

Vaping – Effectiveness as a cessation tool: evidence briefing

Introduction

This briefing presents our understanding of the effectiveness of vaping products as a smoking cessation tool compared to other interventions, such as nicotine replacement therapy (NRT) or counselling.

Background

Over the past few years, vaping products have grown in popularity as a cessation tool among those trying to quit or reduce tobacco smoking. While there is agreement in the existing literature that vaping is less harmful than smoking (when smokers completely switch to e-cigarettes), research on its effectiveness in quitting attempts is still a developing field.

Methodology

This evidence briefing is based on a search and analysis of scholarly research on the effectiveness of vaping products as a cessation tool carried out between December 2022 and November 2023.

The search was conducted on a number of search engines: KandE (a Scottish Government resource covering several databases), Google Scholar, PubMed and ScienceDirect. It included the following terms: “ENDS”, “e-cigarettes”, “vapes”, “vaping”, “harm reduction”, “smoking cessation tool”, “smoking cessation aid”, “dual use”, “pregnant women”.

Twenty-four papers/reports were selected and reviewed (opinion pieces and editorials were excluded). Of these, eight were systematic reviews and/or meta-analyses, hence have been prioritised and represent the core sources used to write this briefing. No critical appraisal of the evidence they examined was undertaken.

In this briefing we make reference to “vaping products” to describe both nicotine and non-nicotine devices used to inhale an aerosol. The sources analysed here adopt different terms and definitions. For accuracy and in order to preserve the original meaning, the terminology chosen by the authors of each review has been retained when summarising their findings.

Key findings

Although existing evidence is still limited, the systematic reviews and meta-analyses examined for this briefing suggest that vaping products can serve as an effective tool for smoking cessation. The sources highlighted that:

- There are limitations in the existing primary studies including: small sample sizes; lack of robust longitudinal studies; risk of bias; small number of randomised controlled trials (RCTs), often with low event rates¹; short follow ups; limited range of treatment comparisons; failure to measure motivation to quit; and use of outdated vaping products.
- There is a need for more long-term, large-scale studies, which account for the effect of newer types of vaping products, assess the effectiveness of vaping products in relation to all existing options, look at use patterns and investigate the risk of relapse.

Policy implications

While evidence on the effectiveness of vaping as a smoking cessation tool is limited, the Scottish Government has adopted a proportionate approach aimed at balancing the benefits of reducing health harms among smokers with the risks involved in promoting the use of vaping products (e.g. uptake in non-smokers and dual use of vaping and conventional tobacco products).

It should be noted that this is a developing area of research and that it may take some years until we can rely on robust evidence on the role played by vaping in quitting attempts. The Scottish Government will continue to consider any new evidence encountered on the matter.

¹ Event rate is a measure of how often a particular statistical event (e.g. quitting smoking) occurs within the treatment group in an experiment (e.g. those assigned to a vaping products arm).

Annex – Analysis of the existing evidence

Evidence on vaping as a potentially successful strategy to quit smoking is still limited and research gaps remain. However, the number of primary studies exploring the effectiveness of vaping products as a cessation tool has been growing over the past few years. The systematic reviews and meta-analyses examined in this briefing are presented below in a time sequence from the most recent to the oldest to reflect this:

- An [Australian umbrella and systematic review](#) on electronic cigarettes and health outcomes, published in 2023, concluded that e-cigarettes may be beneficial for smokers who use them to completely and promptly quit smoking. In particular, the review highlighted that:
 - There is **limited** evidence that the use of freebase nicotine e-cigarettes² with clinical support is more efficacious for assisting smoking cessation than NRT, or than no intervention or usual care.
 - There is **insufficient** evidence on the efficacy of nicotine e-cigarettes for smoking cessation, compared with non-nicotine e-cigarettes.
 - There is **insufficient** evidence on the efficacy of non-nicotine e-cigarettes for smoking cessation, compared with counselling or NRT.
 - There is **insufficient** evidence on the efficacy of non-clinical use of freebase nicotine e-cigarettes for assisting smoking cessation.
 - There is **no** available evidence on the efficacy of nicotine salt products³ for assisting smoking cessation.
 - There is **limited** evidence that the use of nicotine e-cigarettes for assisting smoking cessation results in greater exposure to nicotine (smoking, exclusive e-cigarette use or dual smoking/e-cigarette use) than NRT.

The authors stressed that the risks associated with e-cigarettes, uncertainty about their effects on major clinical outcomes and continued smoking by most users (dual use), render their overall safety and efficacy as a smoking cessation aid unclear.

² One of the two types of vaping products on the market. These have a nicotine formulation that is highly volatile and, when vaporised, enters the bloodstream through the mouth/upper respiratory tract. Freebase nicotine products have higher nicotine concentrations and they are usually perceived by users as harsh and/or bitter.

³ One of the two types of vaping products on the market. These have a formulation resulting from the addition of organic acids to freebase nicotine which then produces protonated nicotine salt. When vaporised, this type of solution travels further down the respiratory tract and is absorbed into the bloodstream by the alveoli (similar to what happens with conventional cigarettes). The addition of organic acids increases nicotine's smoothness and reduces its bitterness.

- The [Cochrane living review](#) on electronic cigarettes for smoking cessation (lastly updated in 2022) examined the effectiveness, tolerability and safety of nicotine e-cigarettes to help people who smoke tobacco achieve long-term smoking abstinence⁴. The review concluded that:
 - There is **high-certainty** evidence that nicotine e-cigarettes are more efficacious than NRT for smoking cessation (the authors are confident that the true effect lies close to the estimate of the effect).
 - There is **moderate-certainty** evidence that nicotine e-cigarettes are more efficacious than non-nicotine e-cigarettes (the authors think the true effect is likely to be close to the estimate of effect).
 - There is **very low-certainty** evidence that nicotine e-cigarettes are more efficacious than usual care/no treatment (the authors have little confidence in the effect estimate).

The main limitations of the evidence pertained to imprecision due to the small number of randomised controlled trials (RCTs), often with low event rates.

The review highlighted the need for more RCTs following participants at six months or longer to reduce the risk of bias and data imprecision. It also stressed how more evidence is needed around the effect of newer types of e-cigarettes which have better nicotine delivery, different flavours and varying nicotine strengths compared to older devices.

- The Public Health England [Vaping in England evidence review](#), published in 2021, concluded that there is **stronger** evidence compared to their 2018 review that nicotine vaping products are effective for smoking cessation and reduction. The review summarised key findings from:
 - Nationally representative surveys, showing that vaping products were the most popular smoking cessation aid compared to NRT and varenicline, despite all three being positively associated with successfully quitting smoking.
 - English stop smoking services data, showing that: the highest quit rates were seen when the quit attempt involved people using a licensed medicine and a vaping product one after another; quit rates were similar for people using a vaping product and licensed medication at the same time, a vaping product alone and varenicline alone; and quit rates involving a vaping product were higher than any other method in every region in England.
 - Systematic reviews and meta-analyses, three of which were deemed of moderate to high quality and consistently found that vaping products

⁴ It has to be noted that inclusion criteria for this review are wider compared to the others as industry-funded research has also been included.

containing nicotine were significantly more effective in helping people quit smoking compared to NRT. Findings of meta-analyses of RCTs confirmed this when studies with a high risk of bias were excluded.

Limitations in the reviewed evidence pertained to: high risk of bias; the use of outdated vaping products (e.g. with low nicotine strength, with no nicotine salts and mostly tobacco-flavoured) in many of the RCTs; and the fact that RCTs don't necessarily reflect real world circumstances due to strict inclusion/exclusion criteria and adherence to particular intervention measures (e.g. type, dose, duration, frequency).

The review highlighted the need for further research to: assess whether smokers who use stop smoking services and vaping products differ from smokers who use the services and other cessation aids; explore the barriers and enablers to using vaping products as part of a supported quit attempt in stop smoking services; and gather data on newer types of vaping products with better nicotine delivery.

- The [US Preventive Services Task Force systematic review](#), published in 2021, addressed the effectiveness and safety of electronic cigarettes, pharmacotherapy and behavioural interventions for tobacco cessation in adults. The review concluded that:
 - Data on the effectiveness and safety of electronic cigarettes for smoking cessation among adults are **limited**.

The review highlighted a need for further research that: compares an e-cigarette intervention with no intervention and with the most effective known combination of pharmacotherapy and behavioural support; tests the more recent generations of products; explores use patterns; and investigates the risk of relapse attributable to e-cigarettes.

- The [Scientific Committee on Health, Environmental and Emerging Risks \(SCHEER\) review](#) for the European Commission, published in 2021, synthesised systematic reviews/meta-analyses alongside newly published RCTs, on the use of e-cigarettes for cessation of traditional tobacco smoking. The review concluded that:
 - There is **weak** evidence to support the effectiveness of electronic cigarettes in helping smokers to quit.
 - The evidence on smoking reduction is **weak to moderate**.

SCHEER highlighted a lack of robust longitudinal data and noted that existent evidence mostly referred to quitting at six months and did not account for relapse or dual use after the initial six-month period.

The Committee stressed the need for further research to assess the impact of newer vaping products on population based smoking cessation, by means

of large population-based cohort data, with sufficient follow-up time to assess potential relapse.

Due to the above limitations, SCHEER recommended that e-cigarettes should only be considered to support smoking cessation for a limited period and under supervision.

- An [Irish systematic review and meta-analysis](#), conducted by the Health Research Board and published in 2020, investigated the safety and efficacy of e-cigarettes in quitting attempts compared to any treatment or combination of treatments usually given for smoking cessation. The authors concluded that:
 - There is **no** evidence of a difference in effect on incidences of smoking cessation at 24 or 26 weeks between the ENDS (electronic nicotine delivery systems) and the NRT groups.
 - There is a **low-level** of certainty in these results due to high risk of bias, low successful event rates and high rates lost to follow-up in all studies.

Further limitations identified by the authors were: limited number of longer-term studies beyond 26 weeks; small sample sizes; mixed results due to the comparison of e-cigarettes to different controls in different studies and to non-standardised interventions (i.e. adoption of a variety of first- and second-generation e-cigarettes with varying nicotine doses).

- The [Smoking Cessation report of the US Surgeon General](#), published in 2020, reviewed a number of interventions and treatments for nicotine dependence and concluded that:
 - The evidence is **inadequate** to infer that e-cigarettes increase smoking cessation.
 - The evidence is suggestive but **not sufficient** to infer that the use of e-cigarettes containing nicotine is associated with increased smoking cessation compared with the use of e-cigarettes not containing nicotine.
 - The evidence is suggestive but **not sufficient** to infer that more frequent use of e-cigarettes is associated with increased smoking cessation compared with less frequent use of e-cigarettes.

Reported limitations of the evidence related to: small numbers of trials; low event rates; wide confidence intervals; the diverse and rapidly evolving e-cigarette products; the contexts in which they were used (e.g. if they were used together with behavioural support); lack of comparison to standard evidence-based therapy; lack of control for confounding based on motivation to quit smoking.

The authors hence suggested that well-controlled clinical trials and rigorous, large-scale observational studies with long-term follow-ups are needed to better understand the impact of different types of e-cigarettes under various

conditions, including real-world use of e-cigarettes in different regulatory contexts.

- The [Public Health Consequences of E-cigarettes](#) report, published by the National Academies of Sciences, Engineering and Medicine (NASEM) in 2018, addressed some research questions about the efficacy of e-cigarettes for smoking cessation. The report concluded that:
 - There is **limited** evidence that e-cigarettes may be effective aids to promote smoking cessation.
 - There is **moderate** evidence from RCTs that e-cigarettes with nicotine are more effective than e-cigarettes without nicotine for smoke cessation.
 - There is **insufficient** evidence from RCTs about the effectiveness of e-cigarettes as cessation aids compared with no treatment or Food and Drug Administration-approved smoking cessation treatments.
 - While evidence from observational trials is mixed, there is **moderate** evidence from observational studies that more frequent use of e-cigarettes is associated with an increased likelihood of cessation.

Limitations of the evidence pertained to: limited number of studies; limited range of treatment comparisons in RCTs; different study designs which complicated comparison; small sample sizes; risk of bias; failure to measure motivation to quit; and failure in some observational studies to account for covariates which may affect the effectiveness of e-cigarettes for smoking cessation (e.g. e-cigarette product characteristics, pattern of current use and user characteristics).



© Crown copyright 2024

You may re-use this information (excluding logos and images) free of charge in any format or medium, under the terms of the Open Government Licence.

To view this licence, visit <http://www.nationalarchives.gov.uk/doc/open-government-licence/> or e-mail: psi@nationalarchives.gsi.gov.uk.

Where we have identified any third party copyright information you will need to obtain permission from the copyright holders concerned.

The views expressed in this report are those of the researcher and do not necessarily represent those of the Scottish Government or Scottish Ministers.

This report is available on the Scottish Government Publications Website (<http://www.gov.scot/Publications/Recent>)

The Scottish Government
St Andrew's House
Edinburgh
EH1 3DG

ISBN: 978-1-83521-902-7

Published by the Scottish Government, January 2024