Can electronic cigarettes (EC) help people stop smoking, and are they safe to use for this purpose?

Findings from the most recent Cochrane review, January 2024

This briefing document brings you the most up-to-date information on the effect and safety of using electronic cigarettes (EC) to help people who smoke achieve long-term smoking abstinence.

Key findings

- Findings across the main comparisons consistently favoured EC for smoking cessation at 6 months or longer. There is now high certainty evidence that people are more likely to stop smoking for at least six months using nicotine e-cigarettes than using nicotine replacement therapies, such as patches and gums. More people probably stopped smoking for at least six months using nicotine e-cigarettes than using nicotine-free e-cigarettes. Nicotine e-cigarettes may work better than no support for quitting smoking, or than behavioural support alone.
- For the most part confidence intervals were wide for data on adverse events and other safety markers. We did not detect any clear evidence of harm from EC; however, longest follow-up was two years and the overall number of studies was small.
- The unwanted effects reported most often with nicotine e-cigarettes were throat or mouth irritation, headache, cough, and feeling sick. These effects reduced over time as people continued using nicotine e-cigarettes.
- Five studies looked at how many people were still using EC versus NRT at six months or longer. Two found no clear evidence of a difference the other three found more people were still using EC than were using NRT. There was no evidence of a difference in three studies comparing nicotine EC to non-nicotine ECs at longest follow up.

This Cochrane systematic review and meta-analysis included 88 studies, representing 27,235 participants. In order to keep the information as up-to-date as possible we are searching monthly for new evidence, a living systematic review. Since becoming a living review at the end of 2020 38 new studies have been added to the review (6 in the April 2021 update, 5 in the Sept 2021 update, 17 in the November 2022 update, & 10 in the December 2023 update). The January 2024 update includes search findings up to 1st July 2023.

DECEMBER 2024 SEARCH UPDATE... Searches are run & screened monthly. Our December 2024 search identified 2 new studies & 4 linked papers. Between August 2023 & November 2024 searches identified 12 new studies, 21 new ongoing studies & 32 papers linked to studies already included in the review or picked up since August 2023. 2 records are awaiting classification. The findings from these searches will be incorporated into a future update.

Implications for policy and practice

Our review presents high certainty evidence on the effectiveness of nicotine EC compared to NRT – a frontline smoking cessation treatment, moderate certainty evidence of nicotine EC compared to non-nicotine EC, and presents low certainty evidence comparing EC to no treatment. All signal a clinically important benefit of nicotine EC, filling an important gap with implications for policymakers, clinicians, and people who smoke.

Unanswered questions and future research

More randomized controlled trials are needed with long-term follow up, testing recent EC devices. As data on EC continue to emerge, we will continue to update our analyses to ensure decision-makers have the best available evidence to hand when considering the role of EC in supporting smoking cessation.

For all references and the most up to date 2024 Cochrane Review follow this link.

For further information please visit our webpage.

About Cochrane reviews

Cochrane reviews bring together the best available evidence from research and systematically review this information to determine the benefits and risks of treatments. Cochrane Reviews are internationally recognized as the highest standard in evidence-based health care.

The process

Databases were searched for randomized trials and uncontrolled intervention studies testing EC for smoking cessation. The main outcomes were smoking cessation at 6 months or more and adverse or serious adverse events at one week or longer. Only randomized trials were included in meta-analyses. Our current review contains evidence up to 1st July 2023. Summary of findings tables were made for main comparisons and outcomes. Forty-seven studies were RCTs, 26 of which contributed to cessation analyses. Eight studies used randomized cross-over designs, and the remainder were uncontrolled cohort studies.

New secondary outcome: continued use of EC or other stop smoking aid

We now include data on the proportion of participants still using study product (EC or pharmacotherapy) at six months or longer. We introduced this new outcome after feedback from readers and key stakeholders. There is no clear evidence of a between-group difference for this outcome.

Funding

Of the 80 studies that reported funding information: 66 had no tobacco or EC industry funding or support; and 14 studies reported tobacco or EC industry funding or support. Where these studies contributed to meta-analyses, we tested whether results were sensitive to their inclusion, and took account of this in our results and conclusions.

Summary of findings tables

Summary of findings tables were made for main comparisons and outcomes, see following pages.

1. Nicotine EC compared to NRT for smoking cessation.

2. Nicotine EC compared to non-nicotine.

3. Nicotine EC compared to behavioural support for smoking cessation

GRADE ratings were used to evaluate certainty in the evidence, and can be interpreted as follows.

Grade Working Group grades of evidence

High certainty: We are very confident that the true effect lies close to that of the estimate of the effect
Moderate certainty: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low certainty: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
Very low certainty: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

GRADE (Grading of Recommendations, Assessment, Development and Evaluations)

See our full review **Visit our webpage** **Listen to our podcast**

1. Summary of Findings: Nicotine EC compared to NRT for smoking cessation

Nicotine EC compared to NRT for smoking cessation					
Patient or population: People who smoke Setting: New Zealand, UK, USA Intervention: Nicotine EC Comparison: NRT					
Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)
	Risk with NRT	Risk with Nicotine EC			
Smoking cessation at 6 months to 1 year Assessed with biochemical validation	Study population		RR 1.59	2544	⨁⨁⨁⨁
	6 per 100	10 per 100 (8 to 12)	(1.29 to 1.93)	(7 RCTs)	HIGH
Adverse events at 4 weeks to 6 months Assessed by self-report	Study population		RR 1.03	2052	⨁⨁⨁⨀
	23 per 100	24 per 100 (21 to 27)	(0.91 to 1.17)	(5 RCTs)	MODERATE[a]
Serious adverse events at 4 weeks to 1 year Assessed via self-report and medical records	Study population		RR 1.20	2411	⨁⨁⨀⨀
	4 per 100	5 per 100 (4 to 6)	(0.90 to 1.60)	(6 RCTs)	LOW[b]

Comment: For serious adverse events 2 studies reported no events and the effect estimate was based on the 4 studies in which events were reported.

*__The estimated number of events in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI). For cessation, the assumed risk in the control group is based on assumed quit rates for NRT assuming receipt of limited behavioural stop-smoking support (as per Hartmann-Boyce 2018a). The assumed risk for adverse events and serious adverse events is a weighted mean average of quit rates across control groups in contributing studies.

CI: Confidence interval; **RCT:** randomised controlled trial; **RR:** Risk ratio

a) Downgraded one level due to imprecision; CIs consistent with benefit and harm
b) Downgraded two levels due to imprecision; fewer than 300 events and confidence intervals encompass clinically important harm and clinically important benefit.

2. Summary of Findings: Nicotine EC compared to non-nicotine EC for smoking cessation

Nicotine EC compared to non-nicotine EC for smoking cessation

Patient or population: People who smoke cigarettes
Setting: Canada, Italy, New Zealand, UK, USA
Intervention: Nicotine EC
Comparison: Non-nicotine EC

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)
	Risk with non-nicotine EC	Risk with Nicotine EC			
Smoking cessation at 6-12 months Assessed with biochemical validation	Study population		RR 1.46 (1.09 to 1.96)	1613 (6 RCTs)	⨁⨁⨁⨀ MODERATE[a,b]
	7 per 100	10 per 100 (8 to 14)			
Adverse events at 1 week to 6 months Assessed via self-report	Study population		RR 1.01 (0.91 to 1.11)	840 (5 RCTs)	⨁⨁⨁⨀ MODERATE[b]
	9 per 100	9 per 100 (8 to 10)			
Serious adverse events at 1 week to 1 year Assessed via self-report and medical records	Study population		RR 1.00 (0.56 to 1.79)	1412 (9 RCTs)	⨁⨁⨀⨀ LOW[c]
	3 per 100	3 per 100 (2 to 6)			

Comment: For serious adverse events the effect estimate was based on the 4 studies in which events were reported.

***The estimated number of events in the intervention group** (and its 95% confidence interval) is based on the assumed number of events in the comparison group and the **relative effect** of the intervention (and its 95% CI). For cessation, the assumed number of events in the control group is based on assumed quit rates for NRT assuming receipt of limited behavioural stop-smoking support (as per Hartmann-Boyce 2018a). The assumed risk for adverse events and serious adverse events is a weighted mean average of quit rates across control groups in contributing studies.
CI: Confidence interval; **RCT:** randomised controlled trial; **RR:** Risk ratio

a) Not downgraded for risk of bias. One of four studies considered high risk of bias; removing this study increased the direction of the effect in favour of the intervention.
b) Downgraded one level due to imprecision; < 300 events overall.
c) Downgraded two levels due to imprecision: confidence intervals encompass clinically significant harm as well as clinically significant benefit.

3. Summary of Findings: Nicotine EC compared to behavioural support for smoking cessation

Nicotine EC compared to behavioural support only/no support for smoking cessation

- Patient or population: People who smoke
  Setting: Canada, Italy, UK, USA
  Intervention: Nicotine EC
  Comparison: Behavioural support only/no support

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)
	Risk with behavioural support only/no support	Risk with Nicotine EC			
Smoking cessation at 6 to 12 months Assessed using biochemical validation	Study population		RR 1.88 (1.56 to 2.25)	5024 (9 RCTs)	⨁⨁⨀⨀ LOW[a,]
	4 per 100	8 per 100 (6 to 9)			
Adverse events at 12 weeks to 6 months Assessed via self-report	Study population		RR 1.22 (1.12 to 1.32)	765 (4 RCTs)	⨁⨁⨀⨀ LOW[a,]
	66 per 100	80 per 100 (74 to 87)			
Serious adverse events at 4 weeks to 6 months Assessed via self-report and medical records	Study population		RR 0.89 (0.59 to 1.34)	3263 (10 RCTs)	⨁⨀⨀⨀ VERY LOW[a, b]
	3 per 100	2 per 100 (1 to 4)			

Comment: For serious adverse events 5 of the 9 studies reported no serious adverse events; meta-analysis is based on pooled results from 4 studies.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI). For cessation, the assumed risk in the control group is based on receipt of limited stop-smoking support. The assumed risk for adverse events and serious adverse events is a weighted mean average of quit rates across control groups in contributing studies.
CI: Confidence interval; **RCT:** randomised controlled trial; **RR:** Risk ratio

a) Downgraded two levels due to risk of bias. Due to lack of blinding and differential support between arms, judged to be at high risk of bias.
b) Downgraded two levels due to imprecision; confidence intervals incorporate clinically significant benefit and clinically significant harm.