e-cigarettes are less harmful than cigarettes when people who regularly smoke switch to them as a complete replacement. Some tobacco researchers and organisations, including Public Health England and the Royal Australian and New Zealand College of Psychiatrists have advocated for the use of e-cigarettes to assist quitting.

The U.S. Centers for Disease Control and Prevention (CDC) conclude that e-cigarettes can benefit adult smokers who are not pregnant, as long as they completely replace any other nicotine or tobacco products. However, besides pregnant women, the CDC add that vaping is not suitable for young people or those who have never smoked before.[12]

Concerns remain regarding the robustness of evidence for the efficacy of e-cigarettes as a cessation aid, product safety, tobacco industry action in the area, and the potential for e-cigarette experimentation in youth to increase the risk of subsequent smoking and nicotine dependence[13]. Nevertheless, the reduced exposure to toxicants of well-regulated e-cigarettes used by established adult smokers as a complete substitution for cigarettes is likely to be less damaging to the smoker than conventional cigarettes or other combusted tobacco products.

According to CSIRO researchers, when e-cigarettes are used by smokers instead of conventional cigarettes there is evidence for improvement in individual health. However, use of e-cigarettes may also introduce independent health risks, and 'dual use' (using both e-cigarettes and conventional cigarettes) is popular.[14]

There is some evidence that e-cigarettes may damage a person's health. Existing evidence shows that e-cigarette aerosol is not merely water vapour as is often claimed in the marketing of these products. The US National Institute on Drug Abuse refers to a number of studies and concludes that:

> *e-Cigarette use exposes the lungs to a variety of chemicals, including those added to e-liquids, and other chemicals produced during the heating/vaporizing process. A study of some e-cigarette products found the vapor contains known carcinogens and toxic chemicals, as well as potentially toxic metal nanoparticles from the device itself. The study showed that the e-liquids of certain cig-a-like brands contain high levels of nickel and chromium, which may come from the nichrome heating coils of the vaporizing device. Cig-a-likes may also contain low levels of cadmium, a toxic metal also found in cigarette smoke that can cause breathing problems and disease. More research is needed on the health consequences of repeated exposure to these chemicals.*[15]

Another area for concern is the presence of the chemical diacetyl used in many electronic cigarette flavours. This chemical can lead to bronchiolitis obliterans or 'popcorn lung', and some companies which previously used it to flavour microwave popcorn have stopped

11 Villanti, AC et al. 2018, 'How do we determine the impact of e-cigarettes on cigarette smoking cessation or reduction? Review and recommendations for answering the research question with scientific rigor', Addiction (Abingdon, England), vol. 113, no. 3, pp. 391–404.

12 U.S. Department of Health and Human Services 2018, Smoking and Tobacco Use; Electronic Cigarettes, Centers for Disease Control and Prevention, viewed 26 November 2018, <https://www.cdc.gov/tobacco/basic_information/e-cigarettes/about-e-cigarettes.html>.

13 Wolfenden, L, Stockings, E, & Yoong, SL 2017, 'Regulating e-cigarettes in Australia: implications for tobacco use by young people', The Medical Journal of Australia, vol. 208, no. 1, p. 89, viewed 26 November 2018, <https://www.mja.com.au/journal/2018/208/1/regulating-e-cigarettes-australia-implications-tobacco-use-young-people>.

14 Byrne, S et al. 2018, E-cigarettes, smoking and health. A Literature Review Update., CSIRO, Australia.

15 National Institute on Drug Abuse n.d., Electronic Cigarettes (E-cigarettes), viewed 26 November 2018, <https://www.drugabuse.gov/publications/drugfacts/electronic-cigarettes-e-cigarettes>.

using it altogether. According to the American Lung Association, using electronic cigarettes or vaping, particularly the flavoured varieties, can cause this condition. [16]

e-Cigarettes have also been linked to overheating, fire and explosion (OH/F/EXP) events. An article published in 2017 notes that:

> *ENDS [electronic nicotine delivery systems] OH/F/EXP events are occurring internationally. The scope, causes and trajectory of events in the US remain incompletely defined... The identified events vary in the involved products, parts, people, device-user interactions, environments, surrounding circumstances, and outcomes, which have included life-threatening injury, permanent disfigurement and disability, and major property damage. These findings suggest a need for ongoing surveillance, along with strategies to prevent and mitigate events such as: failure mode analyses; attention to device design; good manufacturing practices; educating consumers, industry and public health professionals about risk, prevention and event reporting; and continued regulatory efforts. Data on ENDS OH/F/EXP may inform clinical counselling, informed consent in clinical research, consumer best practices, product labelling, organisational and public health system policies and regulation.*[17]

What we need to know about e-cigarettes

As e-cigarettes are a relatively new product, there is very limited evidence available for their long-term use. For policy makers this poses a potential dilemma as making regulatory changes to legalise nicotine e-cigarettes may come with significant risks. Conversely, not making e-cigarettes available deprives smokers of a potentially useful tool to help them quit.

There are a number of questions that have not been fully answered yet including:

- Do e-cigarettes help reduce the number of people smoking tobacco cigarettes?
- What are the health effects of the long-term use of e-cigarettes?
- Would the legal availability of e-cigarettes act as a gateway to nicotine use for non-smokers?
- Is the use of e-cigarettes really less harmful than the use of tobacco products?
- What are the longer-term success rates of people who use e-cigarettes for quitting compared with other stop smoking treatments?
- Does the uptake of e-cigarettes after quitting prevent relapse back to smoking?
- We need more data examining the number and quantities of some metals in e-cigarette aerosol – is it even greater than that in traditional cigarettes, and / or above accepted health-based limits?
- Although some manufacturers have claimed their flavourings are generally recognised as safe for food additives (i.e., to be used in preparing foods for eating), we need to know about the long-term health effects of inhaling these substances into the lungs (for example, the chemical causing 'popcorn lung' described above).
- We also need more information about the risk to others from second-hand exposure.

In summary, a recent literature review update published by the CSIRO concludes that, based on the current evidence it is not possible to determine whether e-cigarettes have a positive or a negative effect on health in countries where they are permitted.[18] Malas et al. make the point:

> *While inconclusive due to low quality, overall the existing literature suggests e-cigarettes may be helpful for some smokers for quitting or reducing smoking. However, more carefully designed and scientificaly sound studies are urgently needed to establish unequivocally the long-term cessation effects of e-cigarettes and to better understand of how and when e-cigarettes may be helpful.*[19]

e-Cigarettes, smoking cessation and mental illness

It is consistently reported in the United States, the United Kingdom, and Australia, that smoking is two to three times more prevalent among people with mental illness, when compared with the general population.

16 Huizen, J n.d., Popcorn lung: Causes, symptoms, and treatment, Medical News Today, viewed 26 November 2018, <https://www.medicalnewstoday.com/articles/318260.php>.

17 Rudy, SF & Durmowicz, EL 2017, 'Electronic nicotine delivery systems: overheating, fires and explosions', Tobacco Control, vol. 26, no. 1, pp. 10–18, viewed 12 February 2019, <https://tobaccocontrol.bmj.com/content/26/1/10>.

18 Byrne, S et al. 2018, E-cigarettes, smoking and health. A Literature Review Update., CSIRO, Australia.

19 Malas, M et al. 2016, 'Electronic Cigarettes for Smoking Cessation: A Systematic Review', Nicotine & Tobacco Research: Official Journal of the Society for Research on Nicotine and Tobacco, vol. 18, no. 10, pp. 1926–1936.

Smoking prevalence is particularly high (almost fivefold greater) among those with schizophrenia, bipolar disorder, post-traumatic stress disorder (PTSD), and alcohol/illicit drug use disorders. Smoking prevalence increases with a greater number of mental disorders, ranging from 18% for people with no mental illness to 61% for people diagnosed with 3 or more mental disorders.[20]

As far as people diagnosed with schizophrenia (the group with the highest smoking rates in this cohort) are concerned, an international team of scientists found that hypofrontality, decreased activity in the brain's prefrontal cortex leading to cognitive issues like troubles with memory and decision-making, may explain why so many in this group are heavy smokers.

The research showed that a genetic mutation, previously linked to a greater risk of schizophrenia, is also linked to the decreased function in the frontal lobe. They claim that nicotine reverses this problem because the addictive chemical acts on receptors in regions of the brain key to healthy cognitive function. Many commentators believe that these findings will ultimately lead to non-addictive, nicotine-based therapies for patients with schizophrenia.[21]

An article in the Australian & New Zealand Journal of Psychiatry states that patients who are not able or willing to quit smoking using conventional methods or who express interest in using e-cigarettes should be provided appropriate counselling and information about the risks and benefits of switching to e-cigarettes and supported in their efforts to do so. New approaches are urgently needed to address the persistently high smoking rates in this priority population. Tobacco harm reduction by switching to e-cigarettes has the potential to substantially reduce the health, financial and social equity gap experienced by this disadvantaged group.[22 23]

Although, according to many sources, the use of e-cigarettes is considered effective in helping people with severe mental illness to quit smoking, it is important to keep in mind that:

- Smoking interacts with both psychiatric and non-psychiatric medications commonly used by people with mental illness.
- Smoking can change the way the body absorbs/responds to medication, which can cause side effects if someone starts, quits, or changes their smoking habits and some people may need dose adjustment when quitting or reducing smoking or when resuming smoking following abstinence.

20 Prochaska, JJ, Das, S, & Young-Wolff, KC 2017, 'Smoking, Mental Illness, and Public Health', Annual Review of Public Health, vol. 38, no. 1, pp. 165–185, viewed 26 November 2018, <https://doi.org/10.1146/annurev-publhealth-031816-044618>.

21 Glowatz, E 2017, Schizophrenia Research 2017: Nicotine May Normalize Brain Activity, Explaining Why Schizophrenics Are Often Heavy Smokers, Medical Daily, viewed 26 November 2018, <https://www.medicaldaily.com/schizophrenia-research-2017-nicotine-may-normalize-brain-activity-explaining-409210>.

22 Sharma, R et al. 2017, 'Should we encourage smokers with severe mental illness to switch to electronic cigarettes?', Australian & New Zealand Journal of Psychiatry, vol. 51, no. 7, pp. 663–664, viewed 26 November 2018, <https://doi.org/10.1177/0004867417697823>.

23 Wurthman, JJ 2017, Can E-Cigarettes Reduce Smoking Among the Mentally Ill?, Psychology Today, viewed 26 November 2018, <https://www.psychologytoday.com/blog/the-antidepressant-diet/201706/can-e-cigarettes-reduce-smoking-among-the-mentally-ill>.

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