Effects of e-cigarette advertising, promotion, and sponsorship on people's attitudes, beliefs, perceptions, intentions, and behaviours: a mixed-methods systematic review

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Abstract

Background:

Tobacco smoking in Australia is at an historic low, primarily owing to the implementation of evidence-informed tobacco control measures. However, there are now concerns about the uptake of electronic cigarettes (e-cigarettes) in Australia, particularly among young adults. The way in which e-cigarettes are being promoted is an important issue globally, and is likely to be a factor driving uptake of the products. However, while primary studies are available, to date there does not appear to be a robust systematic review on the topic of the impacts of e-cigarette advertising and other forms of e-cigarette promotion.

Objectives:

The objective of this review was to systematically appraise both quantitative and qualitative evidence on the effects of e-cigarette advertising, promotion, and sponsorship on a range of attitudinal and behavioural outcomes. The specific research questions addressed in the systematic review were:

1. What is the impact of advertising, promotion, and sponsorship on knowledge, attitudes, belief, intentions, and behaviours related to e-cigarettes?
2. What are people's perceptions of e-cigarette advertising, promotion, and sponsorship and the effects of these activities?

Search methods:

The following databases were searched on 28th June 2021: PubMed, EMBASE, CINAHL, PsycINFO, Cochrane Central Register of Controlled Trials and clinicaltrials.gov. The search terms are listed in Appendix 2 of the accompanying technical report. The reference lists of studies that met eligibility criteria were manually screened to identify newer studies.

Selection criteria for quantitative studies:

Studies that met the following criteria were included:

- Population:
  Studies involving at least one of the following population groups, with no age restrictions were included:

    - General population, regardless of smoking status
    - Current e-cigarette smokers (nicotine or non-nicotine) (used within the past 30 days)
    - Former e-cigarette smokers (nicotine or non-nicotine) (tried/used e-cigarettes but not in the past 30 days)

- Never e-cigarette users
- Current tobacco-only smokers (not e-cigarette users) (used within the past 30 days)
- Former smokers (tried/used any form of smoking tobacco, but not in the past 30 days)
- Never smokers (never used any form of smoking tobacco)
- Non-tobacco smokers (never and former users together)
- Dual users (used both e-cigarettes and combustible cigarettes in the past 30 days)

- <u>Exposures:</u>
  Studies on exposure to any type of e-cigarette advertising, promotion, and sponsorship were included, irrespective of the media of dissemination. Studies on regulations of e-cigarette advertising, promotion, and sponsorship were considered for inclusion.

- <u>Comparators:</u>
  Studies were included irrespective of whether there was a defined comparator group used in analyses.

- <u>Outcomes:</u>
  Studies reporting the following outcomes were included:

  - **Primary Outcomes**
    Behaviours among the specified population groups:
    - Uptake/initiation of e-cigarette use (nicotine or non-nicotine) and/or combustible cigarette use
    - Frequency and/or intensity/quantity of consumption of e-cigarettes (nicotine or non-nicotine) and/or combustible cigarettes use
    - Continuation or maintenance of e-cigarette use and/or combustible cigarette use
    - Quitting combustible cigarette use and/or e-cigarette use

  - **Secondary Outcomes**
    - Total nicotine consumption
    - Knowledge, attitudes, and beliefs about e-cigarettes among the specified population groups
    - Intentions to use e-cigarettes (nicotine or non-nicotine) among the specified population groups

- <u>Study Design:</u>
  Primary studies with the following study designs were eligible for inclusion:

- Intervention study designs:
    - Randomised controlled trials, cluster-randomised trials, quasi-randomised trials
    - Non-randomised controlled trials
    - Controlled before and after studies
    - Interrupted time series (with multiple time points before and after an intervention)
    - Pre-post study designs
- Observational study designs:
    - Cohort studies
    - Cross-sectional studies or surveys (analytical)
    - Case-control studies
- Quantitative components of mixed methods studies provided they had any of the following afore-mentioned quantitative designs

- Setting
  Only studies from Australia, Canada, the European Union, New Zealand, the UK, and the US were included. Multi-country studies were excluded that did not present data in a disaggregated manner to provide access to results from the specified countries/regions.

- Other restrictions
  Studies published in non-English languages (where a publicly available translation was not available), studies that were published in abstract form only (with no full-length publication available), and non-peer reviewed studies were not included as pre-specified in the protocol.

Selection criteria for qualitative studies

Studies meeting the following criteria were included:

- Types of phenomena of interest:
  Studies with a specific focus on beliefs, perceptions, and attitudes towards the advertising, promotion, and sponsorship of e-cigarettes were included.

- Study design:
  Studies that used qualitative approaches considered valid and relevant for both data collection and data analyses were included. Focus groups, individual in-depth interviews, and ethnographic interviews were considered as valid and relevant tools for qualitative data collection; narrative analysis, thematic analysis, and grounded theory were considered relevant and valid methods for qualitative analyses. Studies that used qualitative methods for data collection but did not analyse the data qualitatively were excluded.

- Participants:
  Studies involving at least one of the following population groups were included:

    - General population, regardless of smoking status
    - Current e-cigarette smokers (nicotine or non-nicotine) (used within the past 30 days
    - Former e-cigarette smokers (nicotine or non-nicotine) (tried/used e-cigarettes but not used in the past 30 days)
    - Never e-cigarette users
    - Current tobacco-only smokers (not e-cigarette users) (used within the past 30 days)
    - Former smokers (tried/used any form of smoking tobacco, but not in the past 30 days)
    - Never smokers (never smoked any form of smoking tobacco)
    - Non-tobacco smokers (never and former users together)
    - Dual users (used both e-cigarettes and combustible cigarettes in the past 30 days)

- Setting:
  Only studies published from January 01, 2015 onwards and from Australia, Canada, the European Union, New Zealand, the UK, and the US were included.

- Other restrictions:
  Studies published in non-English languages (where a publicly available translation was not available), studies that were published in abstract form only (with no full-length publication available), and non-peer reviewed studies were not included as pre-specified in the protocol.

Data collection and analysis:

We used standard evidence synthesis methods wherein screening and data extraction was undertaken by at least two independent review authors. Any discrepancies were resolved by consensus with a third review author acting as arbiter. A data extraction form, designed a priori, was used to extract data, with some modifications for ease of extraction made in the initial phase. Standard risk of bias assessment tools of Cochrane, Joanna Brigs Institute and CASP were used. Meta-analysis was conducted whenever it was appropriate to pool results. If meta-analysis was not appropriate, a narrative synthesis was conducted. Where possible, the association between the exposures and outcomes of interest was investigated by combining similar measures of risk pooled in statistical meta-analysis using inverse variance. Effect estimates (odds ratios, as reported in the majority of the studies) and 95% confidence intervals (CIs) were extracted and entered in the calculator in RevMan, which then converted these values into natural logarithms (as a log odds ratio and CIs, and the standard error (SE) of the log odds ratio). Sub-group and sensitivity analyses were performed if an adequate number of studies was available.

A thematic synthesis analysis was conducted on the included qualitative studies.

The certainty of evidence for quantitative and qualitative studies was assessed using the GRADE and GRADE CERQual approach.

Results:

The electronic databases search resulted in 4224 records, which were screened to identify 68 records that met selection criteria. A hand search of the reference lists of included records identified a further eight records, resulting in the inclusion of a total of 76 records in the systematic review (69 quantitative studies and seven qualitative studies).

Of the 69 quantitative studies included in the review, most were cross-sectional in design (n = 43), with cohort studies (n = 15) and randomised controlled trials (n = 10) being the next most common study designs. One quasi-experimental study was included. Most of the studies (n=51) focussed on school-aged adolescents (12-17 years) and young adults (18-25 years), and 18 studies focussed on adults in general. A large majority of the studies were conducted in the US (n = 56), and only four were multi-country studies.

Of the seven qualitative studies included in the review, six were conducted in the US and one in Australia. Two studies were conducted with young adults (aged 18-24 or 18-29), two with adolescents (aged 12-17 or 10-18), one with adults, and one with adolescents with hearing impairments and key staff working at their schools.

The review found evidence relating to numerous individual and combinations of media: radio, television, television + radio (combined), television + movies (combined), billboards/posters, print media, social media, point of sale, internet, mail (e-mail and/or postal), and 3+ media combined. For most media types/combinations, the evidence was of low to very low certainty and effect sizes often varied. The significant results found in quantitative studies assessed as having moderate or high certainty of evidence for primary outcomes are as follows.

Among adolescents, exposure to e-cigarette advertising in **print media** was associated with increased odds of current e-cigarette use (OR 1.33, 95% CI 1.19-1.48, 2 studies, 43,602 participants, moderate certainty evidence), frequency of e-cigarette use (OR 3.40 , $p < 0.001$, 21,491 participants, high certainty of evidence), and ever use of e-cigarettes (OR 1.22, 95% CI 1.07-1.39, 22,007 participants, moderate certainty evidence). Exposure to advertising in **websites and social media** (combined) was associated with higher odds of current e-cigarette use (OR 2.57, 95% CI 2.02-3.27, 12,064 participants, high certainty evidence). Exposure to **social media advertisements** alone was associated with increased odds of e-cigarette uptake (OR 2.60, 95% CI 1.56-4.35, 2 studies, 22,604 participants, moderate certainty evidence). Exposure to e-cigarette advertising in **retail stores** was associated with greater odds

of current use of combustible cigarettes (OR 1.69, 95% CI 1.06-2.68, 2 studies, 391,395 participants, moderate certainty evidence).

Among adolescents, there was moderate certainty of evidence that greater exposure (sometimes/most of the time/always) to e-cigarette advertisements across **multiple media sources (3+media)** was associated with higher odds of e-cigarette initiation compared to those who were never/rarely exposed (OR 1.64, 95% CI 1.45-1.86, 3 studies 27,025 participants), greater odds of current e-cigarette use (OR 6.42, 95% CI 2.28-18.11, 71,702 participants), and greater odds of current combustible cigarette use compared to no exposure or exposure rarely (OR 1.40, 95% CI 1.27-1.55, 4 studies, 58,320 participants).

Among adolescents and young adults, exposure (sometimes/most of the time/always) to advertisements on 2-3 media increased the odds of current e-cigarette use compared to no exposure (OR 2.11, 95% CI 1.77-2.52, 3 studies, 16,117 participants, high certainty of evidence).

Three themes emerged from the thematic analysis of the included qualitative studies: (1) Exposure to e-cigarette advertising occurred both actively and passively, resulting in changed perceptions of the risk profile of e-cigarettes (moderate confidence in findings); (2) Strategies used to enhance the appeal and believability of advertisements are effective in influencing perceptions (moderate confidence in findings); and (3) Exposure to individuals doing 'vape tricks' on social media (moderate confidence in findings).

Authors' conclusions:

The available evidence is largely confined to cross-sectional studies conducted in the US. However, the size of the body of evidence and the general consistency in results across the assessed studies supports the contention that e-cigarette advertising across a wide range of media is positively associated with e-cigarette use among young people. This finding is consistent with outcomes in related substance use areas and supports the implementation of appropriate restrictions on e-cigarette marketing to reduce harms among young people.

Registration:

The protocol was registered a priori with PROSPERO (CRD42021264018) and Open Science Registry (DOI 10.17605/OSF.IO/8U2QT).

Introduction to the report

This report assesses the evidence on the effects of e-cigarette advertising on a range of attitudinal and behavioural outcomes. The primary outcome variables relate to behavioural outcomes of initiation, ever use, current use, and frequency of e-cigarette use. The secondary outcome variables focus on e-cigarette-related knowledge, attitudes, beliefs, and intentions. The work has been commissioned by the National Health and Medical Research Council (NHMRC) to inform the revision and update of the NHMRC 2017 CEO Statement on E-cigarettes.

The structure of this report is as follows:

- Background: provides a brief outline of the evolution and status of e-cigarette marketing

- Methodology: describes the process undertaken to identify and analyse relevant studies

- Findings: summarises the results across the various assessed outcomes

- Discussion: outlines the main findings and identifies gaps and limitations

- Comprehensive appendices

Background

Electronic cigarettes (e-cigarettes) are devices that produce aerosols by heating a liquid that usually contains flavourings, other chemicals, and, depending on the specific product, nicotine.[1] They are also commonly known as 'e-cigs,' 'e-hookahs', 'mods', 'vape pens', 'vapes', and 'electronic nicotine delivery systems (ENDS)'.[1] E-cigarettes were first introduced in China in 2004, and entered global markets in 2007,[2] with their use steadily increasing over time.

The results of the most recent National Drug Strategy Household Survey indicated that 2.6% of Australians aged 14 and over were current e-cigarette users in 2019, up from 1.2% in 2016.[3] Ever use prevalence is substantially higher; in 2019, 11.3% reported having ever used e-cigarettes, with the highest rate (26.1%) found among young adults aged 18-24 years.[3] Overall, the uptake of e-cigarettes in Australia is lower than in many culturally similar countries such as the United States (US) and the United Kingdom (UK), where current use levels are at 4.4% and 5.7%, respectively.[4][5] This difference in uptake is likely to be attributed to Australia's tobacco prevention control measures covering the sale and supply of nicotine-containing e-cigarettes.[6] Australia's low tobacco smoking rates may have also contributed to the relatively low uptake of e-cigarettes.[7]

Although e-cigarette usage rates in Australia are low by international standards, more recent evidence indicates that uptake and usage may be increasing quickly. For example, the seizure of illegal e-cigarette products in NSW alone increased 10-fold between March 2020 and March 2021.[8] and a study of e-cigarette users found that 43% reported increasing their use between March 2020 and mid 2021.[9] There is also a growing number of e-cigarette device options,[10] potentially providing more affordable alternatives for price-sensitive youth.

While some proponents of e-cigarettes argue they are an effective smoking cessation tool,[11] the benefits remain equivocal[12] and a growing body of research supports the proposition that e-cigarettes can act as a gateway to cigarette smoking, particularly among youth.[13][14] Due to the relatively recent emergence of e-cigarettes, there is a lack of evidence from longitudinal studies on health effects,[11] however shorter-term studies have identified harmful respiratory and cardiovascular outcomes.[15] On the basis of the available evidence, the World Health Organization recommends "preventing or restricting advertising, promotion, and sponsorship" of e-cigarettes.[16]

Regulatory environment

The regulation of e-cigarettes in Australia is currently a shared responsibility of both the Commonwealth and state and territory governments, through laws across tobacco control, therapeutic goods, poisons, and consumer protection. E-cigarettes that contain nicotine currently cannot be sold due to nicotine being classified as a

dangerous poison under the *Standard for the Uniform Scheduling of Medicines and Poisons* ('Poisons Standard') Schedule 7.[17] E-cigarettes that do not contain nicotine can be purchased by anyone over the age of 18 in all states except Western Australia, where any items that resemble tobacco products are prohibited.

Under the National Therapeutic Goods Act, nicotine e-cigarettes are regulated as prescription medications, and thus cannot be advertised to consumers. There are also regulations at the state and territory level that prohibit the advertising, promotion, and sponsorship of both nicotine and non-nicotine e-cigarettes. These laws encompass most types of advertising, including print, tv, and radio to point of sale.[18] Additionally, they restrict the display of any e-cigarette product at point of sale, except in Victoria, where certified specialist e-cigarette retailers, defined as businesses whose primary business is the sale of e-cigarettes, can display products in their stores.[19]

Online marketing

Australian surveillance data indicate that 70% of e-cigarette purchases are made online.[20] Currently, only non-nicotine e-cigarettes can be purchased online through Australian vendors, and nicotine e-cigarettes can be purchased online through international vendors. Despite the bans on advertising of e-cigarettes in Australia, Australian online retailers of e-cigarettes are not subject to the same point-of-sale marketing restrictions as brick and mortar retailers except in South Australia, where the online marketing and sale of e-cigarette products was banned in April 2019.[21] While the marketing of e-cigarettes on websites selling e-cigarettes has not been systematically studied, a scan of websites such as Vaperempire (www.vaperempire.com.au) and Vapeking (www.vapeking.com.au) demonstrates that price promotions, such as online games and discounted products, are being used, as well as advertisements that promote different aspects of vaping products, such as flavours of e-juices (e-liquids) and specifications of vape tanks. Australian regulations also do not prevent exposure to online marketing of both nicotine and non-nicotine e-cigarettes on international websites.

Studies show that e-cigarettes are marketed on a range of online platforms including Twitter,[22][23] Instagram,[22] YouTube,[22][24] TikTok,[25] Facebook,[26][27] Pinterest,[22] Internet search engines, and banner/video advertisements[28]. Due to the borderless nature of social media, posts from any country can be viewed in Australia on these platforms and, as such, international practices are relevant here.

The major global social media platforms have enacted policies regarding tobacco marketing that in most cases extend to e-cigarettes. Paid marketing of tobacco products and related paraphernalia, including private sales, trades, and transfers, is banned on Facebook, YouTube, Instagram, Reddit, Twitter, LinkedIn, Pinterest, and TikTok.[29] Facebook, however, does allow the marketing and sale of clothing that features a tobacco brand logo.[27] While non-specific, this exemption would seem to also apply to e-cigarette brands.

The policies for the majority of these platforms do not extend to the accounts of individuals, including influencers and fan pages/groups.[23] This means social media users are still exposed to e-cigarette marketing, primarily through the accounts of individual users, including sponsored posts by influencers or non-sponsored posts by individuals via fan pages/groups.[22 23 26 27] The exception is Instagram, which from December 2019 banned the use of product endorsements such that social media influencers are no longer able to promote e-cigarettes through hashtags or posts showing that they were gifted the devices.[30]

While social media platforms have banned paid advertising, the difficulties associated with monitoring and policing the content of almost 3 billion users means such policies are not always consistently enforced. Studies have shown that e-cigarette companies are circumventing Facebook's advertising bans by establishing brand-sponsored profile pages[27] and encouraging the creation of, or directly creating themselves, brand fan pages.[31] These pages have been found to have purchase links and sales promotions,[27] despite these tactics falling under the remit of paid advertising. Companies are also increasingly circumventing bans on paid advertising by using covert strategies such posting memes, links to sponsored events, and contests on their brand pages.[32 33] Additionally, studies have shown that many of these pages do not have age gates, despite Facebook's policy requiring that only those over 18 can view e-cigarette products for sale.[27] Facebook's current method of prohibiting e-cigarette promotions relies largely on individuals reporting violations of these advertising policies.[27]

Influence of international regulations on content seen in Australia

Due to the borderless nature of social media and the internet more broadly, some regulations in the US are applicable to the Australian context. For example, The United States' Master Settlement Agreement of 1998 restricts the use of cartoons for cigarette marketing, but not for e-cigarette marketing, which means e-cigarette packaging with cartoons can be located and purchased online by Australians.[34] This same legislation restricts the use of product placement for tobacco products but not e-cigarettes, and as such videos on YouTube and other social media platforms may display e-cigarette products or merchandise.

Common messages used to promote e-cigarettes on social media

The most recent review summarising international evidence on the types of messages being used to market e-cigarettes on social media was published in 2019.[22] The review included 18 studies of Twitter promotions, four of YouTube promotions, three of Instagram promotions, and one of Pinterest promotions.

The most common messages in online posts were found to be about health, safety, and harms. This content typically referred to e-cigarettes as being less harmful than conventional tobacco products. The second most common messages were those

promoting the use of e-cigarettes as a smoking cessation tool, and the third were those emphasising certain product types and characteristics such as brands, flavours, and nicotine content. Other identified common message themes were: promoting discounts, giveaways, and competitions; highlighting that e-cigarette use is more economical, cleaner, and environmentally friendly than tobacco smoking; information about how to customise e-cigarettes; and describing vaping tricks.

A study that specifically looked at promotions of e-cigarettes on Australian Twitter accounts similarly found that many posts detailed the putative health benefits of e-cigarettes and used promotional tactics such as contests, giveaways, and free shipping, and displayed/discussed e-liquid products with a particular focus on the appeal of different flavours.[23] The study also found that many posts emphasised a sense of community and shared identity around the use of e-cigarettes, such as by employing the hashtags #vapecommunity and '#vapefam.[23]

A study that examined how disposable e-cigarettes, specifically the 'Puff Bar' brand, were depicted on TikTok between November 2019 and May 2020 found that the 10 most viral videos, based on the number of views, had between 2.8 million and 42.4 million views.[25] Two of these videos included sale or promotional content and two explicitly portrayed youth using the product. The study was unable to determine, however, whether these videos were sponsored.[25]

Marketing techniques used to promote e-cigarettes

Use of cartoons

E-juice (also known as e-liquid) bottles are an important promotional tool for e-cigarettes because they are one of the components of e-cigarettes that can be customised with branding and imagery. A 2020 study examined the presence of cartoons on bottles of e-juice available for sale on a popular e-cigarette website, eliquid.com. The study found that of 1587 brands offering 7135 products, 311 brands (19%) offered 1359 products (19%) that had cartoons on the label.[34] Similarly, a study of Instagram posts over a 2-week period with the hashtag #ejuice or #eliquid found that 723 posts (21%) contained a cartoon and 479 posts (14%) contained brand logos that included a cartoon.[35]

Product placement

The use of product placement, which involves incorporating e-cigarettes, e-cigarette-branded merchandise, clothing, or other products into film, television, or other forms of media (e.g., short videos), has not been extensively studied. While e-cigarette product placement is not permissible in content produced in Australia, countries that produce large volumes of global media and entertainment content, such as the US, do not have such regulations.

A study examining e-cigarette product placement in popular music videos on YouTube found that 2.2% of the 180 sampled videos featured e-cigarette branded merchandise, 3.3% featured e-cigarette devices being used or held, and 0.5% featured an aerosol cloud.[20] Although this only amounted to 7 music videos in total, the combined views for these 7 videos on YouTube was 1.6 billion.[24]

Overall, exposure to e-cigarettes occurs across multiple mediums. Due to e-cigarette regulations in Australia, exposure is most likely to occur online, including on social media, and through product placement in videos, films, and television shows that are produced overseas. In Victoria (a jurisdiction within Australia), individuals may also be exposed to e-cigarette promotion at the point-of-sale at specialist e-cigarette retailers. As exposure can occur via multiple channels, it is important to study the impact of exposure to both individual and combined forms of media.

Review objective

The objective of this review was to systematically appraise both quantitative and qualitative evidence on the effects of e-cigarette marketing, promotion, and sponsorship on a range of attitudinal and behavioural outcomes. This review is required due to a growing body of evidence suggesting that e-cigarette marketing influences a range of e-cigarette-related outcomes including knowledge, intentions, and behaviours, yet no summary of the findings of this evidence base and its quality is currently available to inform policy decisions. In particular, this review provides insights into the relative impacts of different types of e-cigarette advertising, which can assist in the prioritisation of regulatory efforts.

Research questions

This systematic review aimed to understand the influence of advertising, promotion, and sponsorship of e-cigarettes on:

- Knowledge, attitudes, perceptions, and beliefs (what people think)

- Intentions (what people think they will do)

- Behaviours (what people have done, e.g. uptake and use of e-cigarettes).

The systematic review used a mixed method approach wherein quantitative and qualitative research syntheses were performed in a segregated manner, with a final synthesis done at the end (convergent-segregated approach).[36] Such an approach is useful for examining different aspects of the phenomenon being investigated to provide confirmation/refutation and complementarity that enables a more comprehensive understanding of the literature.

The specific research questions addressed in the review were:

1. What is the impact of advertising, promotion, and sponsorship on knowledge, attitudes, belief, intentions, and behaviours related to e-cigarettes?
2. What are peoples' perceptions of e-cigarette advertising, promotion, and sponsorship and the effects of these activities?

For the review, the term "e-cigarettes" referred to any electronic nicotine delivery system (ENDS), electronic non-nicotine delivery system (ENNDS), or alternative nicotine delivery system (ANDS). This included but was not limited to personal vaporisers, e-hookahs, vape pens, and vapes. Heated tobacco products or any other traditional tobacco products were not within the purview of the review.

The standard definition of e-cigarette advertising, promotion, and sponsorship as per Article 13 of the WHO Framework Convention on Tobacco Control (WHO FCTC)[37] was used for conducting the review:

- E-cigarette advertising and promotion: "any form of commercial communication, recommendation, or action with the aim, effect, or likely effect of promoting e-cigarette use either directly or indirectly".

- E-cigarette sponsorship: "any form of contribution to any event, activity, or individual with the aim, effect, or likely effect of promoting e-cigarette use either directly or indirectly".

Mediums for e-cigarette advertising, promotion, and sponsorship included but were not limited to the following:

- Point of sale (tobacco/e-cigarette retail outlets, duty-free stores)
- Social media platforms (e.g. Facebook, Twitter, Instagram)
- Internet websites
- Print media (e.g. newspapers, magazines)
- Broadcast (e.g. radio, television, movies)
- Streaming services or over-the-top media
- Events (e.g. concerts, sports, fashion shows, etc.)
- Direct marketing channels (e.g. telemarketing, broadcasting, e-mail)
- Commercial communication through health service providers or quit support groups
- Word of mouth or peer group communications

Methodology

The protocol was registered a priori with PROSPERO (CRD42021264018) and Open Science Registry (DOI 10.17605/OSF.IO/8U2QT).

Detailed information on the methods, including the PRISMA reporting checklist, is provided in the Technical Report, a companion document to complement the current evidence evaluation report. Only a short summary of methods is presented here.

Eligibility criteria for quantitative studies

Studies that met the following criteria were included:

- Population:
  Studies involving at least one of the following population groups, with no age restrictions were included:

  - General population, regardless of smoking status
  - Current e-cigarette smokers (nicotine or non-nicotine) (used within the past 30 days
  - Former e-cigarette smokers (nicotine or non-nicotine) (tried/used e-cigarettes but not used in the past 30 days)
  - Never e-cigarette users
  - Current tobacco-only smokers (not e-cigarette users) (used within the past 30 days)
  - Former smokers (tried/used any form of smoking tobacco, but not in the past 30 days)
  - Never smokers (never used any form of smoking tobacco)
  - Non-tobacco smokers (never and former users together)
  - Dual users (used both e-cigarettes and combustible cigarettes in the past 30 days)

- Exposures:
  Studies on exposure to any type of e-cigarette advertising, promotion, and sponsorship were included, irrespective of the media of dissemination. Studies on regulations of e-cigarette advertising, promotion, and sponsorship were considered for inclusion. Studies that assessed the effects of ads featuring harm-reduction themes to promote e-cigarettes were included, as this is a potential marketing strategy for these products. Studies on the effects of social marketing initiatives designed to prevent harm from e-cigarette use (by health authorities or non-government organisations) were out of scope of the review. Studies were included irrespective of the duration of exposure and/or intensity/frequency of exposure.

- <u>Comparators:</u>
  Studies were included irrespective of whether there was a defined comparator group used in analyses.

- <u>Outcomes:</u>
  Studies reporting the following outcomes were included:

  - **Primary Outcomes**
    Behaviours among the specified population groups:
    - Uptake/initiation of e-cigarette use (nicotine or non-nicotine) and/or combustible cigarette use
    - Frequency and/or intensity/quantity of consumption of e-cigarettes (nicotine or non-nicotine) and/or combustible cigarettes use
    - Continuation or maintenance of e-cigarette use and/or combustible cigarette use
    - Quitting combustible cigarette use and/or e-cigarette use

  - **Secondary Outcomes**
    - Total nicotine consumption
    - Knowledge, attitudes, and beliefs about e-cigarettes among the specified population groups
    - Intentions to use e-cigarettes (nicotine or non-nicotine) among the specified population groups

Outcomes related to specific user-behaviour (uptake and consumption) of e-cigarettes or combustible cigarettes were classified as primary outcomes as they are measurable outcomes related to use. All other outcomes were treated as secondary outcomes. No exercise to rank or prioritise outcomes was undertaken as this was beyond the scope of this review.

Outcomes were classified into these categories according to the definitions specified by the primary study authors. The outcome relating to continuation or maintenance of e-cigarette and/or combustible cigarette use was typically reported as current use in studies. Outcomes related to e-cigarette experimentation and susceptibility (irrespective of the modality of measurement) were classified under the intention to use e-cigarette outcome.

The time-points of the outcomes measured were determined by the included studies and were explicitly mentioned in the review report. Outcome time-points were captured up to the longest period of follow-up. An inclusive outcome measurement/definition approach was followed to enable capturing of maximal evidence such that outcomes measured in terms of frequency/proportion or any other modality were included. Studies that reported exclusively on health outcomes associated with use of e-cigarettes or prevalence of uptake/use of e-cigarettes generally (not associated with the impact of advertising/marketing) were not included.

- Study Design:
  Primary studies with the following study designs were eligible for inclusion:

  - Intervention study designs:

    - Randomised controlled trials, cluster-randomised trials, quasi-randomised trials
    - Non-randomised controlled trials
    - Controlled before and after studies
    - Interrupted time series (with multiple time points before and after an intervention)
    - Pre-post study designs

  - Observational study designs:
    - Cohort studies
    - Cross-sectional studies or surveys (analytical)
    - Case-control studies

  - Quantitative components of mixed methods studies provided they had any of the following afore-mentioned quantitative designs

  Observational study designs were included because of the challenges conducting interventional research due to the wide array of factors implicated in behaviours around tobacco and e-cigarette use, and the diffuse and pervasive nature of advertising, promotion, and marketing strategies. We did not include any other study designs (e.g., case-series) as they cannot be used to determine association.

- Setting
  Only studies from Australia, Canada, the European Union, New Zealand, the UK, and the US were included. Multi-country studies were excluded that did not present data in a disaggregated manner to provide access to results from the specified countries/regions.

- Other restrictions
  Only studies published from January 01, 2015 onwards were included. The cut-off date was determined by the NHMRC Electronic Cigarettes Working Committee on the basis that almost all literature on e-cigarette advertising has been published from 2015 onwards. Studies published in non-English languages (where a publicly available translation was not available), studies that were published in abstract form only (with no full-length publication available), and non-peer reviewed studies were not included as pre-specified in the protocol.

Eligibility criteria for qualitative studies

Studies meeting the following criteria were included:

- Types of phenomena of interest:
  Studies with a specific focus on beliefs, perceptions, and attitudes towards the advertising, promotion, and sponsorship of e-cigarettes were included. There were no limits in terms of the duration of promotion, the intensity (frequency) of the advertising, or the numbers and types of media employed. Content analyses related to audience behaviours/reactions were included. Studies that only analysed the content of advertisements with no analysis of audience behaviours/reactions were excluded as they do not provide any information relevant to the research questions. Studies that primarily focussed on other aspects of e-cigarette use, including the perceived impacts and harms of e-cigarettes, were not included.

- Study design:
  Studies that used qualitative approaches considered valid and relevant for both data collection and data analyses were included. Focus groups, individual in-depth interviews, and ethnographic interviews were considered as valid and relevant tools for qualitative data collection; narrative analysis, thematic analysis, and grounded theory were considered relevant and valid methods for qualitative analyses. Studies that used qualitative methods for data collection but did not analyse the data qualitatively were excluded. Qualitative components of mixed-methods study design were included, provided they met other criteria.

- Participants:
  Studies involving at least one of the following population groups were included:
    - General population, regardless of smoking status
    - Current e-cigarette smokers (nicotine or non-nicotine) (used within the past 30 days
    - Former e-cigarette smokers (nicotine or non-nicotine) (tried/used e-cigarettes but not used in the past 30 days)
    - Never e-cigarette users
    - Current tobacco-only smokers (not e-cigarette users) (used within the past 30 days)
    - Former smokers (tried/used any form of smoking tobacco, but not in the past 30 days)
    - Never smokers (never smoked any form of smoking tobacco)
    - Non-tobacco smokers (never and former users together)
    - Dual users (used both e-cigarettes and combustible cigarettes in the past 30 days)

- Setting:

  Only studies published from January 01, 2015 onwards and from Australia, Canada, the European Union, New Zealand, the UK, and the US were included. The cut-off date was determined by the NHMRC Electronic Cigarettes Working Committee on the basis that almost all literature on e-cigarette advertising has been published from 2015 onwards. Multi-country studies where results were not presented in a disaggregated manner to report on the specified countries were excluded.

- Other restrictions:

  Studies published in non-English languages (where a publicly available translation was not available), studies that were published in abstract form only (with no full-length publication available), and non-peer reviewed studies were not included as pre-specified in the protocol.

Information sources

Electronic database search

The following databases were searched on 28th June 2021:

- PubMed (https://pubmed.ncbi.nlm.nih.gov)

- EMBASE (https://www.embase.com/landing)

- CINAHL (https://www.ebsco.com/products/research-databases/cinahl-full-text)

- PsycINFO (https://www.wolterskluwer.com/en/solutions/ovid/apa-psycinfo-139)

- Cochrane Central Register of Controlled Trials
  (https://www.cochranelibrary.com/advanced-search)

- clinicaltrials.gov (https://clinicaltrials.gov)

We could not search WHO ICTRP as planned because it was not available by the date data extraction commenced on 5th July 2021. The full search strategies used for all databases are presented as an appendix to the accompanying technical report.

Other methods for searching

The reference lists of studies that met eligibility criteria and were retrieved by other modalities of search were manually screened for identifying newer studies.

Screening process and data management

At least two authors independently screened each reference, extracted data, and conducted the risk of bias assessments. Disagreements were resolved by consensus between two authors, with a third author acting as arbiter if necessary. Authors of

studies were not contacted for additional data and only data as reported in published versions was included.

Relevant details of all studies included in the review were extracted. These included the country where the study was conducted, study design, setting, eligibility criteria for study participants, participants' characteristics, type of advertising/marketing medium, exposures and comparators (where applicable), confounders or covariates, exposure and outcome measurement methods, effect estimates and results relevant to the outcomes of interest, source of study funding, and conflicts of interest.

Risk of bias in included quantitative studies

The following risk of bias assessment tools developed by Cochrane (UK) and Joanna Briggs Institute (JBI, Australia) were used (these two entities are norm-setting organisations in evidence synthesis globally):

- For randomised controlled trials, cluster-randomised trials, and quasi-randomised trials: Cochrane Risk of Bias 1.0 tool.[38]

- For other interventional study designs: JBI Critical Appraisal Checklist for Quasi-Experimental Studies (non-randomised experimental studies).[39]

- For observational studies: JBI Critical Appraisal Checklist for cohort, analytical cross-sectional, and case-control studies.[39]

No specific outcome wise assessment is required for JBI tools. For the Cochrane risk of bias tool, we used the primary outcome relevant to the study for assessing risk of domains related to outcomes. In terms of the critical appraisal approach for quasi-experimental and observational studies, the reviewers agreed prior to commencing the appraisal process on what would be deemed an acceptable level of information within a study for it to receive a positive rather than a negative or unclear rating. When determining the quality of a study using the JBI critical appraisal tool, an overall score summarising the individual scores from each item in the checklist is not used as a way to rate the quality of the study. Rather, it is best practice to consider a combination of criteria to rate the overall quality of a study, including the method of selection of participants, the exposure and outcome measurements used, the presence and measurement of confounders and whether appropriate statistical analysis is used. This is the approach taken by the reviewers for this study.

Risk of bias assessment of included qualitative studies

Risk of bias assessment of included qualitative studies was undertaken by using the Critical Appraisal Skills Programme (CASP) tool for qualitative studies (Critical Appraisal Skills Programme 2018).[40]

Synthesis for quantitative studies

The systematic review was broad. Meta-analysis was conducted whenever it was appropriate to pool results. Results were not pooled for studies that had substantial differences in populations (e.g., age-groups – adolescents, young adults, adults in general), exposure types, study designs, or outcome metrics, or had poor reporting (described in the text, e.g. confidence limits were not reported), or if there was methodological heterogeneity that could not be explained. Under such circumstances, a narrative synthesis was conducted with the data arranged in a tabular format to enable inspection and assessment of the potential patterns within the data.

Where possible, the association between the exposures and outcomes of interest was investigated by combining similar measures of risk derived from the included studies in meta-analysis. Where possible, the results have been pooled in statistical meta-analysis using inverse variance method (RevMan 5.4.1, The Cochrane Collaboration). Effect estimates (odds ratios, as reported in the majority of studies) and 95% confidence intervals (CIs) were extracted and entered in the calculator in RevMan, which then converted these values into natural logarithms (as a log odds ratio and CIs, and the standard error (SE) of the log odds ratio).

For cluster-randomised trials, the plan was to report the authors' methods for adjusting their analyses for the intra-cluster correlation coefficient (ICC) if they used individual participants as the unit of analysis. In the case of multi-arm studies, the plan was to combine all relevant exposure groups into a single large group. However, the review did not find any non-standard study designs (cluster RCTs and interrupted time series) and multi-arm studies in the evidence base.

A random effects model with 95% CI as per Cochrane (Chapter 10.3.2) and JBI guidelines (Chapter 3.3.2) for each exposure-outcome pair separately was used for meta-analysis and exploring heterogeneity. Heterogeneity of included studies of a particular exposure-outcome pair was assessed by visual inspection of forest plots, the standard Chi^2 test (p value), or the I^2 statistic.[41] A p value of less than 0.10 was considered statistically significant in terms of heterogeneity for the standard Chi^2 test. For the I^2 statistic, heterogeneity was determined according to the following criteria:

- 0% to 40%: might not be important
- 30% to 60%: may represent moderate heterogeneity
- 50% to 90%: may represent substantial heterogeneity
- 75% to 100%: considerable heterogeneity

Heterogeneity was explored if there was substantial heterogeneity. This was done using various strategies (including but not limited to using fixed-effects models and subgroup analyses) in alignment with the guidance from the Cochrane handbook (Chapter 10.10.2) and JBI guidelines (Chapter 3.3.10.2).

Effect modification (i.e., different effects for different groups) was explored through sub-group analyses. Sub-group analyses were conducted to explain heterogeneity and are described within text. Where possible, the data have been presented relevant to the age subgroups of interest (i.e. adolescents and young adults). In addition, sensitivity analyses were planned based on the quality of the studies (i.e. high or moderate risk of bias). However, as there were not enough studies in the meta-analyses that addressed each of the outcomes, sensitivity analyses based on the quality of studies could not be conducted. We conducted sensitivity analysis based on exposure duration (past 30 days, six months, or 12 months) and the follow-up period (1 year or 2.5 years), which was a deviation from the protocol.

Reporting biases

Publication bias could not be assessed by a funnel plot[41] as originally planned because there were not enough studies (at least 10) for each exposure outcome pair.

Outcome reporting bias was only assessed for studies that had *a priori* registrations or protocols available. Selective reporting within studies was checked for but no instances were found. As specified in the protocol, studies published in non-English language were not considered for inclusion. The searches were restricted to specific locations as determined by the NHMRC in their commissioning of the systematic review.

Synthesis for qualitative studies

The RETREAT framework was used to guide the choice of qualitative evidence syntheses approach.[42] Thematic synthesis as outlined by Thomas and Harden[43] was the appropriate synthesis approach for the review.

Subgroup analyses as originally planned were not undertaken due to the very small number of qualitative studies identified and the resulting inadequate quantity of data for any sub-group of interest.

Certainty of evidence from quantitative studies

For quantitative studies, we used the GRADE approach to assess certainty of the quantitative evidence as per the GRADE handbook.[44] We used the GRADE Pro GDT software (https://gradepro.org) to create a 'Summary of Findings' table for all primary outcomes. In the GRADE approach, certainty of evidence was classified as very low, low, moderate, or high by the consensus of the review team (involving at least two authors for each study). The certainty levels and their interpretations are:

- High certainty: very confident that the true effect lies close to that of the estimate of the effect.

- Moderate certainty: 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: confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.

- Very low certainty: have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect.

The certainty level for each primary study is reported in the Summary of Findings Tables in the technical report.

Certainty of evidence from qualitative studies

For qualitative studies, we used the GRADE CERQual (Confidence in the Evidence from Reviews of Qualitative Research) approach[45-51] to summarise the confidence in each finding. After assessing each of the four components, a judgement about confidence in the evidence supporting the review findings as very low, low, moderate, or high in alignment with the GRADE CERQual guidelines[45] was made. The certainty levels and their interpretations are:

- High confidence - Highly likely that the review finding is a reasonable representation of the phenomenon of interest.

- Moderate confidence - Likely that the review finding is a reasonable representation of the phenomenon of interest.

- Low confidence - Possibility that the review finding is a reasonable representation of the phenomenon of interest.

- Very low confidence - Unclear whether the review finding is a reasonable representation of the phenomenon of interest.

All reasons for upgrading and downgrading are provided in the footnotes of the GRADE Summary of Findings tables for quantitative studies and in the tables for qualitative studies in the accompanying technical report

Integration of quantitative and qualitative evidence

The findings of the two different synthesis processes were configured in accordance with the JBI methodology,[36] which involved complementary quantitative evidence and qualitative evidence being juxtaposed and organised into a line of argument to provide an overall configured result. The approach recognised that quantitative and qualitative forms of evidence addressed different aspects the same phenomenon of interest and hence could not be directly combined but could be organised into a coherent meaning. Where configuration was not possible, only a narrative description of different results (completed in previous steps) was provided. There is currently no guidance on

assessing confidence of findings after integration of evidence.[36] As such, the GRADE and GRADE-CERQual assessments for informing recommendations were provided in a segregated fashion.

Results

Study selection

The electronic databases search resulted in 4224 records. After removing duplicates, 3691 records remained. During title and abstract screening, 3496 records were excluded. Full-text screening was done on 195 records. Following full text screening, 127 records were excluded that did not meet the eligibility criteria, resulting in 68 records for inclusion. A hand search of the reference lists of included records identified a further eight records, resulting in the inclusion of a total of 76 records in the review (69 records in the quantitative component and seven in the qualitative component). The PRISMA flow chart for included studies is presented in Figure 1.

Reasons for exclusion at full text level are presented in the accompanying technical report (Appendix 3). The most common reasons for excluding studies were wrong exposure of interest (n=51), outcome of interest (n=-35), conference abstracts or articles published in abstract form only with no full-length publication available (n=19), wrong study design (n=11), and wrong phenomenon of interest (n=7). The reasons for four other studies included duplicate study, wrong setting, wrong type of e-cigarette (IQOS) assessed, and lack of clear reporting of data. No ongoing studies were identified in the databases searched (including the Cochrane Central Register of Controlled Trials and clinicaltrials.gov).

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only

Identification

Records identified from
Databases (**n = 4158**)
Registers (**n = 66**)

→

Records removed before screening:
Duplicate records removed (**n = 533**)
Records marked as ineligible by
automation tools (**n = 0**)
Records removed for other reasons (**n = 0**)

Screening

Records identified from
Databases (**n = 4158**)
Registers (**n = 66**)

→

Records excluded (**n = 3496**)

Records sought
for retrieval (**n = 195**)

→

Records not retrieved (**n = 0**)

Studies assessed for
eligibility (**n = 195**)

→

Studies excluded (**n = 127**)

Additional studies identified from
reference screening of included studies
(**n = 8**)

Included

Studies included in the review: **n=76**
(Quantitative studies = **69**)
(Qualitative studies = **7**)

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: *www.prisma-statement.org*

Characteristics of included quantitative studies

Of the 69 quantitative studies included in the review, most were cross-sectional in design (n = 43), with cohort studies (n = 15) and randomised controlled trials (n = 10) being the next most common study designs. One quasi-experimental study was included. Most of the studies (n=51) focussed on school-aged adolescents (12-17 years) and young adults (18-25 years), and 18 studies focussed on adults in general. A large majority of the studies were conducted in the US (n = 56).[52-107] Four studies were conducted in the UK,[108-111] one in Canada,[112] two in Germany,[113 114] one in Finland,[115] and one in the Netherlands.[116] Four were multi-country[117-120] studies.

All the exposures of interest pre-specified in the protocol were identified and reported in the review, except for sponsorship, streaming services or over-the-top media, commercial communication through health service providers or quit support groups, and word or mouth advertising separately. Just over half of the studies (n = 38) reported aggregated data for e-cigarette advertising disseminated via multiple media sources. Most of the included studies used questionnaires and self-reported exposure and outcome measures. Total nicotine consumption as an outcome was not reported in any of the included studies. For each study design, different measures of association, or estimates of effect, were reported, most commonly odds ratios (ORs) and in some cases relative risks (RRs) or prevalence ratios (PRs). The follow-up period ranged from 6 months to 1 year in most cohort studies, with the maximum being 2.5 years. The outcome of intentions to use e-cigarettes was interchangeably used with susceptibility to use e-cigarettes in the included studies.[80 92 108]

The outcome measurement methods included but were not limited to self-report questionnaires (web-based, postal, face-to-face, email) and observations at tobacco retail outlets. The outcome measures were based on the use of different rating scales, such as Likert scales or dichotomous self-reported responsed (yes/no questions). The outcome measures also included questions related to the duration and frequency of use of e-cigarettes and cigarettes.

Characteristics of included qualitative studies

Seven studies met the inclusion criteria and were included in analyses; six were conducted in the US and one in Australia. Two studies were conducted with young adults (aged 18-24 or 18-29),[121 122] two with adolescents (aged 12-17 or 10-18),[123 124] one with adults,[125] and one with adolescents with hearing impairments and key staff working at their schools[126]. Four studies included participants regardless of their e-cigarette smoking status,[121 124 126 127] one included current e-cigarette smokers,[122] one included current or past e-cigarette smokers,[125] and one included non-e-cigarette smokers.[123]

The detailed characteristic of included studies is presented is presented in Appendix 2.

Risk of bias in included randomised controlled trials

The risk of bias summary for the 10 included randomised controlled trials is presented in Figure 2. Additional details are presented in the accompanying technical report.

There was low risk of bias for six studies for random sequence generation, while the remaining studies had unclear risk. For the allocation concealment domain, there was low risk in five studies, high risk in two studies, and unclear risk in the remaining studies. Low risk of performance bias was seen in four studies, high risk was seen in one study, and the remaining studies had unclear risk of bias. Detection bias was low risk in five studies, high risk in one study, and unclear risk for the remaining studies. The risk of attrition bias was judged to be low risk in five studies and unclear in the others. No selective reporting or other biases were detected.

Overall, it was not clearly reported whether allocation concealment, blinding (both related to selection bias and performance bias) and appropriate outcome reporting were addressed in several studies.

Figure 2: Risk of bias summary for included randomised controlled trials

Risk of bias in included quasi-experimental study

The risk of bias summary for the single included quasi-experimental study is presented in Figure 2 Additional details are presented in the accompanying technical report.

There was unclear risk of bias for the domain pertaining to follow-up, due to poor reporting. Multiple measurements for the outcome, both pre and post intervention was not done, thus leading to the corresponding domain being rated high risk. All other domains were at low risk.

Figure 3: Risk of Bias summary of included quasi experimental study

JBI Critical Appraisal Checklist for Quasi-Experimental Studies (non-randomised experimental studies)									
Study ID	1. Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)?	2. Were the participants included in any comparisons similar?	3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	4. Was there a control group?	5. Were there multiple measurements of the outcome both pre and post the intervention/ exposure?	6. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analysed?	7. Were the outcomes of participants included in any comparisons measured in the same way?	8. Were outcomes measured in a reliable way?	9. Was appropriate statistical analysis used?
Maloney 2016	Yes	Yes	Yes	Yes	No	Unclear	Yes	Yes	Yes

Risk of bias in included cohort studies

The risk of bias for the 15 included cohort studies is presented in Figure 4. Additional details are presented in the accompanying technical report.

All the studies were at low risk in terms of group similarity and recruitment from the same population. Twelve studies were at low risk in the domain related to the validity and reliability of the measurement tool used for exposure, and the remaining studies were at unclear risk. Five studies were at low risk for identifying confounders, one study was at high risk as it did not report any confounding factors, and the remaining studies were at unclear risk. Low risk was reported in 13 studies for strategies for dealing with confounders, high risk was reported in one study, and unclear risk in one study.

For the domain pertaining to participants being free of the outcome at the time of exposure, 11 studies were at low risk, three studies were identified at high risk as they included only smokers in the study, and one study was at unclear risk. Ten studies were at low risk in the domain relating to the validity and reliability of the measurement tool used for outcomes and the remaining five studies were at unclear risk. Fourteen studies were at low risk in domain of reporting the follow-up time and whether it was adequately long, and one studies was at unclear risk. Eight studies were at low risk of poor reporting on completion and loss to follow-up, 6 studies were at unclear risk, and 1 was at high risk. Three studies were at low risk for strategies to address incomplete follow-up, 9 studies were at unclear risk, and 3 studies were at high risk. For appropriate statistical analysis, all the studies were at low risk.

Figure 4: Risk of Bias summary of included cohort studies

JBI Critical Appraisal Checklist for Cohort Studies											
Study ID	1. Were the two groups similar and recruited from the same population?	2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?	3. Was the exposure measured in a valid and reliable way?	4. Were confounding factors identified?	5. Were strategies to deal with confounding factors stated?	6. Were the groups/ participants free of the outcome at the start of the study (or at the moment of exposure)?	7. Were the outcomes measured in a valid and reliable way?	8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?	9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	10. Were strategies to address incomplete follow up utilized?	11. Was appropriate statistical analysis used?
Agaku 2017	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	Yes	Yes	Unclear	Yes
Belava 2019	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	Yes
Camenga 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes
Cavazos 2021	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes
Chen-Sankey 2019	Yes	Yes	Yes	Unclear	Yes	Yes	Unclear	Yes	Yes	Unclear	Yes
D'Angelo 2020	Yes	Yes	Unclear	No	No	Yes	Unclear	Unclear	Unclear	Unclear	Yes
Etim 2020	Yes	Yes	Yes	Unclear	Unclear	Yes	Unclear	Yes	Yes	Unclear	Yes
Hansen2020	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes
Lee 2019	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes
Loukas 2019	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes
Mantey 2019	Yes	Yes	Unclear	Unclear	Yes	No	Unclear	Yes	Yes	Yes	Yes
Nagelhout 2016	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Nicksic 2017a	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes
Pierce 2018	Yes	Yes	Yes	Unclear	Yes	No	Yes	Yes	No	No	Yes
Pike 2019	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	No	Yes

Risk of bias in included cross-sectional studies

The risk of bias for the 43 cross-sectional studies is presented in Figure 5. Additional details are presented in the accompanying technical report.

Thirty-two studies were at low risk for the domain of validity and reliability of the tools used for measuring the exposure and 11 studies were at unclear risk. Fifteen studies reported low risk in identifying confounders, 22 studies reported unclear risk, and the remaining studies were at high risk. Thirty-six studies were at low risk in terms of the strategies used for dealing with confounders, four were at high risk, and the remaining studies were at unclear risk. Twenty-seven studies were at low risk in the domain of validity and reliability of measuring outcome variables, while 16 were at unclear risk. Relating to the statistical analysis techniques, all the studies were identified at low risk in terms of statistical analysis techniques.

Overall, the validity and reliability of the tools used for measuring the exposure and outcome variables and for identifying confounding factors was unclear in some of the studies.

Figure 5: Risk of Bias summary of included cross-sectional studies

JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies								
Study ID	1. Were the criteria for inclusion in the sample clearly defined?	2. Were the study subjects and the setting described in detail?	3. Was the exposure measured in a valid and reliable way?	4. Were objective, standard criteria used for measurement of the condition?	5. Were confounding factors identified?	6. Were strategies to deal with confounding factors stated?	7. Were the outcomes measured in a valid and reliable way?	8. Was appropriate statistical analysis used?
Ali 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ashford 2017	Yes	Yes	Yes	Yes	Unclear	Yes	Unclear	Yes
Auf 2018	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes
Booth 2019	Yes	Yes	Yes	Yes	No	No	Unclear	Yes
Case 2020	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes
Cho 2019	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes
Cho 2020	Yes	Yes	Yes	Yes	Unclear	Yes	Unclear	Yes
Dai 2016	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Dai 2017	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Do 2020	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	Yes
Donaldson 2017	Yes	Yes	Yes	Yes	Unclear	Yes	Unclear	Yes
Du 2020	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Ebrahimi 2020	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Filippidis 2017	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Giovenco 2016	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Hammig 2016	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hammond 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hansen 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hébert 2017	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes
Herrera 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kim 2015	Yes	Yes	Unclear	Yes	No	No	Unclear	Yes
Kinnunen 2015	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Lienemann 2019	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Little 2016	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes
Majmundar 2021	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Mantey 2016	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Marion 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nicksic 2017	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Papaleontiou 2020	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Pesko 2017	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Pokhrel 2015	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes
Pokhrel 2017	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes
Pu 2017	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ratneswaran 2019	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Reinhold 2017	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	Yes
Sanders-Jackson 2015	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes
Sawdey 2017	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Shadel 2020	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Singh 2016	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes
Smith 2015	Yes	Yes	Unclear	Yes	Unclear	Unclear	Unclear	Yes
Stroup 2018	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes
Trumbo 2015	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Unger 2018	Yes	Yes	Yes	Yes	No	Unclear	Yes	Yes

Risk of bias in qualitative studies

The risk of bias summary for the seven included qualitative studies is presented in Figure 6 Additional details are presented in the accompanying technical report.

There was a clear statement of the research for all seven studies. A qualitative methodology was appropriate for all studies, and all studies used an appropriate research design to address the aims of the research. The recruitment strategy was deemed appropriate for the aims of the research for one study and was unclear for the remaining six studies. The data was collected in a way that addressed the research issue for all seven studies. The relationship between the research and participants was deemed unclear in six studies and appropriate in one study. Ethical considerations were unclear for only one study as ethical status was not reported. The data analysis was sufficiently rigorous in five studies, and in two studies was deemed unclear. There was a clear statement of findings for all seven studies, and all were deemed valuable.

Figure 6 : Risk of bias summary of included qualitative studies

Study ID	1.Was there a clear statement of the research?	2.Is a qualitative methodology appropriate?	3.Was the research design appropriate to address the aims of the research?	4.Was the recruitment strategy appropriate to the aims of the research?	5.Was the data collected in a way that addressed the research issue?	6.Has the relationship between researcher and participants been adequately considered?	7.Have ethical issues been taken into consideration?	8.Was the data analysis sufficiently rigorous?	9.Is there a clear statement of findings?	10. How valuable is the research?
Amin 2020	Yes	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes	Yes
Alpert 2020	Yes	Yes	Yes	Unclear	Yes	Unclear	Unclear	Yes	Yes	Yes
Chen 2020	Yes	Yes	Yes	Unclear	Yes	Unclear	Yes	Yes	Yes	Yes
Cogwill 2020	Yes	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes	Yes
Kim 2020	Yes	Yes	Yes	Unclear	Yes	Unclear	Yes	Yes	Yes	Yes
Laestadius 2020	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes
Park 2019	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes

Results of syntheses of quantitative studies

The synthesis of the quantitative studies is presented below according to medium of e-cigarette advertising exposure. For each exposure of interest, details of the evidence located from the search are first introduced, followed by the results. Where a reference is made throughout the text to very low, low, moderate, or high certainty of evidence for primary outcomes, this corresponds to the quality of evidence assessed in the Summary of Findings tables that have been developed using the GRADE approach and are in the accompanying technical report.

Almost all the studies reported odds ratios (ORs) along with 95% confidence intervals (CIs). An OR of 1 indicated no effect of exposure on the odds of the outcome. As such, a statistically not significant result is indicated by the confidence limits (i.e. 95% CI) crosses the line of no effect (OR = 1) and reported accordingly in the report, as applicable. In the interpretation of results, it should be noted that a statistically significant result might not necessarily mean the effect is of public health significance.

1. Effect of radio advertising

Three studies examined the effects of e-cigarette radio advertising.[77][84][107] All were cohort studies conducted in the US. Two of the studies addressed primary outcome variables and two addressed secondary outcome variables. Both studies examining primary outcome variables were assessed as providing very low certainty of evidence. Across all three studies, only one statistically significant effect was identified: exposure to e-cigarette radio advertising was found in one study to result in increased odds of young adults intending to use e-cigarettes. The GRADE Summary of Findings tables for adolescents and young adults are detailed in the technical report (Tables 2 and 3 respectively).

1.1. Effect of radio advertising on e-cigarette uptake/initiation in adolescents (12-17 years)

One cohort study with a follow-up period of 2.5 years reported on this outcome.[77] Very low certainty evidence was found that exposure to e-cigarette radio advertising increased initiation in never e-cigarette adolescent users compared to those who were not exposed (OR 1.24, 95% CI 0.76–2.01, 2288 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

1.2. Effect of radio advertising on e-cigarette uptake/initiation in young adults (12-29 years)

One cohort study with a follow-up period of 2.5 years reported on this outcome.[77] Very low certainty evidence was found that exposure to e-cigarette radio advertising might be associated with decreased odds of e-cigarette initiation in never e-cigarette young adult users compared to those who were not exposed (OR 0.99, 95% CI 0.77–1.27, 2,423 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

1.3. Effect of radio advertising on current e-cigarette use in adolescents (12-17 years)

One cohort study with a follow-up period of 6 months reported on this outcome among adolescents who at baseline were never, ever, or current users of e-cigarettes.[84] Very low certainty evidence was found of no clear effect of exposure to e-cigarette radio advertising on current e-cigarette use at follow-up compared to non-exposure (OR 0.95, 95% CI 0.51–1.79, 2488 participants). The 95% CI crossed the line of no effect, indicating statistical non-significance.

1.4. Effect of radio advertising on e-cigarette ever use in adolescents (12-17 years)

One cohort study with a follow-up period of 6 months reported on this outcome among never, ever, and current adolescent users of e-cigarettes.[84] Very low certainty evidence was found that exposure to e-cigarette radio advertising was associated with decreased odds of being an e-cigarette ever user at follow-up compared to non-exposure (OR 0.82, 95% CI 0.31–2.18, 2,488 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

1.5. Effect of radio advertising on intentions to use e-cigarettes in adolescents (12-17 years)

Two cohort studies reported on this outcome among never, ever and current e-cigarette users, and never users of combustible cigarettes, with follow-up periods of 6 months and 12 months.[84][107] These studies found that adolescents' exposure to e-cigarette radio advertising was associated with increased intentions to use e-cigarettes compared to non-exposure (OR 1.36, 95%CI 0.92-2.01, 2 studies, 13,711 participants).[84][107] However, the 95% CI crossed the line of no effect, indicating statistical non-significance. The forest plot is shown in Figure 7.

Figure 7: Forest plot for effect of radio advertising on intentions to use e-cigarettes among adolescents (cohort studies)
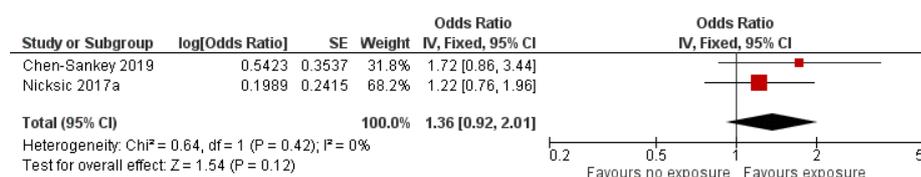
1.6. Effect of radio advertising on intentions to use e-cigarettes in young adults (18-25 years)

One cohort study with a follow-up period of 12 months reported on this outcome.[107] It found that exposure to radio e-cigarette advertising resulted in increased odds of intending to use e-cigarettes among young adult never users of e-cigarettes and never users of combustible cigarettes compared to those who were not exposed (OR 6.36, 95% CI 1.57–25.66, 9,804 participants).

2. Effect of television and radio (combined) advertising

One cohort study from the US examined the effect of television and radio (combined) e-cigarette advertising on the primary outcome of ever use.[57] The GRADE Summary of Findings table for adolescents is detailed in the technical report (Table 4).

2.1. Effect of television and radio (combined) advertising on e-cigarette ever use in adolescents (12-17 years)

Very low certainty evidence was found in the cohort study that exposure to e-cigarette advertising on television and radio did not have an effect on ever use in adolescent who were never users of e-cigarettes at baseline (OR 0.85, 95% CI 0.43-1.69, 1,742 participants), when compared to those who were not exposed.[57] However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

3. Effect of television advertising

Eleven studies examined the effect of television e-cigarette advertisements.[52 53 68 73 74 77 84 86 94 96 107] All studies were conducted in the US. Two were randomised controlled trials,[68 86] five were cohort studies,[52 74 77 84 107] and four were cross-sectional studies.[53 73 94 96]

Of the 11 identified studies, six addressed primary outcome variables and eight addressed secondary outcome variables. All studies examining primary outcome variables were assessed as providing low to very low certainty of evidence. Across the 11 studies, exposure to e-cigarette advertising on television was typically found to result in increased odds of the outcomes of interest among adolescents, young adults, and adults. The GRADE Summary of Findings tables for adolescents, young adults, and adults are detailed in the technical report (Tables 5, 6, and 7, respectively).

3.1. Effect of television advertising on e-cigarette uptake/initiation in adolescents (12-17 years)

Two cohort studies[74][77] reported on this outcome for adolescents, with follow-up periods of 2.5 and 3 years. At baseline, the studies included never adolescent users of e-cigarettes and never adolescent users of cigarettes and e-cigarettes, respectively.

Very low certainty evidence was found that exposure to e-cigarette advertising on television was associated with greater e-cigarette uptake compared to non-exposure (OR 1.11, 95% 0.80–1.55, 2 studies, 16,036 participants).[74][77] However, the 95% CI crossed the line of no effect, indicating statistical non-significance. The forest plot is shown in Figure 8.

Figure 8: Forest plot for effect of television e-cigarette advertising on e-cigarette initiation among adolescents (cohort studies)
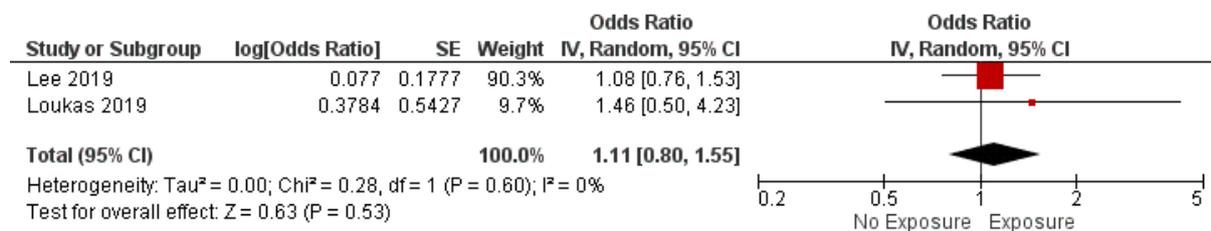
3.2. Effect of television advertising on e-cigarette uptake/initiation in young adults (18-29 years)

One cohort study[77] with a follow-up period of 2.5 years reported on this outcome. Very low certainty evidence was found that daily exposure to e-cigarette advertising on television increased the odds of e-cigarette uptake in young adult never users compared to those who were unexposed (OR 1.29, 95% CI 1.03–1.63, 2423 participants).

3.3. Effect of television advertising on e-cigarette ever use in adolescents (12-17 years)

One cohort study with a follow-up period of 6 months reported on this outcome among adolescents who were never, ever, or current users of e-cigarettes at baseline.[84] Very low certainty evidence was found of an association between exposure to e-cigarette advertising on television and being an ever e-cigarette user at follow-up (OR 1.36, 95% CI 0.58–3.19, 2,488 participants).[84] However, the 95% CI crossed the line of no effect, indicating statistical non-significance

3.4. Effect of television advertising on ever e-cigarette ever use in adults (≥ 18 years)

One cross-sectional study reported on this outcome.[53] Low certainty evidence was found of an association between exposure to e-cigarette advertising on television and

ever e-cigarette use (regression coefficient 0.02, 95% CI 0.0-0.03, 98,746 participants).

3.5. Effect of television advertising on current e-cigarette use in adolescents (12-17 years)

One cohort study with a follow-up period of 6 months[84] conducted among never, ever, and current adolescent users of e-cigarettes and one cross-sectional study[94] reported on this outcome

Very low certainty evidence from both the cohort study (OR 1.09, 95% CI 0.67–1.79, 3,907 participants)[84] and the cross-sectional study (OR 1.38, 95% CI 1.20–1.60, 21,595 participants)[94] indicated increased odds of current e-cigarette use among those reporting exposure to television e-cigarette advertising compared to those who were not exposed. However, for the cross-sectional study, the 95% CI crossed the line of no effect, indicating statistical non-significance.

3.6. Effect of television advertising on current e-cigarette use in adults (≥ 18 years)

One cohort study with a follow-up period of 5 months[52] and one cross-sectional study[53] reported on this outcome among never, current, and ever e-cigarette users and never and current cigarette users, respectively.

Both the cohort study (OR 1.57, 95% CI 1.04–2.37, very low certainty of evidence, 2191 participants)[52] and the cross-sectional study (regression coefficient 0.02, 95% CI 0.01-0.04, low certainty of evidence, 98,709 participants)[53] indicated increased likelihood of being a current e-cigarette user among those exposed to television e-cigarette advertising.

3.7. Effect of television advertising on current combustible cigarette use in adults (≥ 18 years)

One cross-sectional study reported on this outcome.[53] Low certainty evidence was found among adults that exposure to television e-cigarette advertising was associated with current cigarette use (regression coefficient 0.02, 95% CI 0.01-0.03, 98,503 participants).

3.8. Effect of television advertising on frequency/intensity of consumption of combustible cigarette use in adults (≥ 18 years)

One cross-sectional study reported on this outcome.[53] Low certainty evidence was found among adults that exposure to e-cigarette advertising was not associated with total number of cigarettes smoked per month (regression coefficient 0.00, 95% CI 0.00-0.01, 12,361 participants).

3.9. Effect of television advertising on intentions to use e-cigarettes in adolescents (12-17 years)

Three studies reported on this outcome in adolescents.[84] [94] [107] Two were cohort studies[84] [107] with follow-up periods of six months to 12 months and one was a cross-sectional study.[94]

The cohort studies found that adolescents exposed to television e-cigarette advertising were more likely than those who were unexposed to intend to use e-cigarettes (OR 1.41, 95% CI 1.02-1.94, 2 studies, 13,711 participants).[84] [107] At baseline, few participants were ever and current adolescent e-cigarettes users while most were never users of e-cigarettes and combustible cigarettes. The forest plot is presented in Figure 9.

Figure 9: Forest plot for effect of television e-cigarette advertising on intentions to use e-cigarettes among adolescents (cohort studies)
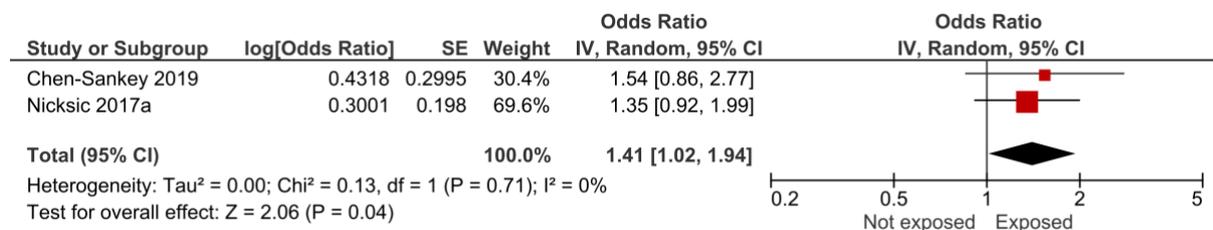
The cross-sectional study found that exposure to television e-cigarette advertising was associated with greater intentions to use e-cigarettes compared to non-exposure (OR 1.31, 95% CI 1.07–1.59, 21595 participants).[94]

3.10. Effect of television advertising on intentions to use e-cigarettes in young adults (18-25 years)

One cohort study with a follow-up of 12 months[107] and one cross-sectional study[73] reported on this outcome.

The cohort study found that exposure to television e-cigarette advertising among never user (e-cigarettes and combustible cigarettes) young adults increased the odds of intending to use e-cigarettes compared to non-exposure (OR 9.22, 95% CI 1.96–43.36, 9804 participants).[107]

Similarly, the cross-sectional study found that e-cigarette current users had greater intentions (urges) to use e-cigarettes (mean=42.1, SD=1.9) compared to non-users (mean=40.3, SD=2.4, 519 participants)[73] after seeing television e-cigarette advertisements.

3.11. Effect of television advertising on intentions to use e-cigarettes in adults (≥ 18 years)

Two randomised controlled trials reported on this outcome.[68][86] The two studies could not be pooled because they used different comparators. The trials found that:

- Never and ever e-cigarette adult users exposed to e-cigarette advertising on television had increased odds of intending to use e-cigarettes compared to a control group (OR 1.54, CIs not reported, p=0.001, 5020 participants).[68]

- Exposure to low youth appeal advertisements (that had more health-related claims) on television increased never e-cigarette and cigarette adult users' intentions to use e-cigarettes compared to those exposed to non-e-cigarette advertisements (OR 1.80, CI not reported, p=0.03, 1267 participants). A similar result was reported for high youth value advertisements (OR 1.30, CIs not reported).[86] However, the p value indicated statistical non-significance for both analyses.

3.12. Effect of television advertising on young adults' (18-25 years) knowledge, attitudes, and beliefs relating to e-cigarettes

One cross-sectional study reported on this outcome.[96] It found that compared to non-exposure, exposure to e-cigarette advertising on television was associated with stronger beliefs among young adults that e-cigarette use is acceptable in bars (OR 1.37, 95% CI 1.20–1.57, 4793 participants), stores (OR 1.33, 95% CI 1.15–1.53, 4784 participants), at work (OR 1.23, 95% CI 1.07–1.41, 4792 participants), in class (OR 1.25, 95% CI 1.07–1.45, 4792 participants), and in dorms (OR 1.33, 95% CI 1.15–1.52, 4799 participants).

3.13. Effect of television advertising on adults' (≥ 18 years) knowledge, attitudes, and beliefs relating to e-cigarette use

Two randomised controlled trials[68][86] and a cross-sectional study[53] reported on this outcome.

The two randomised controlled trials used different comparators and hence could not be pooled. They found that:

- Exposure to television e-cigarette advertising led to greater odds of never and ever e-cigarette adult users agreeing that e-cigarettes are a safer alternative to cigarettes (OR 1.19, p=0.01, 5020 participants) and are less toxic (OR 1.16, p=0.03), and lower odds of agreeing that e-cigarettes are harmful or very harmful (OR=0.84, p=0.009) compared to the non-exposed control group.[68]

- Exposure to low youth appeal advertisements (that had more health-related claims) in never e-cigarette and cigarette adult users was associated with more positive beliefs about e-cigarettes (β = 0.22, p < .001, 465 participants), while exposure to

high youth appeal advertisements was associated with marginally increased positive beliefs compared to non-exposure (β = 0.08, p = .09, 428 participants).[86]

The cross-sectional study found that an increase in exposure by one additional e-cigarette advertisement on television was associated with a 0.18 percentage point increase in awareness of e-cigarettes in adults (p< 0.05).[53]

4. Effect of advertising on television and movies combined

Three cross-sectional studies[61] [80] [100] examined the combined effect of e-cigarette marketing on television and in movies. All the studies were conducted with school-aged adolescents (11-18 years) in the US and addressed primary outcome variables. The studies were assessed as providing very low certainty of evidence. One study also addressed a secondary outcome variable. In the one study assessing the ever use primary outcome, exposure to e-cigarette advertising resulted in increased odds of ever e-cigarette use in adolescents compared to no exposure. However, across all three studies there was no clear evidence that greater exposure in the past 30 days (sometimes/most of the time/always) to e-cigarette advertising on television and movies combined resulted in increased odds of current e-cigarette use compared to no or rare exposure among adolescents. The GRADE Summary of Findings tables for adolescents and young adults are detailed in the technical report (Table 8).

4.1. Effect of advertising on television and movies (combined) on current use of e-cigarettes in adolescents (12-17 years)

Two studies examined exposure to e-cigarette marketing on television/movies on current use of e-cigarettes with exposure to e-cigarette marketing on television/movies.[61] [80] However, they were assessed separately as the data were presented in different formats so pooling was not feasible.

Very low certainty evidence was found that self-reported exposure to e-cigarette marketing on television/movies (sometimes/most of the time/always) was associated with greater odds of current use of e-cigarettes (OR 1.41, 95% CI 1.22-1.62, 22,007 participants) compared to being never/rarely exposed.[80]

Very low certainty evidence found that exposure to e-cigarette ads on television /movies was not significantly associated with current e-cigarette use compared to no exposure or exposure rarely (OR 0.9, p value non-significant, confidence intervals not reported, 21,491 participants).[61]

4.2. Effect of advertising on television and movies (combined) on current e-cigarette use in middle school students (11-13 years)

One study examined current e-cigarette use among middle school students.[100] The total number of participants was 9027. Very low certainty evidence was found that exposure to e-cigarette advertising on television/movies sometimes resulted in greater

odds of current e-cigarette use compared to exposure to advertising never/rarely (OR 1.25, 95% CI 0.87-1.80). However, the 95% CI crossed the line of no effect, indicating statistical non-significance. More frequent exposure (most of the time/always) was associated with greater odds of current e-cigarette use compared to exposure never or rarely (OR 1.80, 95% CI 1.30-2.49).[100]

4.3. Effect of advertising on television and movies (combined) on current e-cigarette use in high school students (14-18 years)

Very low certainty evidence was found that more frequent exposure to e-cigarette advertising on television/movies was associated with greater odds of current e-cigarette use. The total number of participants was 10,265. Results for different exposure categories were most of the time/always vs never/rarely (OR 1.24, 95% CI 1.04-1.50) and sometimes vs never/rarely (OR 1.54, 95% CI 1.28-1.86).[100]

4.4. Effect of advertising on television and movies (combined) on e-cigarette ever use in adolescents (12-17 years)

One study found very low certainty evidence that exposure to e-cigarette advertising on television /movies among middle and high school students was associated with increased odds of ever using e-cigarettes (OR 1.20, 95% CI 1.07-1.35, 22,007 participants).[80]

4.5. Effect of advertising on intentions to use e-cigarette in adolescents (12-17 years)

Exposure to e-cigarette advertising on television /movies was associated with greater odds of susceptibility to e-cigarettes among adolescents (OR 1.16, 95% CI 1.07-1.27, 22,007 participants).[80]

5. Effect of billboard/poster advertising

Four studies examined the effect of e-cigarette advertisements on billboards and posters.[57 77 84 107] All four were cohort studies conducted in the US and addressed primary outcome variables, with two also addressing secondary outcome variables. All studies examining primary outcome variables were assessed as providing very low certainty of evidence and produced statistically non-significant findings. One study reported significantly increased odds of intentions to use e-cigarettes among young adults who were exposed to billboard advertising. The GRADE Summary of Findings tables are detailed in the technical report for adolescents and young adults (Tables 9 and 10, respectively)

5.1. Effect of billboard/poster advertising on e-cigarette uptake/initiation in adolescents (12-17 years)

One cohort study with a follow-up period of 2.5 years reported on this outcome among adolescents who were never users of e-cigarettes at baseline.[77] Very low certainty evidence was found that exposure to e-cigarette advertisements on billboards was associated with initiation (OR 1.30, 95% CI 0.89–1.91, 2,288 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

5.2. Effect of billboard/poster advertisements on e-cigarette uptake/initiation in young adults (18-29 years)

One cohort study with a follow-up period of 2.5 years reported on this outcome among young adults who were never users of e-cigarettes at baseline.[77] Very low certainty evidence was found that exposure to e-cigarette advertisements on billboards was associated with initiation (OR 1.10, 95% CI 0.87–1.41, 2,423 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

5.3. Effect of billboard/poster advertisements on current e-cigarette use in adolescents (12-17 years)

One cohort study with a follow-up period of 6 months reported on this outcome among adolescents who were never, ever, or current users of e-cigarettes at baseline.[84] Very low certainty evidence was found that exposure to e-cigarette advertisements on billboards decreased the odds of adolescents being current e-cigarette users (OR 0.75, 95% CI 0.42–1.33, 2,488 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

5.4. Effect of billboard/poster advertisements on e-cigarette ever use in adolescents (12-17 years)

Two cohort studies with follow-up periods of 6 months and 9 months, respectively, reported on this outcome.[57,84] The studies included adolescents who were never, ever, or current users of e-cigarettes at baseline. Very low certainty evidence was found that exposure to e-cigarette advertisements on billboards was associated with ever e-cigarette use (OR 1.08, 95%CI, 0.65-1.81, 2 studies, 4,230 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance. The forest plot is shown in Figure 10.

Figure 10: Forest plot for effect of billboard/poster advertisements on e-cigarette ever use among adolescents (cohort studies)

Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Fixed, 95% CI
Camenga 2018	0.01	0.4125	40.5%	1.01 [0.45, 2.27]
Nicksic 2017a	0.1222	0.3403	59.5%	1.13 [0.58, 2.20]
Total (95% CI)			100.0%	1.08 [0.65, 1.81]

Heterogeneity: Chi² = 0.04, df = 1 (P = 0.83); I² = 0%
Test for overall effect: Z = 0.29 (P = 0.77)

Odds Ratio IV, Fixed, 95% CI — 0.2 0.5 1 2 5 — Favours not exposed Favours exposed
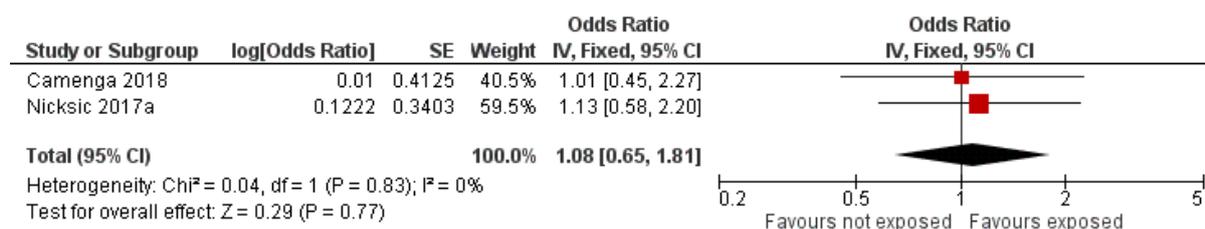
5.5. Effect of billboard/poster advertisements on intentions to use e-cigarettes in adolescents (12-17 years)

Two cohort studies with follow-up periods of 6 months and 12 months, respectively, reported on this outcome.[84] [107] At baseline, one of the studies included adolescents who were never, ever, or current users of e-cigarettes while the other included never users of e-cigarettes and cigarettes. Pooled analyses found exposure to e-cigarette advertisements on billboards was associated with intentions to use e-cigarettes (OR 1.22, 95%CI 0.87-1.72, 2 studies, 13,711 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance. The forest plot is shown in Figure 11.

Figure 11: Forest plot for effect of billboard/poster advertisements on intentions to use e-cigarettes among adolescents (cohort studies)

Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Fixed, 95% CI
Chen-Sankey 2019	0.3148	0.2924	35.7%	1.37 [0.77, 2.43]
Nicksic 2017a	0.1398	0.2181	64.3%	1.15 [0.75, 1.76]
Total (95% CI)			100.0%	1.22 [0.87, 1.72]

Heterogeneity: Chi² = 0.23, df = 1 (P = 0.63); I² = 0%
Test for overall effect: Z = 1.16 (P = 0.25)

Odds Ratio IV, Fixed, 95% CI — 0.2 0.5 1 2 5 — Favours not exposed Favours exposed
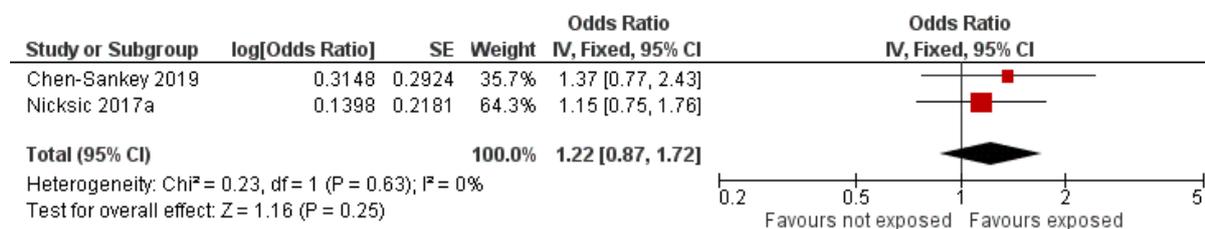
5.6. Effect of billboard/poster advertisements on intentions to use e-cigarettes in young adults (18-25 years)

One cohort study reported on this outcome.[107] It found that exposure to e-cigarette advertisements on billboards increased the odds of intending to use e-cigarettes in young adult never users of e-cigarettes and cigarettes (OR 7.00, 95% CI 1.43–34.43, 9804 participants).[107]

6. Effect of print media advertisements

Twelve studies examined this outcome.[53] [57] [61] [80] [94] [96] [100] [101] [108] [110] [107] [111] Three were conducted in the UK[108] [110] [111] and the remaining nine studies were conducted in the US. Two of the 12 studies were cohort studies,[57] [107] seven were cross-sectional studies,[53] [61] [80] [94] [96] [100] [101] and three were randomised controlled trials[108] [110] [111].

Of the 12 identified studies, eight addressed primary outcome variables and eight addressed secondary outcome variables. Five studies examining primary outcome variables were assessed as providing very low certainty of evidence while three each provided high and moderate certainty of evidence and one provided low certainty of evidence. Across eight studies, exposure to e-cigarette advertising on print media was found to result in increased odds of the outcomes of interest among adolescents, young adults, and adults. There was no statistically significant effect of exposure on ever e-cigarette use in adolescents and adults, current e-cigarette use in adolescents and adults, frequency of cigarette use in adults, intentions to use e-cigarettes in adolescents and knowledge, attitudes, and beliefs relating to e-cigarette use in adolescent users. The GRADE Summary of Findings tables for adolescents and adults are detailed in the technical report (Tables 11 and 12, respectively)

6.1. Effect of print media advertisements on e-cigarette ever use in adolescents (12-17 years)

Two studies reported on this outcome, one of which was a cohort study with a follow-up period of 9 months[57] and the other was a cross-sectional study.[80]

The cohort study found very low certainty evidence that exposure to e-cigarette advertisements in print media among never e-cigarette adolescent users was associated with decreased odds of e-cigarette ever use compared to non-exposure (OR 0.88, 95% CI 0.59-1.30, 1742 participants).[57] However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

The cross-sectional study found moderate certainty evidence that exposure to e-cigarette advertisements in print media was associated with greater odds of e-cigarette ever use compared to non-exposure (OR 1.22, 95% CI 1.07-1.39, 22,007 participants).[80]

6.2. Effect of print media advertisements on e-cigarette ever use in adults (≥ 18 years)

One cross-sectional study reported this outcome.[53] It found very low certainty evidence that exposure to e-cigarette advertisements in print media was not associated with e-cigarette ever use (regression coefficient 0.01, 95% CI -0.00 to 0.01, 98,746 participants).

6.3. Effect of print media advertisements on current e-cigarette use in adolescents (12-17 years)

Five studies reported on this outcome, one of which was a randomised controlled trial[108] and four of which were cross-sectional studies.[61 80 94 100]

The randomised controlled trial[108] assessed the effects of exposure to e-cigarettes categorised as either 'glamorous' (depicting e-cigarettes as cool, attractive,

fashionable, and popular, and featuring attractive young people) or 'healthy' (featuring people wearing white coats and claiming e-cigarettes can aid smoking cessation, do not contain carcinogens found in tobacco cigarettes, and are 'safe and healthy') among never and ever cigarette and e-cigarette adolescent users. The trial reported three comparisons and found:

- Very low certainty evidence was found that adolescents exposed to 'glamourous' e-cigarette advertisements in print media had higher levels of current e-cigarette use at follow-up compared to those in a control group who were not exposed to any advertisements (U=7461.000, Z=−2.213, p=0.027, r=0.136, 373 participants). However, the p value indicated statistical non-significance.

- Very low certainty evidence was found that adolescents exposed to 'glamourous' e-cigarette advertisements in print media had higher levels of current e-cigarette use compared to those exposed to 'healthy' e-cigarette advertisements (U=7981.500, Z=−2.334, p=0.020, r=0.140, 377 participants). However, the p value indicated statistical non-significance.

- Very low certainty evidence of no difference in current use between adolescents who were exposed to 'healthy' e-cigarette advertisements in print media and those in a control group who were not exposed to any advertisements (U=9003.000, Z=−0.153, p=0.879, r=0.009, 378 participants). However, the p value indicated statistical non-significance.

Pooling of results from two cross-sectional studies[80][94] found moderate certainty evidence that exposure to e-cigarette advertisements in print media was associated with increased odds of current e-cigarette use compared to non-exposure (OR 1.33, 95% CI 1.19-1.48, 2 studies, 43,602 participants). The forest plot is shown in Figure 12.

Figure 12: Forest plot for effect of print media advertisements on current e-cigarette use among adolescents (cross-sectional studies)
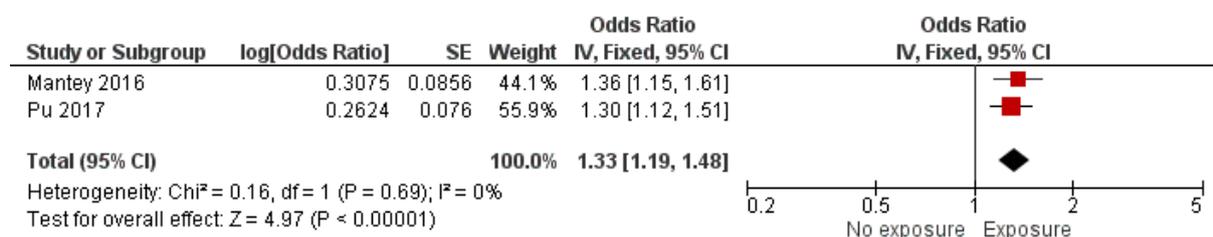
The third cross-sectional study provided disaggregated data for middle and high school adolescents,[100] and hence was not pooled with those reported above. High certainty evidence was found that middle school students with high levels of exposure (exposed most of the time/always) to e-cigarette advertising in print media had higher odds of current e-cigarette use compared to those who were never or rarely exposed (OR 1.87, 95% CI 1.21–2.87, 6,418 participants). The study showed dose response effects. High certainty evidence was also found that high school students

with high exposure to e-cigarette advertising in print media had higher odds of current e-cigarette use (OR 1.71, 95% CI 1.25–2.33, 8,312 participants) compared to non-exposure. The study showed dose response effects.

Moderate certainty evidence was found in the fourth cross-sectional that high exposure to e-cigarette advertising in print media (defined as read newspapers or magazines most of the time/always) had no clear effect on current e-cigarette use compared to low exposure (defined as don't read newspapers or magazines) (OR 0.9, 95% CI not reported 21,491 participants). The p value indicated statistical non-significance.[61]

6.4. Effect of print media advertisements on current e-cigarette use in adults (≥ 18 years)

One cross-sectional study reported on this outcome.[53] Very low certainty evidence was found that exposure to e-cigarette advertisements in print media was not associated with current e-cigarette use (regression coefficient -0.02, 95%CI -0.04 to -0.01, 98746 participants).[53]

6.5. Effect of print media advertisements on current cigarette use in adults (≥ 18 years)

One cross-sectional study reported on this outcome.[53] Low certainty evidence was found that exposure to e-cigarette advertisements in print media was associated with current cigarette use compared to non-exposure (regression coefficient 0.02, 95% CI 0.01-0.02, 98,746 participants).[53]

6.6. Effect of print media advertisements on frequency of e-cigarette use in adolescents (12-17 years)

One cross-sectional study reported on this outcome.[61] High certainty evidence was found that high exposure (defined as read newspapers or magazines most of the time/always) to e-cigarette advertising in print media was associated with higher odds of more frequent e-cigarette use (defined as >20 days within the past 30 days) compared to low exposure (defined as read newspapers or magazines never/rarely) (OR 3.40, p < 0.001, 2,017 participants).[61] The study showed dose response effects.

6.7. Effect of print media advertisements on frequency of combustible cigarette use in adults (≥ 18 years)

One cross-sectional study reported on this outcome.[53] Very low certainty evidence was found that exposure to e-cigarette advertising in print media had no clear effect on total number of cigarettes smoked per month compared to non-exposure (regression coefficient -0.00, 95% CI -0.00-0.00, 98,746 participants).

6.8. Effect of print media advertisements on intentions to use e-cigarettes in adolescents (12-17 years)

Six studies reported on intentions to use e-cigarettes among adolescents. Three were randomised controlled trials,[108 110 111] one was a cohort study with a follow-up of 1 year,[107] and two were cross-sectional studies.[80 94]

The three randomised controlled trials[108 110 111] had different types of comparisons and outcome data, thus preventing meta-analysis. These studies found that:

- Exposure to flavoured e-cigarette advertisements in print media was associated with increased intentions to use e-cigarettes among adolescents who never used e-cigarettes and never used combustible cigarettes (Mann-Whitney test, U=9140.000, Z=-3.949, p<0.001, 598 participants).[110]

- Exposure to 'glamourous' e-cigarette advertisements (depicting e-cigarettes as cool, attractive, fashionable, and popular, and featuring attractive young people) in print media was associated with decreased intentions to use e-cigarettes (mean rank=660.39, Mann-Whitney U=69 202.500, Z=−14.298, p<0.001, 1,449 participants) compared to never e-cigarette and cigarette adolescent users who were in the control group and were shown advertisements of pens.[111]

- Exposure to advertisements depicting e-cigarettes as glamourous and healthy in print media had no clear effect on intentions to use e-cigarettes among adolescent never e-cigarette users (Mean (SD): 1.36 (0.49) and 1.44 (0.57), respectively, 278 participants).[108]

The cohort study found exposure to e-cigarette advertisements in print media to be associated with higher odds of intending to use e-cigarettes compared to non-exposure among adolescents who never used e-cigarettes and never used combustible cigarettes (OR 1.38, 95% CI 0.78–2.44, 9804 participants).[107] However, the 95% CI crossed the line of no effect, indicating statistical non-significance. The cross-sectional studies found that exposure to e-cigarette advertisements in print media was associated with greater intentions to use e-cigarettes compared to non-exposure (OR 1.24, 95% CI 1.13-1.35, 2 studies, 43,602 participants).[80 94] The forest plot is show in Figure 13.

Figure 13: Forest plot for effect of print media advertisements on intentions to use e-cigarettes among adolescents (cross-sectional study)
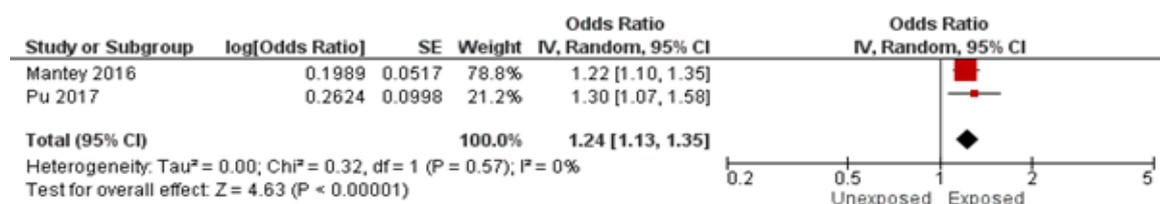
6.9. Effect of print media advertisements on intentions to use e-cigarettes in young adults (18-25 years)

One cohort study with a follow-up of 1 year reported on this outcome in young adult never e-cigarette users and never combustible cigarette users.[107] It found that exposure to e-cigarette advertisements in print media was associated with increased odds of intending to use e-cigarettes compared to non-exposure (OR 6.11, 95% CI 1.21–30.89, 9804 participants).[107]

6.10. Effect of print media advertisements on intentions to use e-cigarettes in adults (≥ 18 years)

One cross-sectional study reported on this outcome.[101] It found that exposure to e-cigarette advertisements in print media was associated with stronger intentions to use e-cigarettes among exposed smokers compared to exposed non-smokers ($\chi 2$ = 91.95, p-value < 0.001, Cramer's V = .554, 600 participants).[101]

6.11. Effect of print media advertisements on adolescents' (12-17 years) knowledge, attitudes, and beliefs relating to e-cigarette use

Two randomised controlled trials[110][111] and one cross-sectional study[101] reported on this outcome.

The two randomised controlled trials had different types of comparisons, thus preventing meta-analysis. These studies found that:

- Flavoured e-cigarette advertisements in print media were considered more appealing by adolescent never e-cigarette users and never combustible cigarette users than ads for non-flavoured e-cigarettes (Mann-Whitney test, U=10,056.500, Z=-2.777, p=0.005, 598 participants).[110]

- Exposure to print advertisements depicting e-cigarettes as glamorous (cool, attractive, fashionable, and popular, and featuring attractive young people) was associated with lower perceived danger of occasional tobacco smoking compared to non-exposure among adolescent never e-cigarette users and never combustible cigarette users (mean rank = 546.84, Mann-Whitney U=129045.500, Z=-2.129, p=0.033, 1449 participants).[111] However, the p value indicated statistical non-significance.

The cross-sectional study reported that exposure to e-cigarette advertisements in print media had a strong relationship with positive attitudes about the product ($\chi 2$= 31.117, p-value < 0.001, Cramer's V = .322).[101]

6.12. Effect of print media advertisements on adults' (≥ 18 years) knowledge, attitudes, and beliefs relating to e-cigarette use

One cross-sectional study reported on this outcome.[53] An increase in exposure to e-cigarette advertisements in magazines by one unit was associated with a 0.19 percentage point increase in awareness of e-cigarettes in adults (p < 0.05).

6.13. Effect of print media advertisements on young adults' (18-25 years) e-cigarette-related knowledge, attitudes, and beliefs

One cross-sectional study reported on this outcome.[96] Compared to non-exposure, exposure to e-cigarette advertisements in print media was associated with the belief that the use of e-cigarettes is acceptable in bars (OR 1.05, 95% CI, 0.91–1.21, 6,819 participants), at work (OR 1.06, 95% CI 0.92–1.23, 6,819 participants), and in dorms (OR 1.06, 95% CI 0.91–1.22, 6819 participants), but not in stores (OR 0.99, 95% CI 0.85–1.15, 6,819 participants) or in class (OR 0.96, 95% CI 0.82–1.13, 6,819 participants). However, for all results the 95% CI crossed the line of no effect, indicating statistical non-significance.[96]

7. Effect of advertisements disseminated via social media

Eight studies examined this outcome.[57 59 71 74 78 98 103 106] All the studies were conducted in the US and studied the effects of e-cigarette advertisements disseminated via social media in general or specific social media platforms (e.g. Facebook, YouTube, Twitter, Pinterest/Google Plus). Three of the eight studies were cohort studies,[57 59 74] four were cross-sectional,[71 78 98 103] and one was a randomised controlled trial.[106]

Of the eight identified studies, six addressed primary outcome variables and four addressed secondary outcome variables. Two of the studies were assessed as providing moderate certainty of evidence, with remainder being low or very low certainty of evidence. Across most of the studies, exposure to e-cigarette advertising on social media was found to result in increased odds for various outcomes of interest among adolescents and young adults. The GRADE Summary of Findings tables are detailed in the technical report for adolescents and young adults for advertisements disseminated via Facebook, Twitter, YouTube, and Pinterest/Google Plus (Tables 13, 14, 15, 16, 17, 18, and 19, respectively).

7.1. Effect of social media advertisements on e-cigarette uptake/initiation in adolescents (12-17 years)

Two cohort studies with a maximum follow-up of 3 years reported on this outcome among adolescent never users of e-cigarettes and never users of combustible cigarettes.[59 74] Moderate certainty evidence was found that exposure to social media advertisements among adolescents was associated with increased odds of e-cigarette uptake compared to those who reported not seeing any online tobacco advertisements

(OR 2.60, 95% CI 1.56-4.35, 2 studies, 22,604 participants). The forest plot is shown in Figure 14.

Figure 14: Forest plot on effect of social media advertisements on e-cigarette initiation among adolescents (Cohort studies)
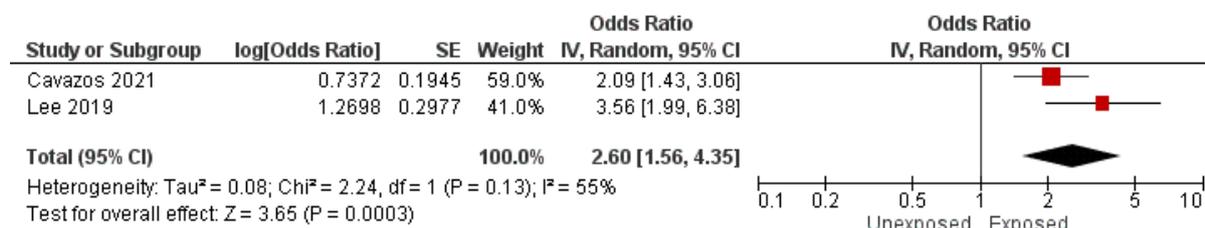
7.2. Effect of social media advertisements on e-cigarette ever use in adolescents (12-17 years)

One cohort study with a follow-up period of 9 months[57] and one cross-sectional study[71] reported on this outcome.

Very low certainty evidence was found in the cohort study that exposure to e-cigarette advertising on Facebook was associated with increased odds of ever e-cigarette use among adolescents who were never e-cigarette users at baseline (OR 2.20, 95% CI 1.37-3.52, 1742 participants).[57] The same cohort study produced very low certainty evidence in favour of the exposure to e-cigarette advertising on other social media platforms (listed below) on e-cigarette ever use in never e-cigarette adolescent users. However, the 95% CI crossed the line of no effect indicating statistical non-significance.

- Twitter: OR 1.23, 95% CI 0.82-1.84, very low certainty of evidence[57]
- YouTube: OR 1.28, 95% CI 0.53-3.09, very low certainty of evidence[57]
- Pinterest/Google Plus: OR 1.30, 95% CI 0.54-3.13, very low certainty of evidence[57]

Very low certainty evidence was found in the cross-sectional study that exposure to e-cigarette advertising on any social media platform was associated with greater odds of ever e-cigarette use compared to non-exposure (OR 1.16, 95% CI .82-1.63, 3907 participants).[71] However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

7.3. Effect of social media advertisements on e-cigarette ever use in young adults (18-25 years)

Two cross-sectional studies reported on this outcome.[78][98]

Very low certainty evidence was found that exposure to e-cigarette advertising on any social media platform increased the odds of being an e-cigarette ever user compared to non-exposure (3.01; 95% CI 1.63–9.05, 258 participants).[98]

Very low certainty evidence was found that exposure to e-cigarette advertising on YouTube was associated with e-cigarette ever use (OR 2.81,95% CI 1.72-4.59, 1,280 participants).[78]

7.4. Effect of social media advertisements on current e-cigarette use in adolescents (12-17 years)

One cross-sectional study reported on this outcome.[71] Very low certainty evidence was found that the exposure to e-cigarette advertising on social media in general was not associated with current e-cigarette use compared to non-exposure (OR 0.92, 95% CI 0.54–1.55, 3,907 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

7.5. Effect of social media advertisements on current e-cigarette use in young adults (18-25 years)

Two cross-sectional studies reported on ever use outcomes in young adults.[78 98]

Very low certainty evidence was found that exposure to e-cigarette advertisements on social media was associated with being a current e-cigarette user compared to non-exposure (OR 2.63, 95% CI 0.73–9.48, 258 participants).[98] However, the 95% CI crossed the line of no effect, indicating statistical non-significance

Very low certainty evidence was found that exposure to e-cigarette advertisements on YouTube was associated with current e-cigarette use compared to non-exposure (OR 3.64, 95% CI 2.19- 6.04, 1,280 participants).[78]

7.6. Effect of social media advertisements on intentions to use e-cigarettes in adolescents (12-17 years)

Two studies reported on this outcome – a randomised controlled trial[106] and a cross-sectional study.[71]

The randomised controlled trial found that exposed versus non-exposed had increased odds of intending to use e-cigarettes among adolescent never, ever, or current users of e-cigarettes and combustible cigarettes (d=0.36, F (1,126) =12.51, p=0.001, 135 participants).[106]

The cross-sectional study found that exposure to e-cigarette advertising on social media, compared to non-exposure, was associated with increased odds of intending to use e-cigarettes compared to non-exposure (OR 2.08, 95% CI 1.31–3.30, 3,907 participants).[71]

7.7. Effect of social media advertisements on intentions to use e-cigarettes in young adults (18-25 years)

Two cross-sectional studies reported on this outcome.[78][103] Exposure to e-cigarette advertising on social media was associated with higher odds of intending to use e-cigarettes (OR 1.31, 95% CI 0.85-2.01, 1280 participants; B=.01 SE=.01, p=.004, 296 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

7.8. Effect of social media advertisements on adolescents' (12-17 years) knowledge, attitudes, and beliefs relating to e-cigarettes

One randomised controlled trial study reported on this outcome. The sample comprised adolescent never, ever, and current users of e-cigarettes and combustible cigarettes at baseline.[106] Those reporting heavy exposure to e-cigarette advertising on YouTube had more positive attitudes towards e-cigarettes compared to low exposure [(F $(1,126)$ = 5.62, p = .019]. The study also found that exposure to e-cigarette advertising on social media was associated with greater perceptions of e-cigarettes as being normative compared to exposure to peer-generated posts about e-cigarettes (d=0.28, F $(1,126)$ =7.13, p=0.009).

8. Effect of point-of-sale advertising and marketing

Seventeen studies examined the effect of point-of-sale (POS) e-cigarette advertising and marketing. Eleven were cross-sectional studies,[61][63][65][66][69][80][91][94][100][118][119] and six were longitudinal cohort studies.[56][57][60][77][81][84] All studies involved samples from the US, with two also including participants from other high-income countries.[118][119] Of the 17 identified studies, 16 addressed primary outcome variables and five addressed secondary outcome variables. All studies examining primary outcome variables were assessed as providing low to very low certainty of evidence. Across the assessed studies, in most instances exposure to e-cigarette advertising at POS resulted in increased odds of the outcomes of interest among adolescents and young adults. Among adolescents, greater exposure to e-cigarette advertising at POS (sometimes/most of the time/always) was associated with greater odds of ever e-cigarette use compared to no exposure or exposure very rarely. Similar findings were reported for current e-cigarette use, with greater exposure resulting in greater odds of use compared to no or rare exposure. The GRADE Summary of Findings tables for adolescent, young adults, and adults are detailed in the technical report (Tables 20 and 21, respectively).

8.1. Effect of POS advertising and marketing on initiation of e-cigarettes in adolescents (12-17 years) and young adults (18-25 years)

One cross-sectional study[91] and one cohort study with a follow-up period of 2.5 years[77] reported on this outcome.

In the cohort study, very low certainty evidence was found that adolescents (never e-cigarette users at baseline) who recalled retail store–based e-cigarettes marketing had higher odds of subsequent e-cigarette initiation up to 2.5 years later compared to those with no recall (OR 1.99, 95% CI 1.25-3.1, 2,288 participants).[77] Similarly, very low certainty evidence was found that young adults (18-29 years) who never smoked at baseline who recalled store-based e-cigarette marketing had higher odds of subsequent e-cigarette initiation up to 2.5 years later compared to those with no recall of e-cigarette advertisements (OR 1.30 95% CI 1.05-1.61, 2,423 participants).[77]

Very low certainty evidence was found in the cross-sectional study that higher frequency of convenience store visits was associated with greater odds of e-cigarette initiation among young adults (OR 1.27, 95% CI 0.79-2.04, 470 participants).[91] However, the 95% CI crossed the line of no effect, indicating non-significance.

8.2. Effect of POS advertising and marketing on e-cigarettes ever use in adolescents (12-17 years)

Two cohort studies[57 84] and two cross-sectional studies[69 80] examined the effects of POS advertising on adolescents' ever use of e-cigarettes. The two cohort studies were not pooled as they included heterogenous populations (only never e-cigarette users[57] vs both never and current users[84]) and the two-cross-sectional studies were not pooled as the outcome measures were different.

In the cohort study with adolescent never and ever users of e-cigarettes, very low certainty evidence was found that those who recalled retail store e-cigarette advertisements had higher odds of ever e-cigarette use at follow-up compared to those who did not recall retail store advertisements (OR 2.99, 95% CI 1.50-5.97, 2,488 participants).[84]

In the cohort study with only adolescent never e-cigarette users, very low certainty evidence was found that those exposed to e-cigarette POS advertising in convenience stores had lower odds of being an e-cigarette ever user nine months later compared to those who were not exposed (OR 0.91, 95% CI 0.38-2.15, 1,742 participants).[57] A similar outcome was reported for exposure to POS advertising for e-cigarettes in tobacco shops (OR 0.80, 95% CI 0.47-1.36, 1,742 participants). However, the 95% CI crossed the line of no effect in both instances, indicating statistical non-significance.[57]

Very low certainty evidence was found in one cross-sectional study that among high school students, the adjusted prevalence ratio (aPR) for ever use of e-cigarettes with frequency of seeing ads in stores (most of the time or always vs never, rarely, or sometimes) was 1.25 (95% CI 1.14-1.36, 3,909 participants).[69] Low certainty evidence was found in the other cross-sectional study that exposure to retail e-cigarette advertising was associated with higher odds of e-cigarette ever use among middle and high school students (OR1.61, 95% CI 1.43-1.80, 22,007 participants.[80]

8.3. Effect of POS advertising and marketing on current e-cigarette use in adolescents (12-17 years) and young adults (18-25 years)

Nine studies, including one cohort study,[84] and eight cross-sectional studies,[61 69 80 91 94 100 118 119] examined this outcome.

The cohort study[84] found low certainty evidence that recall of retail store advertisements at baseline, compared to no recall, was associated with higher odds of current e-cigarette use at follow-up (OR 2.03, 95% CI 1.11-3.72, 2,488 participants).

Two cross-sectional studies were included in a meta-analysis.[80 94] Very low certainty evidence was found that adolescents exposed to retail store e-cigarette advertising were more likely to be current users of e-cigarettes compared to those who were not exposed (OR 1.48, 95% CI 1.08-2.03, 2 studies, 43,602 participants).[80 94] Both the studies used data from the 2014 National Youth Tobacco Survey (NYTS). However, there was high heterogeneity between the studies, possibly due to methodological or unexplained heterogeneity. The forest plot is shown in Figure 15.

Figure 15: Forest plot for effect of e-cigarette retail store marketing on adolescents' current e-cigarette use (cross-sectional studies)
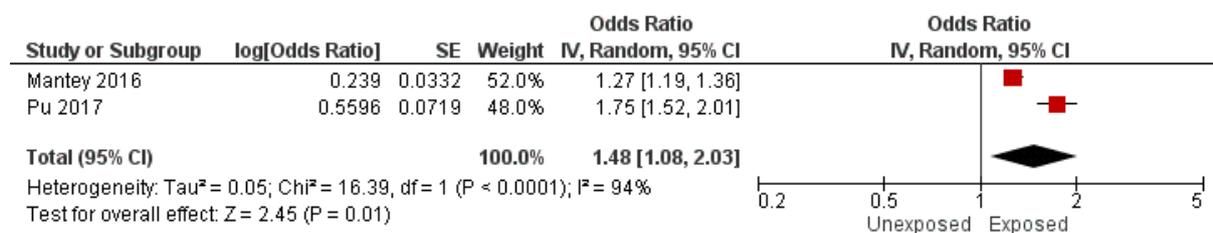
The third cross-sectional study found very low certainty evidence that current exclusive e-cigarette users were more likely than never users to report exposure to vaping product advertisements at POS (OR 1.89, 95% CI 1.48-2.41, 12,064 participants).[119]

A fourth cross-sectional study conducted in multiple countries found very low certainty evidence that past 30 days exposure to vaping product advertisements at POS among young adults was associated with greater odds of current e-cigarette use in current users (OR 1.6, 95% CI 1.4-1.9, 12,294 participants) and former smokers (OR 1.0, 95% CI 0.8-1.2, 12,294 participants). However, the 95% CI crossed the line of no effect for former smokers, indicating statistical non-significance.[118]

A fifth cross-sectional study found very low certainty evidence among adolescents that greater exposure to e-cigarette ads in retail stores was associated with greater odds of e-cigarette use (high exposure OR 1.9, p < .0001; medium exposure OR 1.3, p < 0.01, 21,491 participants).[61] Exposure to ads at POS was categorised as low (never/rarely), medium (sometimes), and high (most of the time/always).[61]

A sixth cross-sectional study found very low certainty evidence that higher frequency of convenience store visits was associated with greater odds of current e-cigarette use (OR 1.97, 95% CI 1.10-3.55).[91]

A seventh cross-sectional study found low certainty evidence that among middle school students, exposure to e-cigarette advertising in retail stores most of the time/always was associated with greater odds of current e-cigarette use compared to exposure never/rarely (OR 2.34, 95% CI 1.70-3.23, 8988 participants).[100] The same study found very low certainty evidence that among middle school students, exposure to e-cigarette advertising in retail stores sometimes was associated with greater odds of current e-cigarette use compared to exposure never/rarely (OR 1.78, 95% CI 1.30-2.45, 8988 participants).[100] Among high school students, very low certainty evidence was found that exposure to e-cigarette advertising in retail stores most of the time/always and sometimes was associated with higher odds of current e-cigarette use compared to exposure never/rarely (OR 1.91, 95% CI 1.56-2.35; OR 1.37, 95% CI 1.08-1.73, respectively, 10,310 participants).[100]

The final cross-sectional study found very low certainty evidence that among high school students, e-cigarette retail exposure was associated with past-month e-cigarette use. For every additional e-cigarette advertisement, the probability of past-month e-cigarette use increased by 1% (p = .031, 3,909 participants).[69]

8.4. Effect of POS advertising and marketing on current e-cigarette use in adults (≥18 years)

A cross-sectional study found very low certainty evidence among adult smokers of little to no difference in current e-cigarette use in states with laws prohibiting self-service displays of e-cigarettes compared to states without prohibition laws (OR 1.04, 95% CI 0.99-1.09, 894,997 participants).[65]

8.5. Effect of POS advertising and marketing on current e-cigarette use in alternative high school students

A cross-sectional study[56] found very low certainty evidence that among alternative high school (AHS) students (adolescents who fall behind in their education or are expelled from the school) who were dual users at baseline, exposure to POS tobacco and e-cigarette advertising (including advertising for e-cigarettes, cigarettes, cigars, and smokeless tobacco) was associated with greater use of e-cigarettes, vaporisers, and vape pens one year later (Beta coefficient regression (β) 0.25, Standard Error (SE)) 0.05, p < 0.001, 609 participants). However, it was unclear whether the effects were due to the combined assessment of e-cigarette and tobacco products advertising or only e-cigarette advertising.

8.6. Effect of POS advertising and marketing on current cigarette use in adolescents (12-17 years)

Four studies reported on this outcome. Two were cohort studies.[56 60] and two were cross-sectional studies.[63 119]

One cohort study[56] found very low certainty evidence that among AHS students who were smokers and e-cigarette users at baseline, exposure to POS tobacco advertising was associated with greater combustible cigarette use one year later (β 0.30, SE 0.04, p <.001, 609 participants).

A cohort study[60] found very low certainty evidence that e-cigarette retail store exterior advertising prevalence was associated with state smoking rate (prevalence ratio (PR) 1.03, 95% CI 1.0-1.06, 2,126 participants).

Pooled results from the two cross-sectional studies found moderate certainty evidence that among adolescents, exposure to e-cigarette advertising in retail stores was associated with greater odds of current use of combustible cigarettes compared to non-exposure (OR 1.69, 95% CI 1.06-2.68, 2 studies, 391,395 participants).[63 119] The forest plot is shown in Figure 16.

Figure 16: Forest plot of effect of retail stores marketing in adolescents (cross-sectional studies)
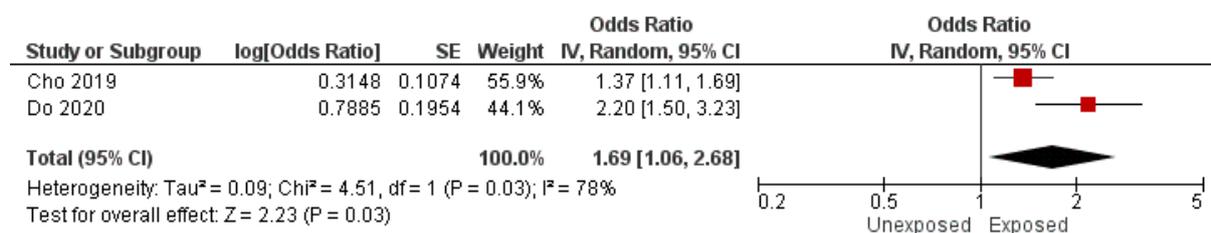
8.7. Effect of POS advertising and marketing on current dual use of e-cigarette and combustible cigarette in adolescents (12-17 years)

Two cross-sectional studies[63 119] reported on this outcome.

Very low certainty evidence was found among adolescents that e-cigarette ad exposures at POS were associated with higher odds of dual use versus never use compared to non-exposure (at retail stores that sell cigarettes: OR 1.83, 95% CI 1.43-2.35; at kiosks: OR 1.88, 95% CI 1.47-2.40, 12,064 participants).[119] Very low certainty evidence was found among high school students that POS tobacco advertising exposure was associated with greater odds of current dual use compared to non-exposure (OR 1.5, 95% CI 1.0-2.1, 379,331 participants).[63]

8.8. Effect of POS advertising and marketing on quitting e-cigarette and combustible cigarette use in young adult smokers (18-25 years)

One cohort study[81] reported on this outcome. Very low certainty evidence was found that young adults' exposure to advertising of e-cigarettes was negatively associated with cigarette smoking abstinence at 6-month follow-up (OR 0.85, 95% CI 0.72-1.01, 813 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

8.9. Effect of POS advertising and marketing on intentions to use e-cigarettes in adolescents (12-17 years)

One cohort study (follow up period 6 months)[84] and three cross-sectional studies[66 80 94] and reported on this outcome.

In a cohort study, adolescent never, ever, and current users of e-cigarettes who recalled e-cigarette advertisements in retail stores at baseline had higher odds of being susceptible to e-cigarette use at follow-up compared to those who did not recall advertisements (OR 1.77, 95% CI 1.20-2.61, 2,488 participants).[84]

The three cross-sectional studies were not pooled because they measured outcomes differently. Among adolescents who were never smokers and never e-cigarette users, high (most of the time/always) exposure to e-cigarette advertising at POS was associated with higher odds of e-cigarette susceptibility compared to low exposure (never/rarely) (OR 1.45, 95% CI 1.09-1.94, 13,428 participants).[66] Exposure to e-cigarette marketing was associated with susceptibility to e-cigarettes among never users (OR 1.30, 95% CI 1.20-1.41, 22,007 participants).[80] Exposure to e-cigarettes advertising via retail stores was associated with intention to try e-cigarettes among adolescents who had never used e-cigarettes (OR 1.32, 95% CI 1.07-1.62, 22,007 participants).[94]

8.10. Effect of POS advertising and marketing on intentions to use e-cigarettes in young adults (18-25 years)

In a cross-sectional study[91] of young adults, it was found that frequency of convenience store visits was not associated with e-cigarette susceptibility (OR 0.90, 95% CI 0.48-1.69, 470 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

9. Effect of Internet advertising and marketing

Eleven studies examined the effect of Internet e-cigarette advertising and marketing. One was a randomised controlled trial,[95] two were cohort studies,[77 84] and eight were cross-sectional studies.[61 80 82 94 96 100 104 117] Of the 11 identified studies, eight addressed primary outcome variables and seven addressed secondary outcome variables. All studies examining primary outcome variables were assessed as

providing low to very low certainty evidence. Across all 11 studies, exposure to e-cigarette advertising on the Internet was found to result in increased odds of the outcomes of interest among adolescents, with the exception of initiation of e-cigarette use for which no significant effect was found in the one study assessing this outcome. The Summary of Findings tables for adolescents and young adults are detailed in the technical report (Tables 22).

9.1. Effect of Internet advertising and marketing on initiation of e-cigarette use among adolescents (12-17 years) and young adults (18-25 years)

One cohort study[77] reported on this outcome. The study sample included participants were never e-cigarette users. Very low certainty evidence was found that among adolescents and young adults who were never users of combustible cigarettes, recall of exposure to e-cigarette marketing via the Internet was negatively associated with e-cigarette initiation among adolescents up to 2.5 years later (OR 0.85, 95% CI 0.61-1.18, 2,288 participants) and positively associated with e-cigarette initiation among young adults up to 2.5 years later (OR 1.20, 95% CI 0.97-1.48, 2,423 participants). The 95% CIs crossed the line of no effect, indicating statistical non-significance.

9.2. Effect of Internet advertising and marketing on e-cigarette ever use among school-aged adolescents (12-17 years)

One cohort study[84] and two cross-sectional studies[80] [104] reported on this outcome.

Very low certainty evidence was found from the cohort study[84] which included never, ever and current users of e-cigarettes at baseline that adolescents who recalled e-cigarette advertisements on the Internet (sometimes/most of the time/always) had higher odds of ever e-cigarette use compared to those who did not recall or rarely recalled the advertisements. However, the 95% CI crossed the line of no effect, indicating statistical non-significance (OR 1.24, 95% CI 0.92-1.69, 2,488 participants).

In one cross-sectional study,[80] very low certainty evidence was found that adolescents' exposure (sometimes/most of the time/always) to e-cigarette and cigarette advertising via the Internet was associated with greater odds of ever use of e-cigarettes compared to those who were not exposed or rarely exposed (OR 1.61, 95% CI 1.41-1.83, 22,007 participants).

In the other cross-sectional study,[104] very low certainty evidence was found that adolescents' exposure to e-cigarette and cigarette advertising on tobacco company websites was associated with greater odds of ever use of e-cigarettes compared to non-exposure (OR 3.20, 95% CI 2.30-4.50, 13,651 participants).

9.3. Effect of Internet advertising and marketing on current use of e-cigarettes in adolescents (12-17 years)

One cohort study[84] and five cross-sectional studies[61 80 94 100 104] reported on this outcome.

The cohort study included never, ever, and current users of e-cigarettes at baseline. Very low certainty evidence was found that adolescents who recalled viewing e-cigarette advertisements on the Internet sometimes/most of the time/always had greater odds of current e-cigarette use compared to those who did not recall or rarely recalled seeing advertisements (OR 1.20, 95% CI 0.70-2.07, 2,488 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance.[84]

Two cross-sectional studies[80 94] were sufficiently homogenous to be included in a meta-analysis. Low certainty evidence was found that adolescents' exposure (sometimes/most of the time/always) to e-cigarette and cigarette advertising via the Internet was associated with greater odds of current use of e-cigarettes compared to those who were not exposed or rarely exposed (OR 1.59, 95% CI 1.44-1.75, 2 studies, 43,602 participants). The forest plot is shown in Figure 17.

Figure 17: Forest plot of the effect of exposure to e-cigarette marketing via the Internet vs non-exposure on current e-cigarette use among adolescents (cross-sectional studies)

Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Random, 95% CI
Mantey 2016	0.4762	0.0677	54.0%	1.61 [1.41, 1.84]
Pu 2017	0.4511	0.0733	46.0%	1.57 [1.36, 1.81]
Total (95% CI)			100.0%	1.59 [1.44, 1.75]

Heterogeneity: Tau² = 0.00; Chi² = 0.06, df = 1 (P = 0.80); I² = 0%
Test for overall effect: Z = 9.34 (P < 0.00001)
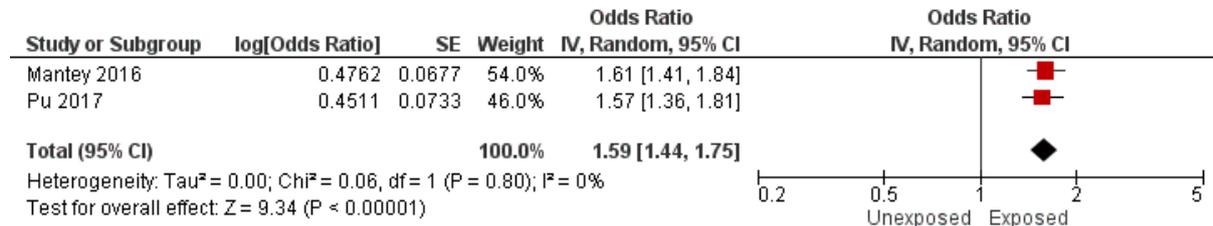
In the third cross-sectional study, very low certainty evidence was found that adolescents' exposure to e-cigarette and cigarette advertising websites was associated with greater odds of current use of e-cigarettes compared to non-exposure (OR 3.0, 95% CI 1.90-4.70, 13,651 participants).[104] In the fourth cross-sectional study, low certainty evidence was found that greater exposure of adolescents to e-cigarette ads on the Internet was associated with greater odds of using e-cigarettes (high exposure OR 1.9, p < 0.001; medium exposure OR 1.4, p < 0.01, 21,491 participants).[61]

In the fifth cross-sectional study, low certainty evidence was found that current e-cigarette use was greater among middle and high school students with exposure to e-cigarette advertising on the Internet most of the time/always compared to those exposed never/rarely (middle school students: OR 2.91, 95% CI 1.89-4.47, 9009 participants; high school students OR 2.02, 95% CI 1.66-2.46, 10,303 participants).[100] Low certainty evidence was found that current e-cigarette use was

greater among middle and high school students exposed to e-cigarette advertising on the Internet sometimes compared to those exposed never/rarely (middle school students: OR 1.44, 95% CI 1.03-2.00, 9009 participants; high school students: OR 1.49, 95% CI 1.22-1.84, 10,303 participants).[100]

9.4. Effect of Internet advertising and marketing on current cigarette use in adolescents (12-17 years)

Very low certainty evidence from a cross-sectional study[104] was found that adolescents viewing tobacco product company brand websites (both cigarettes and e-cigarettes) had greater odds of being current cigarette users (OR 3.2, 95% CI 2.2-4.4, 13,651 participants).

9.5. Effect of Internet advertising and marketing on current dual use among adolescents (12-17 years)

In one cross-sectional study,[82] very low certainty evidence was found that exposure to online multi-product (cigarettes, other tobacco products, and e-cigarettes) promotion was associated with greater odds of dual use among middle and high school students (OR 1.73, 95% CI 1.39-2.17, 15,328 participants).

9.6. Effect of Internet advertising and marketing on e-cigarette-related attitudes and beliefs among young adults (18-25 years)

One cross-sectional study[96] (5,983 participants) reported on this outcome. E-cigarette advertising exposure via the Internet among young adults was associated with beliefs that e-cigarette use is more acceptable in bars (OR 1.33, 95% CI 1.16-1.53), stores (OR 1.20, 95% CI 1.04-1.39), at work (OR 1.16, 95% CI 1.00-1.33), in class (OR 1.25, 95% CI 1.07-1.46), and in dorms (OR 1.35, 95% CI 1.17-1.55).

9.7. Effect of Internet advertising and marketing on e-cigarette-related attitudes and beliefs among adults (18 to 65 years)

One cross-sectional study[117] (964 participants) reported on this outcome. Adult smokers exposed to Internet e-cigarette advertising scored e-cigarettes as healthier than cigarettes (Cohen's d effect (Z) 2.21, p=0.027) but did not consider them more desirable or socially acceptable. Dual users in the sample reported e-cigarettes as healthier (Z 2.53, p=0.011) and more desirable (Z 2.04, p=0.042) than cigarettes.

9.8. Effect of Internet advertising and marketing on adolescents' (12-17 years) intentions to use e-cigarettes

One cohort study[84] and three cross-sectional studies[80 94 104] reported on this outcome.

In the cohort study[84] with adolescent never, ever, and current users of e-cigarettes at baseline, the odds of being susceptible to e-cigarette use were higher among those

who recalled e-cigarette advertisements on the Internet compared to those with no recall (OR 2.79, 95% CI 1.80-4.33, 2,488 participants).

Results from a meta-analysis of the three cross-sectional studies showed that adolescents' exposure to e-cigarette and cigarette advertising via the Internet was associated with greater odds of intending to use e-cigarettes compared to those who were not exposed (OR 1.80, 95% CI 1.28-2.54, 57,253 participants).[80][94][104] However, there was high heterogeneity across the three studies, possibly due to exposure type. The study by Unger et al.[104] specifically assessed exposure via tobacco brands' Internet websites compared to general Internet websites being assessed in the other two studies. The forest plot is shown in Figure 18.

Figure 18: Forest plot of effect of exposure to e-cigarette marketing via the Internet vs non-exposure on adolescents' intentions to use e-cigarettes (cross-sectional studies)
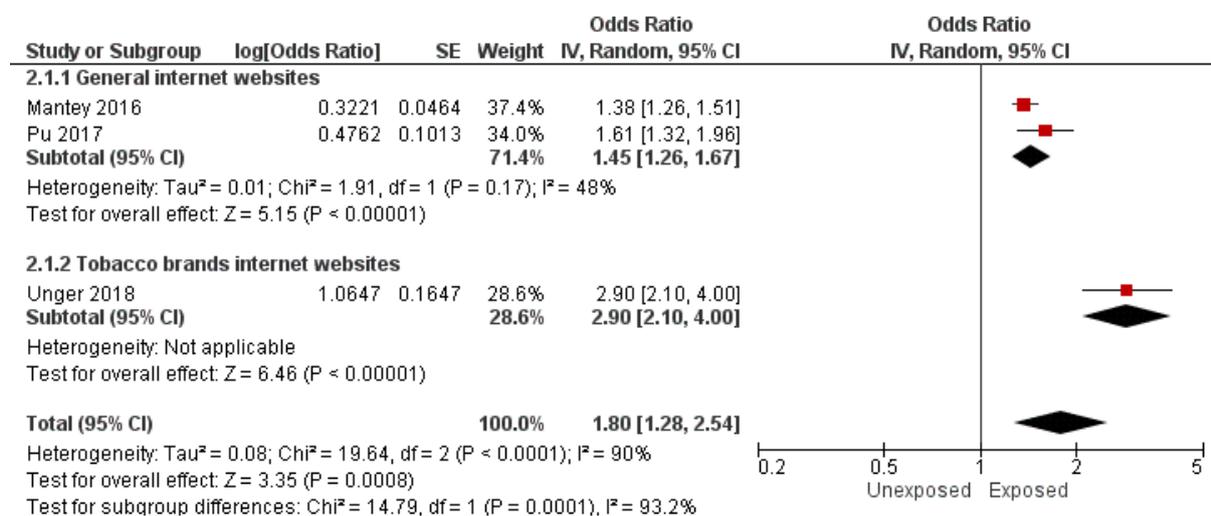
9.9. Effect of Internet advertising and marketing on adults' (18-34 years) intentions to use e-cigarettes

In a randomised controlled trial,[95] adult current cigarette smokers who had visited or registered on a tobacco company website were found to be more likely to try an e-cigarette than those who were not exposed to the same tobacco company website (OR 1.22, 95% CI 0.34-4.39, 2,110 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

10. Effect of mail (e-mail and/or postal) marketing

One study examined the effect of mail marketing of e-cigarettes.[62] The study was cross-sectional in design, included an adult sample, was conducted in the US, and covered both postal and email forms of mail advertising. The GRADE Summary of Findings tables are detailed in the technical report for adults for e-mail advertising, postal mail advertising and, postal and email advertising (Tables 23, 24 and 25, respectively).

10.1. Effect of mail marketing on current e-cigarette use in adults (≥18 years)

Low certainty evidence was found that exposure to mail (postal or e-mail) e-cigarette marketing was associated with higher odds of being a current e-cigarette user compared to non-exposure (OR 2.0, 95% CI 1.7–2.4, 5,382 participants).[62] When assessed by mail type, e-mail marketing had a stronger effect than postal mail (email: OR 2.6, 95%CI 2.1–3.1, low certainty of evidence, 3,422 participants; postal mail: OR 1.2, 95%CI 1.0–1.6, very low certainty of evidence, 1,960 participants).

10.2. Effect of mail marketing on frequency of e-cigarette use in adults (≥18 years)

Low certainty evidence was found that those who received any type of mailed e-cigarette marketing had increased odds of using e-cigarettes daily (OR 1.7, 95% CI 1.2–2.4, 5,382 participants) and on some days (OR 1.6, 95% CI 1.1–2.2, 5,382 participants) compared to those who did not receive such promotions.[62] When analysed separately, the results were stronger for email marketing over postal marketing (email: every day OR 2.0, 95% CI 1.4–3.0, low certainty evidence, 3422 participants; some days OR 1.5, 95% CI 1.1–2.2, low certainty evidence, 3422 participants; postal mail: every day OR 1.7, 95% CI 1.0–2.7, very low certainty evidence, 1,960 participants; some days OR 1.5, 95% CI 1.0-2.3, very low certainty evidence, 1,960 participants).[62]

11. Effect of multiple media advertising

Thirty-nine studies examined the effect of multiple media e-cigarette advertising. Four were randomised controlled trials,[83 92 95 105] one was a non-randomised trial,[79] nine were cohort studies,[64 74 77 84 89 90 107 114 116] and 25 were cross-sectional studies.[54 55 58 64 70 72 75 80 85 87 88 93 91 94 97 99 102 109 112 113 115 118-120 128] Most of the studies were conducted in the US, with the exceptions being studies conducted in the UK,[109] Canada,[112] Germany,[113 114] Finland,[115] and the Netherlands.[116] Three studies were conducted in multiple countries: one in Canada, England, and the US,[119] one in Australia, Canada, England, and the US,[118] and one in multiple countries in the European Union.[120]

Of the 38 identified studies examining the effects of exposure to e-cigarette advertising or marketing via multiple media sources, 28 addressed primary outcome variables and eight addressed secondary outcome variables in adolescents and young adults. Two studies addressed primary outcome variables and eight addressed secondary outcome variables in adults. One study examined ever e-cigarette use in pregnant women. Included studies assessed two or more e-cigarette advertising media exposure sources. In most of the studies, multiple media sources commonly included social media, Internet, print media, retail outlets, and billboards and posters.

Most studies examining primary outcome variables were assessed as providing very low certainty evidence. Across all 28 studies with adolescents and young adults, greater exposure to e-cigarette advertising via multiple media sources resulted in greater odds of initiation of e-cigarettes, ever use of e-cigarettes, and current cigarette use compared to non-exposure. The evidence on current e-cigarette use among adolescents and young adults was mixed, however most studies indicated that exposure to multiple media sources was associated with current use. Cumulative exposure to multiple media sources in the past 30 days and 6 months resulted in greater odds of current cigarette use compared to no exposure among adolescents and young adults. The GRADE Summary of Findings tables for adolescents and young adults, and adults, are detailed in the technical report (Tables 26 and 27, respectively).

11.1. Effect of multiple media advertising on initiation of e-cigarette use in adolescents (12-17 years)

Six studies examined initiation of e-cigarette use. Three were cohort studies[74 77 89] and three were cross-sectional studies.[58 91 115]

Three cohort studies examined initiation of e-cigarette use among adolescents, with follow-up periods ranging from 1 to 2.5 years.[74 77 89] Two of these studies assessed exposure to six media sources (broadcast, print, events, social media, Internet, POS) [74 77] and one study[89] assessed exposure to three media sources (print, direct mail, and television ads). The participants in the cohort studies were never e-cigarette users[74 77] and never tobacco users[89] at baseline.

In adolescents, greater exposure (sometimes/most of the time/always) to e-cigarette ads across multiple media sources was associated with higher odds of e-cigarette initiation compared to those who were never/rarely exposed (OR 1.64, 95% CI 1.45-1.86, 3 studies 27,025 participants, moderate certainty of evidence). No heterogeneity was found between the three studies.[74 77 89] The forest plot is shown in Figure 19.

Figure 19: Forest plot of effect of exposure to e-cigarette advertising on ever use of e-cigarettes among adolescents (cohort studies)
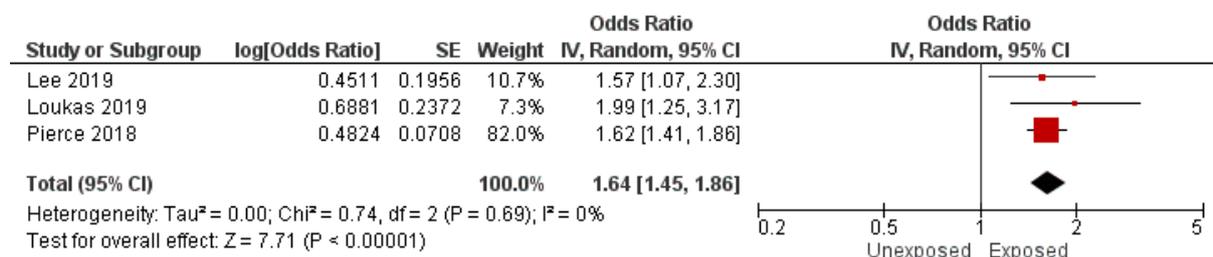
Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Random, 95% CI
Lee 2019	0.4511	0.1956	10.7%	1.57 [1.07, 2.30]
Loukas 2019	0.6881	0.2372	7.3%	1.99 [1.25, 3.17]
Pierce 2018	0.4824	0.0708	82.0%	1.62 [1.41, 1.86]
Total (95% CI)			100.0%	1.64 [1.45, 1.86]

Heterogeneity: Tau² = 0.00; Chi² = 0.74, df = 2 (P = 0.69); I² = 0%
Test for overall effect: Z = 7.71 (P < 0.00001)

Two cross-sectional studies examined e-cigarette initiation among adolescents and young adults.[91 115] Low certainty evidence from pooled analyses of two studies found that more frequent exposure (sometimes/most of the time/always) was associated with e-cigarette initiation compared to no or rare exposure (OR 1.32, 95% CI 0.93-1.88). However, the 95% CI crossed the line of no effect, indicating statistical

non-significance. Moderate heterogeneity was reported between the two studies. Kinnunen et al.[115] assessed advertising exposures across multiple media including Facebook, other Internet websites, traditional media, shops, and billboards, and reported greater odds of cigarette initiation with frequent exposure compared to no or rare exposure. Pokhrel et al. assessed exposure to print magazine ads and video still images.[91] The forest plot is shown in Figure 20. .

Figure 20: Forest plot of effect of exposure to e-cigarette advertising on multiple ad sources vs no exposure on e-cigarette initiation among adolescents and young adults (cross sectional studies)
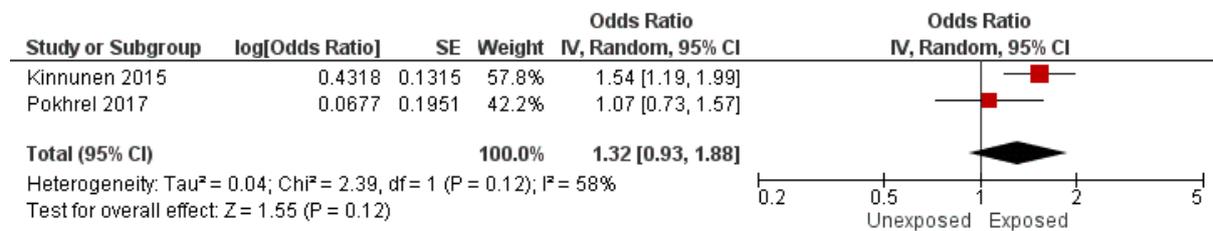
Very low certainty evidence from a cross-sectional study found that among adolescents, higher recall of e-cigarette marketing might be associated with higher risk of initiating use of JUUL e-cigarettes compared to no recall of exposure (Relative risk ratio (RRR) 1.64, 95% CI 1.17-2.29, 1,365 participants).[58]

11.2. Effect of multiple media advertising on initiation of e-cigarette use in young adults (18-25 years)

One randomised controlled trial examined e-cigarette initiation at 6-month follow-up among adults aged 18-34 years.[105] Low certainty evidence was found that there were increased odds of e-cigarette initiation among e-cigarette never users exposed to e-cigarette ads via print media and online displays compared to those who were not exposed (OR 1.53, 95% CI 0.98-2.39, 3,196 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance. The participants included current cigarette smokers who had never used e-cigarettes at baseline.

11.3. Effect of frequency of multiple media advertising exposure on e-cigarette initiation in adolescents (12-17 years)

One cross-sectional study examined e-cigarette initiation.[70] Very low certainty evidence was found that middle and high school students with moderate (sometimes) or high exposure (most of the times/always) were more likely to initiate e-cigarette use compared to those who reported little to no exposure to e-cigarette advertising (moderate exposure: OR 1.23, 95% CI 1.02-1.50; high exposure: OR 1.64, 95% CI 1.07-2.50, 736,158 participants).[70]

11.4. Effect of multiple media advertising on initiation of cigarettes in adolescents (12-17 years)

Two cross-sectional studies examined initiation of cigarette use; one study was conducted with adolescent dual users[58] and one with adolescent never smokers[89].

Very low certainty evidence was found that higher recall of e-cigarette marketing was associated with increased risk of initiating combustible tobacco use compared to those with no recall of exposure (RRR 2.10, 95% CI 1.08-4.07, 1,365 participants).[58]

Very low certainty evidence was found that among adolescents and young adults who have never smoked, exposure to e-cigarette advertising was associated with initiation of cigarette use at follow-up after 1 year (OR 1.43, 95% CI 1.23-1.65, 10,989 participants).[89]

11.5. Effect of multiple media advertising on ever e-cigarette use in adolescents (12-17 years) and young adults (18-25 years)

Seven studies examined this outcome.[72 80 84 89 93 113 114] Three were cohort studies[114 84 89] and four were cross-sectional studies.[72 80 93 113]

Very low certainty evidence was found from the three cohort studies that exposure (sometimes/most of the time/always vs never/rarely) to e-cigarette ads across multiple media sources increased the odds of e-cigarette ever use (OR 1.28, 95% CI 1.08-1.53, 3 studies, 16,595 participants).[114 84 89] At baseline, two studies included never e-cigarette and cigarette users,[114 84] and one study included never tobacco users.[89] Subgroup analysis by follow-up period showed that for follow-up of less than a year, the effect was OR 1.45 (95% CI 1.19-1.75, 10,989 participants).[89] For follow-up of more than a year, the effect was OR 1.19 (95% CI 1.02-1.39, 5,606 participants).[84 114] The forest plot is shown in Figure 21.

Figure 21: Forest plot of effect of exposure to e-cigarette ads across multiple media sources on ever use of e-cigarettes among adolescents and young adults by follow-up periods (cohort studies)
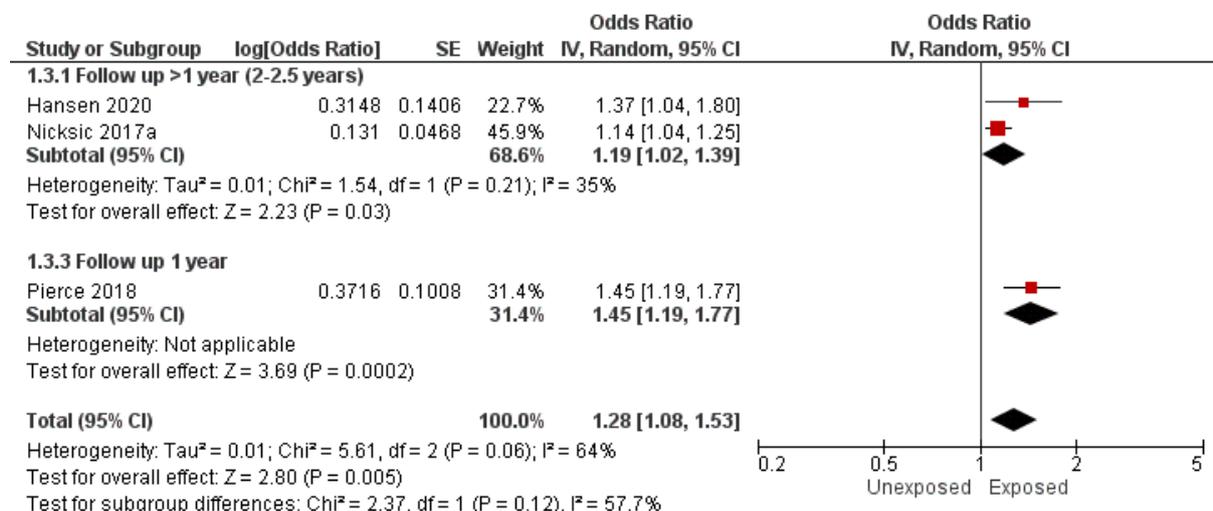
Very low certainty evidence from the four cross-sectional studies found exposure to advertisements on multiple media was associated with greater odds of e-cigarette use (OR 1.22, 95% CI 1.08-1.39, 4 studies, 28,944 participants).[72] [80] [93] [113] However, considerable heterogeneity was identified between the studies. The study by Herrera et al.[72] had a small sample size and the study by Hansen et al.[113] included only two exposure sources. The forest plot is shown in Figure 22.

Figure 22: Forest plot of effect of exposure to e-cigarette advertising on multiple ad sources vs no exposure on ever use of e-cigarettes among adolescents and young adults (cross-sectional studies)
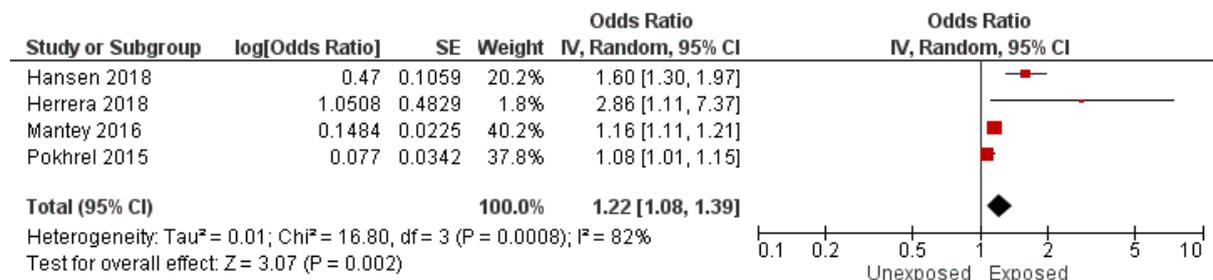
11.6. Effect of multiple media advertising on e-cigarette ever use among pregnant women (≥18 years)

Very low certainty evidence from a cross-sectional study was found indicating that among pregnant women (18 to 45 years) who were dual users, exposure to e-cigarette advertising on multiple media sources was associated with higher odds of ever use of e-cigarettes (OR 1.04, 95% CI 1.00-1.08, 194 participants).[54]

11.7. Effect of multiple media advertising on cigarette ever use in adolescents (12-17 years) and young adults (18-25 years)

Two cohort studies examined cigarette ever use.[89] [114] The follow up period in both studies was 12 months. At baseline, the participants in one study[114] were e-cigarette non-users, cigarette non-users, hookah non-users at baseline, and in the other they were tobacco users.[89]

Low certainty evidence from pooled analysis of two studies found that exposure to advertisements from multiple media sources among adolescents and young adults was associated with greater odds of ever cigarette use at follow-up (OR 1.49, 95% CI 1.19-1.87, 2 studies, 14,107 participants). No heterogeneity was identified between the two studies.[89] [114] The forest plot is shown in Figure 23.

Figure 23: Forest plot of effect of exposure to e-cigarette advertising on multiple ad sources vs no exposure on ever use of cigarettes in adolescents and young adults (cohort studies)
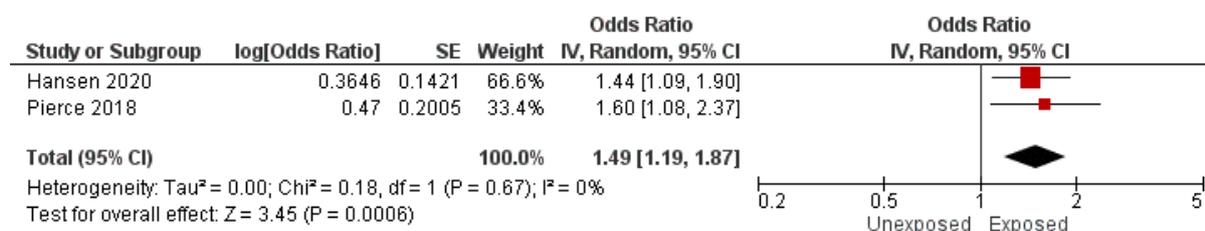
Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Random, 95% CI
Hansen 2020	0.3646	0.1421	66.6%	1.44 [1.09, 1.90]
Pierce 2018	0.47	0.2005	33.4%	1.60 [1.08, 2.37]
Total (95% CI)			100.0%	1.49 [1.19, 1.87]

Heterogeneity: Tau² = 0.00; Chi² = 0.18, df = 1 (P = 0.67); I² = 0%
Test for overall effect: Z = 3.45 (P = 0.0006)

In a cross-sectional study, very low certainty evidence was found that among adolescents, exposure to e-cigarette marketing increased the odds of ever-use of cigarettes compared to non-exposure (OR 1.2, 95% CI 1.0-1.4, 6,538 participants).[113]

11.8. Effect of multiple media advertising on dual e-cigarette and cigarette current use in adolescents (12-17 years)

In a cross-sectional study, very low certainty evidence was found that among adolescents, exposure to e-cigarette advertisements was associated with higher odds of current use of e-cigarettes and combustible cigarettes (OR 1.6, 95% CI 1.3-1.9, 6,538 participants).[113]

11.9. Effect of multiple media advertising on e-cigarette current use among adolescents (12-17 years) and young adults (18-25 years)

In three pooled cohort studies, very low certainty evidence was found for an effect of e-cigarette advertising exposure across multiple media sources on current e-cigarette use compared to no exposure in adolescents and young adults (OR 0.99, 95% CI 0.83-1.18, 3 studies, 7,064 participants). However, the 95% CI crossed the line of no effect, indicating statistical non-significance.[64 84 116] The follow up period ranged from 6 months[64 84] to 12 months.[116] Participants in the three studies at baseline were never users of e-cigarettes,[116] never users of combustible cigarettes,[84] and tobacco users.[64] Overall, there was moderate heterogeneity between the three studies. In two of the studies, exposure to ads in the past 6 months was associated with increased odds of current e-cigarette use compared to non-exposure (OR 1.09, 95% CI 0.92-1.30, 2,254 participants). No heterogeneity was identified between the two studies.[84 116] When exposure to media sources was assessed over only the past 30 days, lower odds of current e-cigarette use were found compared to no exposure (OR 0.86, 95% CI 0.69-1.07, 3,738 participants).[64] The forest plot is shown in Figure 24.

Figure 24: Forest plot of effect of exposure to multiple ad sources vs no exposure on current e-cigarette use among adolescents and young adults (cohort studies)
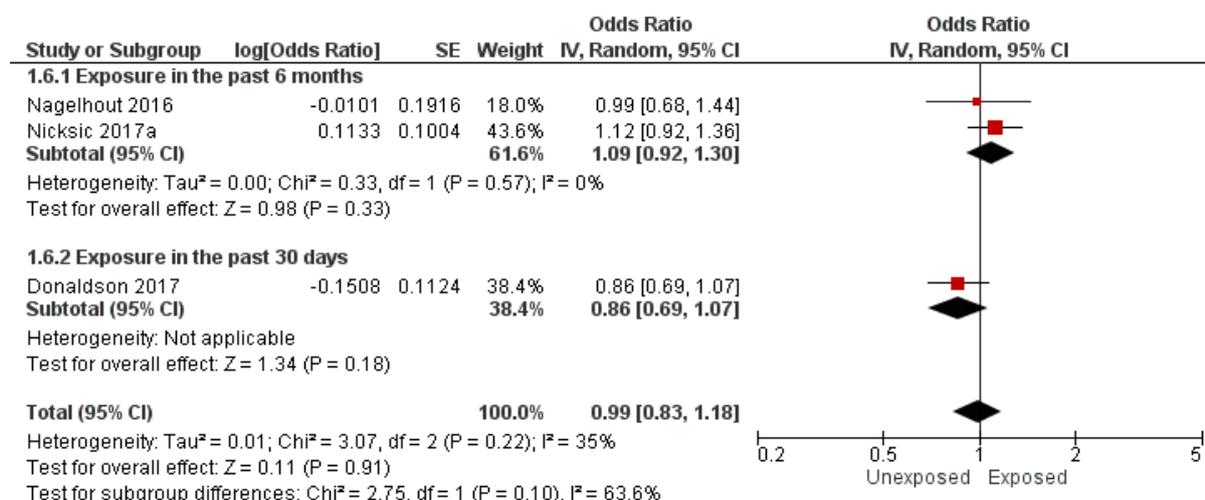
In a cross-sectional study conducted with adolescents aged 16 to 19 years from the US, Canada, and England who only used e-cigarette products, exposure to advertising on websites plus social media was associated with higher odds of current e-cigarette use compared to no exposure (OR 2.57, 95% CI 2.02-3.27, 12,064 participants, high certainty of evidence).[119]

11.10. Effect of multiple media advertising on e-cigarette current use among adolescents (12-17 years) and young adults (18-25 years)

Pooled results from three cross-sectional studies showed that among adolescents and young adults, exposure (sometimes/most of the time/always) to advertisement of 2-3 mediums increased the odds of current e-cigarette use compared to no exposure (OR 2.11, 95% CI 1.77-2.52, 3 studies, 16,117 participants, high certainty of evidence).[75 91 113] No heterogeneity was reported between the studies. The forest plot is shown in Figure 25.

Figure 25: Forest plot of effect of exposure to multiple ad sources (2-3 sources) vs no exposure on current e-cigarette use among adolescents and young adults (cross-sectional studies)
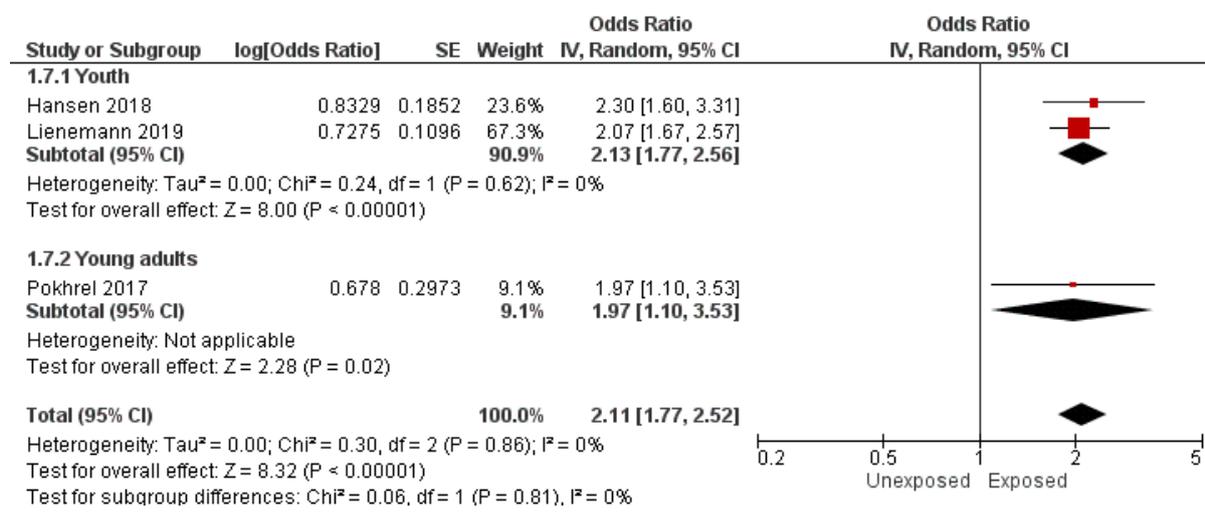
11.11. Effect of multimedia advertising on current e-cigarette use in adolescents (12-17 years) and young adults (18-25 years)

Six cross-sectional studies examined this outcome.[80 87 88 112 93 94]

Low certainty evidence from four cross-sectional studies was found that among adolescents, exposure (sometimes/most of the time/always) to >3 ad sources increased the odds of current e-cigarette use compared to no exposure (OR 1.28, 95% CI 1.18-1.39, 4 studies, 83,317 participants). Considerable heterogeneity was reported between the studies.[80 87 94 112] The forest plot is shown in Figure 26.

Figure 26: Forest plot of effect of exposure to multiple ad sources (>3 sources) vs no exposure on current e-cigarette use among adolescents (cross-sectional studies)
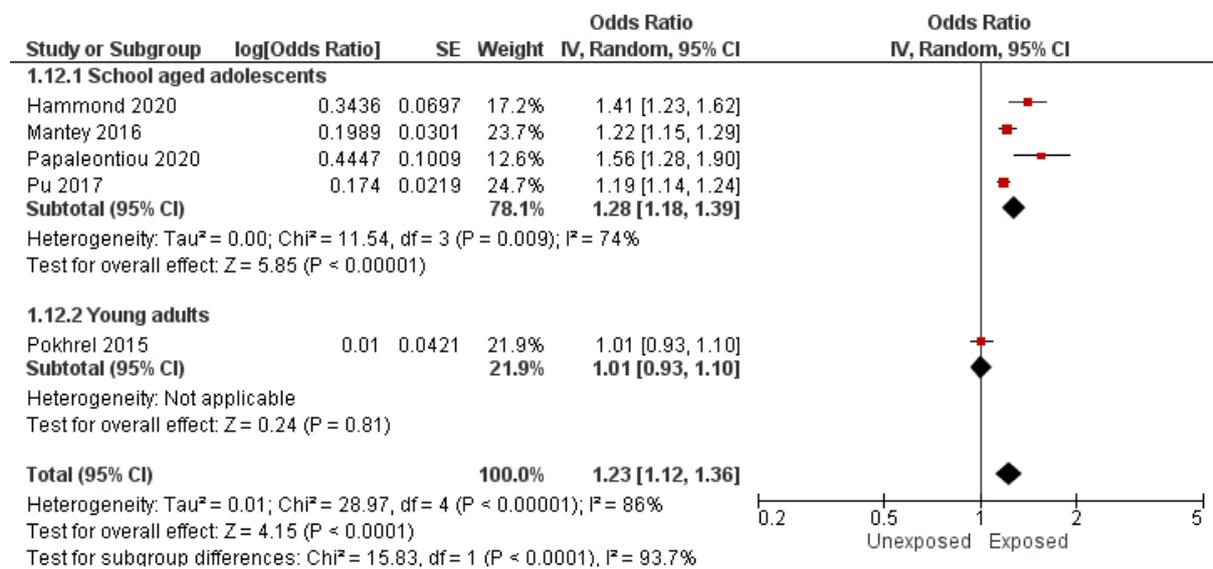
Very low certainty evidence was found that among young adults there was no clear effect of exposure to >3 ad sources versus no exposure on current e-cigarette use (OR 1.01, 95% CI 0.93-1.10, 307 participants).[93]

In one cross-sectional study of adolescents, there was moderate certainty evidence that a one-interval increase on an ad exposure measure was associated with greater odds of current e-cigarette use (OR 6.42, 95% CI 2.28-18.11, 71,702 participants).[88] The tobacco advertisement at the county level exposure score was reported as one-interval increase in exposure measured from rarely to sometimes or sometimes to most of the time.[88]

11.12. Effect of multiple media advertising on current e-cigarette use in adult (≥18 years) exclusive vapers

One cross-sectional study reported on this outcome.[118] Very low certainty evidence was found that in adult exclusive e-cigarette users (who used e-cigarettes but not combustible cigarettes), exposure (sometimes/most of the time/always) to websites and social media was associated with greater odds of current e-cigarette use compared to no exposure or exposure rarely (OR 2.4, 95% CI 1.7-3.2, 12,246 participants).

11.13. Effect of multiple media advertising on current e-cigarette use in adolescents (12-17 years) from alternative high schools

Very low certainty evidence from one cohort study[90] was found that among high school students from AHS, a one-unit change in exposure to e-cigarette advertising from multiple media sources was associated with a 21.8% increase in the number of times adolescents used e-cigarettes one year later (unstandardised beta co-efficient (b) 0.20, standard error (SE) 0.03, p < .001, 923 participants).[90]

11.14. Effect of multiple media advertising on current cigarette use in adolescents (12-17 years) and young adults (18-25 years)

Six cross-sectional studies[55 64 87 113 119 120] examined this outcome.

Moderate certainty evidence demonstrated that cumulative exposure (sometimes/most of the time/always) to e-cigarette advertising across multiple sources in the past 30 days was associated with greater odds of current combustible cigarette use compared to no exposure or exposure rarely (OR 1.40, 95% CI 1.27-1.55, 4 studies, 58,320 participants).[55 87 113 119] The forest plot is shown in Figure 27.

Very low certainty evidence was found indicating no clear effect of either daily media exposure in the past 30 days or cumulative exposure in the past 30 days on current cigarette use (OR 0.99, 95% CI 0.56-1.75, 3,738 participants). The 95% CI crossed the line of no effect, indicating statistical non-significance.[64] Very low certainty evidence was found that exposure to multiple media sources over a 12-month period was associated with greater odds of current cigarette use (OR 1.11, 95% CI 1.01-1.18, 27,801 participants).[120]

Figure 27: Forest plot of effect of exposure to multiple ad sources vs no exposure on current cigarette use among adolescents and young adults (cross-sectional studies)
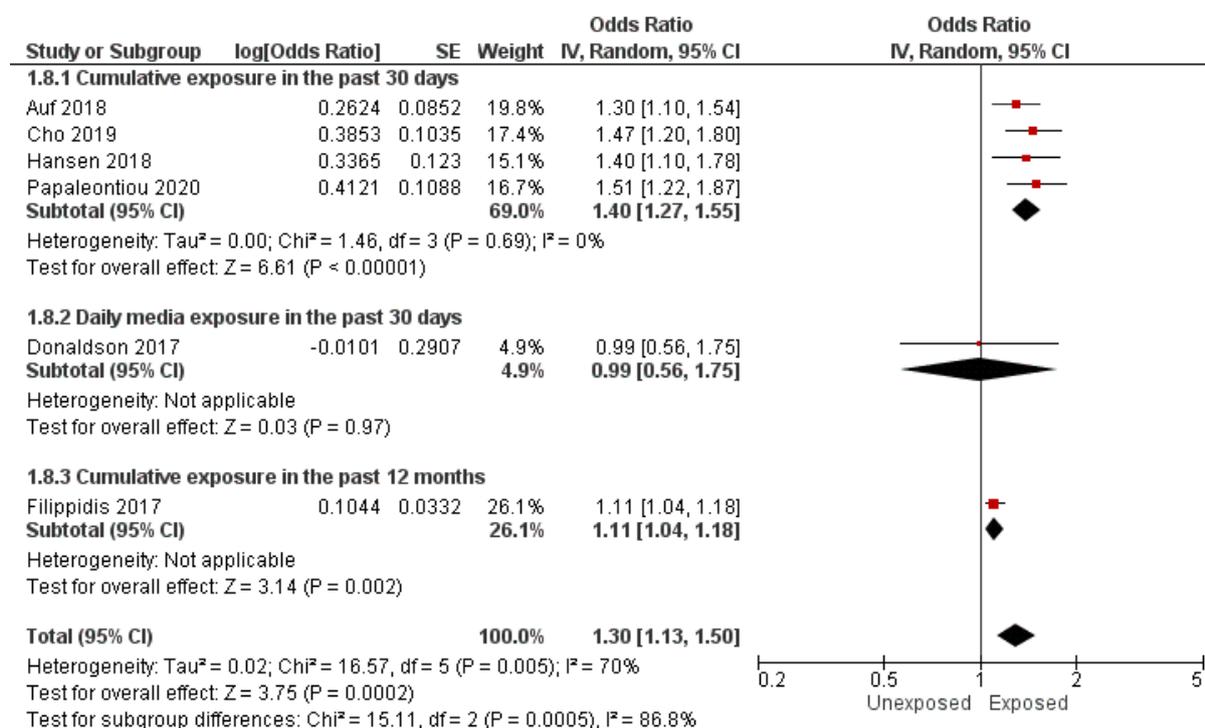
Low certainty evidence was found for an association between exposure to tobacco advertisements (including e-cigarette advertisements) assessed at county level and current cigarette use among adolescents aged 11-17 years (OR 3.28, 95% CI 1.96-5.49, 71,012 participants).[88] However, it was not clear whether the effect was due to e-cigarette advertising alone.

11.15. Effect of multiple media advertising on frequency of e-cigarette use in adolescents (12-17 years) from alternative high schools

A cohort study found very low certainty evidence that among high school students from alternative high schools (AHS) who were tobacco product users, every unit change in exposure to e-cigarette advertising was associated with a 10.1% increase in the number of times adolescents used e-cigarettes one year later (b 0.10, SE 0.02, p < .001, 923 participants).[90]

11.16. Effect of multiple media advertising on current dual use in adolescents (12-17 years)

Very low certainty evidence was found in a cross-sectional study for an association between exposure (sometimes/most of the time/always) to e-cigarette advertisements from multiple media sources and higher odds of current dual use of e-cigarettes and cigarettes among adolescents compared to no exposure or exposure rarely (OR 2.4, 95% CI 1.50-4.10, 6,538 participants).[113]

11.17. Effect of multiple media advertising on quitting cigarette use in adults (≥ 18 years)

Very low certainty evidence from a cross-sectional study found that in adults, exposure to e-cigarette advertisements was associated with weaker intentions to quit smoking (Difference or change (Δ) -0.32, p <0.001, 106 participants).[109]

11.18. Effect of multiple media advertising in quitting cigarette use in young adult smokers (18-25 years)

Very low certainty evidence from a cohort study (12-month follow-up) found exposure to e-cigarette advertising to be associated with lower odds of cigarette quit success among young adult smokers (OR 0.92, 95% CI 0.47-1.81, 835 participants).[116] However, the 95% CI crossed the line of no effect, indicating statistical non-significance. A majority of the participants had never used e-cigarettes at baseline.[116]

11.19. Effect of multiple media advertising on knowledge and awareness of e-cigarettes among young adults (18-25 years)

One cross-sectional study reported on this outcome and found that frequent exposure to e-cigarette marketing was associated with a lower likelihood of not knowing that some e-cigarettes contain nicotine compared to no exposure or rare exposure (RRR 0.81, 95% CI 0.76-0.87, 1,247 participants).[97]

11.20. Effect of multiple media advertising on attitudes and beliefs of adolescents (12-17 years) and young adults (18-25 years)

Three studies, including one randomised controlled trial,[83] and two cross-sectional studies[119] [128] examined attitudes and beliefs related to e-cigarettes and cigarettes following exposure to e-cigarette advertisements.

In a randomised trial with non-smokers aged 18-30 years (436 participants), those assigned to a health effects warning-only condition reported higher perceived addictiveness of e-cigarettes (Least square means (M) 3.25, SE 0.07) than those in an e-cigarette ad-stimuli-only condition (M 2.82, SE 0.07, p<.001). Overall, participants in the warning-only condition reported e-cigarettes to be closer to cigarettes in perceived addictiveness (M 3.61, SE 0.07) compared to those in the ad-only condition (M 3.84, SE 0.07, p = 0.055).[83]

In a multi-country cross-sectional study (12,064 participants) that included adolescents aged 16 to 19 years from Canada, England, and the US, more than 85% of participants across the three countries reported any exposure to e-cigarette ads. More than 70% perceived that e-cigarette ads target e-cigarette users and more than half (56% in the Canada and the US and 58% in England) perceived the target audience for e-cigarette ads to include non-e-cigarette users.[119]

A cross-sectional study of college students found that among young adults aged 18-25 years, exposure to e-cigarette advertising was associated with higher perceived prevalence of e-cigarettes use on campus among college students in both females (b=2.31, SE=0.17, 95% CI=1.97-2.64, 4,142 participants) and males (b=1.96 SE=0.28, 95% CI=1.41-2.50, 1,610 participants) compared to no exposure.[128]

11.21. Effect of multiple media advertising on attitudes and beliefs of adults (≥18 years)

Six studies, including two randomised controlled trials,[92] [105] one non-randomised controlled trial,[79] and three cross-sectional studies[64] [85] [109] examined attitudes and beliefs about e-cigarettes and cigarettes following exposure to e-cigarette advertisements.

In a randomised controlled trial[92] that included adults aged 18–29 years who had never used an e-cigarette and smoked less than 100 cigarettes in their lifetime, exposure to e-cigarette advertising was associated with more favourable implicit attitudes towards e-cigarettes as a safer alternative to cigarettes compared to those who were not exposed ($\chi2 = 21.4$, $p = .16$, 95% CI 0.01-0.06, 393 participants).

In the second randomised controlled trial (3196 participants),[105] 69.9% of participants in an ad exposure group perceived that using e-cigarettes could help with quitting the use of regular cigarettes compared to 64.1% in an unexposed group ($p = 0.007$). In the ad exposure group, 48.6% of participants perceived that e-cigarette smoking was cheaper than smoking regular cigarettes compared to 43.0% in the unexposed group ($p=.014$).[105]

In a non-randomised controlled trial with adult smokers, no effects of exposure to e-cigarette advertising were reported regarding attitudes towards smoking cessation among daily smokers (Cohen's f statistic (F) 1.152, $p = .317$, $\eta2 = .008$) or intermittent smokers (F 2.14, $p = .120$; $\eta2 = .016$, 884 participants).[79]

In a cross-sectional study (3,738 participants),[64] female adults were less likely than their male counterparts to believe that e-cigarette use (OR 0.92, 95% CI 0.71-1.20), cigar smoking (OR 0.91, 95% CI 0.70-1.18), and smoking tobacco in a hookah/waterpipe (OR 0.92, 95% CI 0.72-1.18) are very or moderately addictive following exposure to e-cigarette advertisements. However, the 95% CIs crossed the line of no effect, indicating statistical non-significance. In addition, female adults were more likely than their male counterparts to believe that conventional cigarettes (OR 1.24, 95% CI 0.65-2.38) are very or moderately addictive following exposure to e-cigarette advertisements.[64]

In another cross-sectional study,[109] following e-cigarette advertising exposure, participants felt that smoking conventional cigarettes was more socially acceptable ($\Delta0.82 \pm 0.29$ 95% CI, $p < 0.001$, 106 participants) and non-e-cigarette users felt that

conventional cigarette smoking was more socially acceptable (Δ0.89 ± 0.34 95% CI, p < 0.001, 82 participants).

The third cross-sectional study found moderate (sometimes) tobacco advertising exposure among adult smokers to be associated with positive perceptions that e-cigarettes could help reduce conventional cigarette use (OR 2.06, 95% CI 1.04-4.08, 1220 participants).[85] High (most of the time/always) tobacco advertising exposure was associated with perceptions that e-cigarettes were less addictive than conventional cigarettes (OR 1.92, 95% CI 1.01-3.65, 1,220 participants).[85]

11.22. Effect of multiple media advertising on intentions to use e-cigarettes among adolescents (12-17 years)

Four studies, including one randomised controlled trial,[105] two cohort studies (follow-up range of 6 months to 1 year),[84][107] and one cross-sectional study[102] examined this outcome.

The randomised controlled trial found e-cigarette advertising exposure was positively associated with increased intentions to use e-cigarettes among never users of both e-cigarettes and combustible cigarettes when compared to those who were not exposed (OR 2.85, 95% CI 1.07-7.61, 3196 participants).[105]

In the two cohort studies,[84][107] exposure to e-cigarette advertising from multiple sources versus no exposure was found to result in higher odds of intending to use e-cigarettes (OR 1.28, 95% CI 1.04-1.58, 2 studies, 12,292 participants). The participants in the studies included never tobacco users[107] and never e-cigarette users and combustible cigarette users.[84] Low heterogeneity was identified between the two studies.[84][107] The forest plot is shown in Figure 28.

Figure 28: Forest plot of effect of exposure to e-cigarette advertising via multiple sources vs no exposure on intentions to use e-cigarettes among adolescents and young adults (cohort studies)

Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Random, 95% CI
Chen Shanky 2019	0.4253	0.1825	26.3%	1.53 [1.07, 2.19]
Nicksic 2017a	0.1823	0.073	73.7%	1.20 [1.04, 1.38]
Total (95% CI)			100.0%	1.28 [1.04, 1.58]

Heterogeneity: Tau² = 0.01; Chi² = 1.53, df = 1 (P = 0.22); I² = 35%
Test for overall effect: Z = 2.30 (P = 0.02)
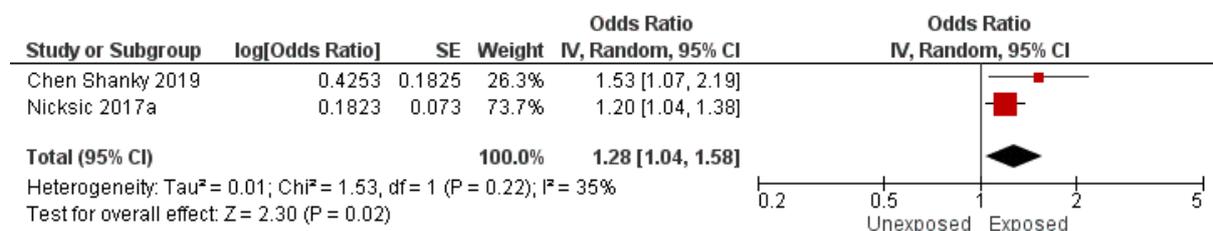
In one cross-sectional study (17,286 participants), increased exposures to e-cigarette advertising were found to be associated with increased intentions to use e-cigarettes among non-smokers (b=0.039, p < 0.001), but not among combustible cigarette users. Among smokers, there was no positive association between advertising exposure and intention to use e-cigarettes (b=−0.010, p=0.859).[102]

11.23. Effect of multiple media advertising on intentions to use e-cigarettes among young adults (18-25 years)

In one cross-sectional study[99] with tobacco users, the advertising appeal (in terms of cost, flavours, and taste) of e-cigarette ads was found to be positively associated with homeless tobacco users' future intentions to use e-cigarettes (F 0.38, SE 0.14, p<0.01, 354 participants).

11.24. Effect of multiple media advertising on intentions to use e-cigarettes among adults (≥18 years)

Three studies, including two randomised controlled trials,[83 95] and one cross-sectional study[109] examined adults' intentions to use e-cigarettes.

In one randomised controlled trial with adult non-smokers aged 18-30 years at baseline, exposure to an e-cigarette advertisement was not associated with intentions to use e-cigarettes (F= .02, p=.891, η2 <.001, 436 participants).[83] In the other randomised controlled trial[95] that included adults aged 18-34 years, higher e-cigarette advertisement likeability ratings were associated with greater odds of being curious about trying an e-cigarette (OR 2.33, 95% CI 1.84-2.95, 2,110 participants).

In the cross-sectional study, adults who viewed e-cigarette advertisements were found to have stronger intentions to use e-cigarettes (Δ1.20 ± 0.26 95% CI, p < 0.001, 106 participants).[109]

11.25. Effect of multiple media advertising on intentions to use e-cigarettes (susceptibility) in adolescents (12-17 years) and young adults (18-25 years)

Two cross-sectional studies examined e-cigarette susceptibility among adolescents and young adults.[80 91] Pooled results of the two studies showed that the odds of e-cigarette susceptibility were higher following exposure to e-cigarette advertisements compared to no exposure (OR 1.11, 95% CI 1.08-1.14, 22,477 participants).[80 91] The forest plot is shown in Figure 29. The sample size in the study by Mantey et al. (2016) was 22,007[80] compared to only 470 in the study by Pokhrel et al.[91] Pokhrel et al.[91] reported lower odds of e-cigarette susceptibility with exposure to advertisements compared to no exposure. However, the 95% CI included the line of no effect, indicating statistical non-significance.

Figure 29: Forest plot of effect of exposure to e-cigarette ads via multiple sources vs no exposure on e-cigarette susceptibility among adolescents and young adults (cross-sectional studies)

Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Random, 95% CI	Odds Ratio IV, Random, 95% CI
Mantey 2016	0.1044	0.014	99.8%	1.11 [1.08, 1.14]	
Pokhrel 2017	-0.1054	0.3207	0.2%	0.90 [0.48, 1.69]	
Total (95% CI)			100.0%	1.11 [1.08, 1.14]	

Heterogeneity: Tau² = 0.00; Chi² = 0.43, df = 1 (P = 0.51); I² = 0%
Test for overall effect: Z = 7.44 (P < 0.00001)
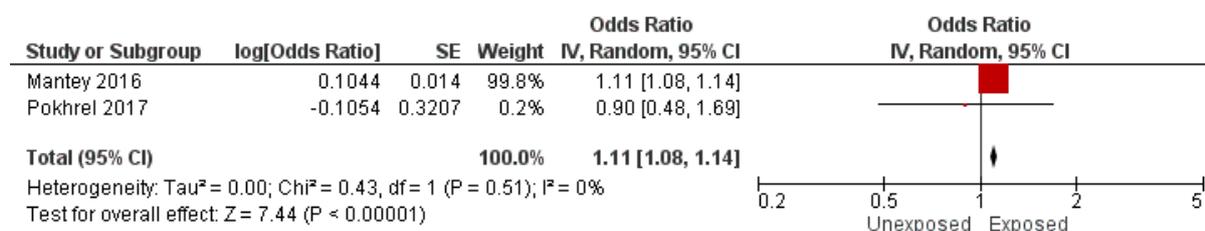
11.26. Effect of multiple media advertising on intentions to use e-cigarettes (susceptibility) in young adults (18-25 years)

One randomised controlled trial[92] reported on this outcome. The study compared non-smoking participants who were shown ads that promoted e-cigarettes as cessation aids and control advertisments (of everyday items). The results showed that being shown real-world e-cigarette ads was associated with increased susceptibility to use e-cigarettes (Standardised regression coefficients 0.05, SE 0.02, p = .04, 393 participants).

11.27. Effect of multiple media advertising on e-cigarette susceptibility in adults (≥18 years)

One cross-sectional study[85] reported on this outcome. A high level of tobacco product advertising exposure was associated with greater e-cigarette susceptibility (2.52, 95% CI 1.03-6.15, 1,220 participants).[85]

12. Effect of other forms of e-cigarette promotion

Two studies examined the effect of exposure to e-cigarette marketing at events (e.g., fairs, festivals) and receiving free giveaways (e.g., in bars).

Of the two identified studies, one was a cohort study (with 1-year follow-up) that addressed the secondary outcome variable of intentions to use e-cigarettes.[107] The second study was a cross-sectional study that addressed the primary outcome variable of e-cigarette ever use.[76] It was assessed as providing very low certainty evidence. Both studies were conducted in the US. The GRADE Summary of Findings table for adults is detailed in the technical report for other forms of e-cigarette advertising in adults (Table 28).

12.1. Effect of other marketing and sponsorship mediums on e-cigarette ever use in adults (≥ 18 years)

Very low certainty of evidence from the cross-sectional study was conducted with US Air Force trainees and found that exposure to free giveaways at bars or social events was associated with e-cigarette ever use (OR 1.48, 95% CI 1.21-1.82, 13,873 participants).[76]

12.2. Effect of marketing and sponsorship in events on intentions to use e- cigarette in adolescents (12-17 years)

The cohort study found that among adolescents who were never e-cigarette users and never cigarette smokers at baseline, exposure to e-cigarette marketing at events such as fairs and festivals was associated with lower odds of intending to use e-cigarettes (OR 0.96, 95% CI 0.56–1.63, 9,804 participants).[107] However, the 95% CI crossed the line of no effect, indicating statistical non-significance.

12.3. Effect of marketing and sponsorship events on intentions to use e- cigarette in young adults (18-25 years)

The cohort study found that among young adult never users of e-cigarettes and combustible cigarettes at baseline, exposure to e-cigarette marketing at events such as fairs and festivals was associated with increased odds of intending to use e-cigarettes (OR 9.98, 95% CI 1.44–69.17, 9,804 participants).[107]

Results of syntheses of qualitative studies

The thematic analysis undertaken on the qualitative studies produced three themes. The summary of findings for GRADE CERQual is presented in the accompanying technical report.

Theme 1

Exposure to e-cigarette advertising occurred both actively and passively, resulting in changed perceptions of the risk profile of e-cigarettes (moderate confidence in findings)

Evidence for this theme emerged from six studies.[79] [121] [123-126] Participants, particularly adolescents and young adults, reported being exposed to e-cigarette advertisements throughout the course of their lives in multiple ways. This exposure occurred passively in the normal course of life and actively when they sought information on the safety and benefits of e-cigarettes.

Passive exposure was commonly reported. Adolescents and young adults discussed being exposed to e-cigarette advertisements on college campuses, in kiosks at malls, on television,[121] as well as in convenience and liquor stores.[126] Multiple studies reported that participants received unsolicited e-cigarette content on social media platforms, particularly Facebook, YouTube, Instagram, and Snapchat.[79] [121] [123-126] Some study participants reported actively seeking out advertisements and information about e-cigarettes through web searches or social media platforms – for example, by searching the hashtag '#e-cig' on Instagram.[123] Participants who actively sought out information about e-cigarettes online were particularly interested in information about how e-cigarettes work, recommendations for specific vaping products,[116] and learning vape tricks.[121] [124]

Participants noted that e-cigarette advertisements often claimed the products were healthier than combustible cigarettes. Many stated that exposure to such advertisements made them believe e-cigarettes were either less dangerous than cigarettes or not harmful at all.[121] They were persuaded by advertisements that emphasised the lack of second-hand smoke, believing this was a "big selling point" for e-cigarettes.[123] Some participants were able to easily recall the content of e-cigarette advertisements that highlighted the health benefits of e-cigarettes: "I have seen posters that say less nicotine, so it is less harmful to your body".[123]

Not all participants, however, accepted the legitimacy of health messages in e-cigarette advertisements. In one study that explored perceptions of vaping-related hashtags on Instagram, participants who were combustible cigarette users or non-tobacco smokers viewed vaping-related hashtags on Instagram, such as #vapingsavedmyife and #stopsmoking, to be less believable and valid than vapers and dual users.[127] While all participants in this study interpreted the hashtags as attempting to portray positive health messages about e-cigarettes, some were sceptical about the intent of individuals using these hashtags, acknowledging that such Instagram users would likely include these hashtags to obtain more views or make a profit from the sale of e-cigarettes.[127] Similarly, participants in another study involving both users and non-users of e-cigarettes expressed frustration towards advertisements that presented e-cigarettes as less dangerous than cigarettes without providing sufficient information about the potential harms of e-cigarettes.[124]

Theme 2

Strategies used to enhance the appeal and believability of advertisements are effective in influencing perceptions (moderate confidence in findings)

Five studies explored different message and executional aspects of e-cigarette advertisements that influenced participants' liking of the advertisements, perceptions of e-cigarettes, and intentions to use e-cigarettes.[121-124] [127]

Visual elements of e-cigarette advertisements

Two studies, both from the US, explored the visual elements of e-cigarette advertisements that appealed to young people.[121] [123] Participants responded favourably to the test advertisements and expressed more positive perceptions of e-cigarettes when vibrant colours, bold images, and special effects were used.[121] [123] These advertisement attributes also influenced which e-cigarette brands participants were most interested in using.[121]

In one study, it was the perceived synergy of the e-cigarette device, viewed by participants as sleek and modern, with the perceived calm and sophisticated visuals of the advertisement, that resulted in positive perceptions of e-cigarettes.[121] Visual elements of the e-cigarettes themselves were also mentioned independently as

appealing attributes of advertisements, particularly in comparison to cigarettes, with some participants viewing e-cigarettes as a "classy alternative".[123]

Depiction of characters in e-cigarette advertisements

Two studies, both from the US, explored how young adults responded to the types of characters depicted in e-cigarette advertisements.[122] [121] In one study, participants were shown several e-cigarette advertisements from different mediums featuring a variety of characters.[121] Overwhelming, participants found the most appealing advertisement be a Blu e-cigarette advertisement depicting a stylish man in his 20s using an e-cigarette in a swimming pool.[121] Some participants felt that the advertisement was not just selling e-cigarettes, but also promoting a lifestyle: "I think people would want to emulate his style … one of the ways to emulate his style is to smoke e-cigarettes." Conversely, many participants did not relate to the JUUL advertisement shown in this study, as it was deemed visually unappealing and the character looked 'tense' and unhealthy,[121] making him non-aspirational.

Peer-influence strategies

Advertisements often depicted and aimed to influence the peer-crowd, and this was reported in two studies.[121] [122] Participants typically found advertisements more likeable, relatable, identifiable, and convincing if a 'matching' peer group was depicted (i.e. the characters depicted were similar to the own peer-group of the participant, such as 'hipsters' or 'young professionals').[122] Advertisements that felt natural and relaxed and captured a "real slice of life"[122] were favoured.

One study found that regardless of the peer group depicted, participants reacted negatively towards advertisements where the characters did not look like a 'genuine' e-cigarette user, the advertisement looked staged, or characters were depicted using e-cigarettes in unrealistic scenarios (e.g. in bed or in a meeting room at a workplace).[122] A second study found that peer recommendations on social media influenced brand preferences and perceptions of e-cigarettes.[121]

Theme 3

Exposure to individuals doing 'vape tricks' on social media (moderate confidence in findings)

Three studies, one from Australia and two from the US, explored the effect of videos of individuals doing vape tricks on social media on participants' perceptions of e-cigarettes and the appeal of e-cigarettes.[124-126] The tricks included making rings or other shapes out of vapour. Across all three studies, it was not possible to determine whether the individuals or celebrities depicted doing vape tricks online were sponsored

by e-cigarette companies or acting independently. Recruited participants watched these videos on Instagram and YouTube or were members of Facebook groups where vape trick content was displayed. Participants who reported having seen social media videos that included tricks or tutorials believed that using e-cigarettes was 'trendy,' 'cool', and 'fun'.[124-126] Additionally, participants who reported viewing social media videos appeared to have greater interest in e-cigarettes.[126] Some participants were particularly drawn to videos featuring celebrities or influencers performing tricks.[125]

Integration of findings of quantitative and qualitative studies

The quantitative studies included in this review primarily assessed the effects of e-cigarette advertising on e-cigarette initiation, intentions to use e-cigarettes, and current use of e-cigarettes, while the few qualitative studies primarily explored reactions to advertisements and exposure to e-cigarette-related content on the Internet, including on social media. These differing foci and the small number of qualitative studies preclude a comprehensive integration of the quantitative and qualitative results.

An important finding from the qualitative studies was that participants reported being exposed to e-cigarette-related content in advertisements and other forms of promotion disseminated via multiple media sources, mainly through social media, other Internet sources, and point-of-sale locations. The evidence from the quantitative studies indicated larger effect sizes for exposures to multiple media types, although the evidence certainty varied. In combination, these results suggest the need for comprehensive efforts across media types to address the effects of cumulative exposure.

In the qualitative studies, school-aged adolescents and young adults reported that e-cigarettes are depicted in advertisements as attractive and safer alternatives to conventional cigarettes, potentially influencing their intentions to use and initiation behaviours. In particular, the portrayal of vaping tricks appeared to help normalise e-cigarette use. These findings provide insights into the pathways for the effects observed in the quantitative studies.

Discussion

Summary of main results

The aim of this review was to assess the evidence relating to multiple behavioural and attitudinal outcomes of e-cigarette advertising across a range of media. The primary outcome variables of interest were uptake/initiation, frequency/intensity of use, ever use, current use, and quitting tobacco/e-cigarette use. The systematic review was broad in scope and complex in nature; to the best of our knowledge it is the most extensive review on the topic to date. Overall, it included 76 studies published between January 2015 and June 2021.

This review found evidence relating to numerous individual media and combinations of media. This included radio, television, television + radio (combined), television + movies (combined), billboards/posters, print media, social media, point-of-sale, Internet, mail (e-mail and/or postal), and combinations of 3+ media. For most media types/combinations, the evidence was of low to very low certainty and effect sizes and directions of effect often varied. Where studies were assessed as having moderate or high certainty of evidence for primary outcomes, significant results were always in the direction of exposure to e-cigarette advertising resulting in adverse outcomes among adolescents (see Table 1 overleaf). Similarly, most of the studies deemed as being of low/ very low certainty or that focused on secondary outcome variables also yielded results indicating that exposure to e-cigarette promotion produced more favourable attitudes to e-cigarette use and increased use intentions and use behaviours among the assessed target groups. Overall, the strongest available evidence was found for the effects of e-cigarette advertising on current use of e-cigarettes among adolescents.

Overall completeness and applicability of evidence

This review identifies areas for which data are currently lacking and were therefore inadequately represented in the results. Most of the included studies were deemed to be of low or very low quality, mainly due to combinations of a reliance on observational approaches, self-reported outcomes, and confinement to a single national context, typically the US. Many of these issues relate to the use of cross-sectional study designs that can preclude determination of the direction of effect and identification of reverse causation (e.g., e-cigarette users may be more likely than non-users to notice e-cigarette advertisements).

To overcome these limitations, additional high quality studies are needed to augment the evidence base. In particular, more longitudinal studies are required that involve the recruitment of participants prior to e-cigarette initiation and allocation of sufficient time periods between study waves to provide the opportunity for effects to manifest. Such studies need to recruit adequate numbers of participants to achieve sample representativeness and minimise the adverse effects of loss to follow-up.

Across the examined exposure and outcome types, most studies focused on the population groups of adolescents and/or young adults. Greater attention to differences according to socioeconomic position and other equity indicators would be useful for providing a more detailed understanding of which groups may be most adversely affected by e-cigarette advertising. The majority of the studies controlled for covariates such as age and gender. It is possible that residual factors (e.g. greater access to the Internet, social media, or tobacco retail outlets) may have influenced the results in terms of association between exposure and the outcome.

Table 1: Results for primary outcome studies assessed as providing significant results of high or moderate certainty of evidence

Exposure type	Population group	Study type	OR	95% CI / p value	Outcome^
High certainty of evidence					
Print	Adolescents	Cross-sectional	3.40	p < 0.001	Frequency of use
Print	Adolescents	Cross-sectional	1.87 1.71	1.21-2.87 1.25-2.33	Current use
Websites & social media	Adolescents	Cross-sectional	2.57	2.02-3.27	Current use
Multiple (2-3 media)	Adolescents & young adults	Cross-sectional (3 pooled studies)	2.11	1.77-2.52	Current use
Moderate certainty of evidence					
Print	Adolescents	Cross-sectional (2 pooled studies)	1.33	1.19-1.48	Current use
Print	Adolescents	Cross-sectional	1.22	1.07-1.39	Ever use
Point-of-sale	Adolescents	Cross-sectional (2 pooled studies)	1.69	1.06-2.68	Current use (combustible cigarettes)
Social media	Adolescents	Cohort (2 pooled studies)	2.60	1.56-4.35	Uptake
Multiple (3+ media)	Adolescents	Cross-sectional (3 pooled studies)	1.64	1.45-1.86	Initiation
Multiple (3+ media)	Adolescents	Cross-sectional	6.42	2.28-18.11	Current use
Multiple (3+ media)	Adolescents	Cross-sectional (4 pooled studies)	1.40	1.27-1.55	Current use (combustible cigarettes)

OR = odds ratio
CI = confidence interval (p value provided where CI not available)
^ Relates to e-cigarette outcomes unless specified otherwise

The most commonly assessed forms of advertising media were multiple (i.e. 2+ types of media combined), point-of-sale, Internet, print, and social media. Specific media for which data were lacking include sponsorship, merchandising, and other forms of endorsement. A greater focus on e-cigarette promotion via social media also appears warranted given the importance placed on this medium by participants in the assessed qualitative studies. Finally, additional research on the relationship between e-cigarette advertising and outcomes such as total nicotine consumption and quitting is needed.

Effect estimates varied widely between studies included in this review. This is unsurprising considering the substantial variation in terms of differing frequency and duration of exposure, level and adjustment of covariates, exposure and outcome measures used, and variation in follow-up periods. In many of the studies, the effect estimates were simply calculated on the exposed compared to non-exposed

populations, without detailed consideration of aspects of exposure such as duration or intensity.

Publication bias could not be assessed because of the paucity of studies in each particular exposure type. Some degree of social desirability is likely to exist in the included studies, resulting in participants under-reporting usage of e-cigarettes and combustible cigarettes. In addition, recall bias may have occurred whereby users versus non-users had different abilities to recall e-cigarette promotion. Finally, the reliance on advertising exposure data generated via questionnaires was a limitation of almost all included studies.

Despite these gaps in the literature and study limitations, the volume of studies and the availability of some moderate to high quality studies provide confidence in an overall interpretation that exposure to e-cigarette advertising across a range of media types influences adolescents' and young adults' use of these products.

Potential biases in the review process

This broad scope review was conducted according to a registered *a priori* protocol, with all phases completed over a period of just a few weeks. Data collection was confined to studies conducted in high-income countries that were deemed to be most relevant to the Australian cultural context, and papers published in languages other than English were not included. Only studies reporting on the pre-specified primary and secondary outcomes were included. Given the diverse range of study outcomes assessed and multiple population groups of interest, meta-analysis was not appropriate in many cases. Of note is that some of the larger studies included in the review were based on cohort surveys conducted 2014-2017, potentially limiting the relevance of the findings to current marketplace characteristics.

There are several methodological issues that would benefit from resolution in future research. In the first instance, there are considerable obstacles to objectively assessing exposure to e-cigarette advertising and promotion, both overall and in relation to specific media. Second, complications arise when attempting to isolate the effects of e-cigarette advertising from the effects of other social factors such as peer use and word-of-mouth communications. This is compounded by the nature of digital platforms, where paid advertising and public input co-exist and reinforce each other, making it difficult for both consumers and researchers to disentangle the interwoven communications. Third, the e-cigarette market is evolving rapidly in terms of product types/attributes and the nature of digital marketing. In this environment, study results can quickly lose relevance.

Agreements and disagreements with other studies or reviews

The identified association between exposure to e-cigarette advertising and e-cigarette use is consistent with the results of major reviews of the effects of tobacco and alcohol

advertising on young people's use of these substances.[129-131] It also reflects the basic tenet of advertising theory and practice that marketing communications influence consumer decision making and are an important contributor to product sales.[132] In particular, the reinforcement of marketing messages across multiple media is understood to be an effective method of reaching and influencing target audiences.[133] The results of this review are therefore aligned with existing bodies of evidence in both the substance use and general advertising literatures.

Implications for policy and practice

The association demonstrated in this review between exposure to various forms of e-cigarette promotion and young people's e-cigarette initiation and use supports the World Health Organization's recommendation for these products to be treated the same as tobacco products, including through the implementation of bans/restrictions on advertising, promotion, and sponsorship.[16] The review findings are also generally consistent with Australia's current stance on e-cigarette marketing whereby in most instances the products cannot be promoted directly to consumers. However, the overall finding that exposure to e-cigarette advertising content influences adolescents' vaping-related attitudes and behaviours has implications in the context of the new e-cigarette prescription regulations in Australia. To avoid unintended consequences, the results of this review indicate that point-of-sale communications about e-cigarettes in online and brick-and-mortar pharmacies should be limited to those specified as acceptable for tobacco products in Article 13 of the Framework Convention on Tobacco Control.[37]

The review results relating to Internet-related exposures (such as on social media and websites) highlight the importance of developing effective strategies to prevent exposure to e-cigarette promotion in online contexts.[22] This is a challenging task given the international and often ephemeral nature of the online environment and the many indirect processes by which promotion occurs (e.g. influencer communications and product placement in movies and music clips). This is a problem shared with other unhealthy products, such as tobacco, alcohol, and foods that are high in negative nutrients, indicating the potential utility of a co-ordinated approach.[134]

The ability of e-cigarette promotion to reduce harm perceptions highlights a need to monitor public understanding of the absolute and relative harms of e-cigarettes and implement appropriate educational campaigns to address knowledge deficits. This approach would be aligned with the World Health Organization's 'Best Buys' for tobacco control that include effective mass media campaigns that educate the public about product harms.[135]

Conclusion

Overall, although more research is needed, the available evidence supports the contention that exposure to e-cigarette advertising across a wide range of media is positively associated with e-cigarette user status among young people. This finding is consistent with outcomes in related substance use areas and supports the implementation of appropriate restrictions on e-cigarette marketing to reduce harms among young people.

Ethics

The systematic review does not involve any living participant and is a review of existing research that has been already published. No ethical approval was required.

Availability of data and other materials

All data associated with the review is presented along with.

Declaration of interests

The authors declare no competing interests.

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Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Ali 2021	To estimate the association of e-cigarette advertisement exposure with e-cigarette and cigarette use behavior among US adults.	USA	Cross-sectional studies or surveys	Community	Young adults and adults	Adults aged ≥ 18 years who responded to the waves of 2013–14 NATS residing in 50 states or DC.	Multiple - TV advertisements, magazines	98,746	Ever e-cigarette use, Current e-cigarette use, Current combustible cigarette use, frequency/intensity of consumption of combustible cigarette use, Knowledge, attitudes, and beliefs relating to e-cigarette use	Dhaval M. Dave, Gregory J. Colman, Henry Saffer, Michael Grossman were Supported by grant 1R01DA039968A1 from the National Institute on Drug Abuse to the National Bureau of Economic Research.	The authors declared that they had no competing interests.
Agaku 2017	To examine the relationship between receptivity to e-cigarette advertisements and current e-cigarette use among a national sample of U.S. adults who were non-users of conventional cigarettes and e-cigarettes.	USA	Cohort	Community	Young adults and adults	Adult aged ≥18 years were recruited from a probability sample of residential postal addresses covering approximately 95% of all U.S households.	Broadcast - Video stream, storyboard of image	2191	Current e-cigarette use	There was no external funding for this study.	The authors declared that they had no competing interests.
Ashford 2017	The study examined the relationship between exposure to e-cigarette advertising and e-cigarette use by pregnancy status, including use of flavoured e-cigarette products, among women of childbearing age.	USA	Cross-sectional studies or surveys	Women's Health Clinic and hospital	Young adults and adults	English-speaking women between 18 and 45 years of age who reported using tobacco within the past 12 months were eligible to participate. Pregnant women were recruited from two university-affiliated prenatal clinics and nonpregnant women of childbearing age were recruited from one women's health clinic; clinics were located in Central and Eastern Kentucky.	Multiple - Newspaper, Magazine, Social media (i.e., Facebook, Instagram, Vine, etc.), Internet blogs or advertisements on websites, Internet news sources (i.e., MSN, ESPN, FOX, etc.), Received mail, Received an email, At a health fair or community event, Television, and Radio.	200	Ever use of e-cigarettes	National Institute on Drug Abuse at the National Institutes of Health [R01DA040694-01 to K.A.] ; university of Kentucky Clinical and Translational Research Center KL2RR033171 CTSA grant number NIH CTSA UL1TR000117; Research Support Grant from the University of Kentucky Office of the Vice President for Research.	Not reported

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Auf 2018	To assess the relationship between e-cigarette marketing and e-cigarette, tobacco use among adolescents in U.S.	USA	Cross-sectional studies or surveys	School	School-aged adolescents	Middle and high school students (grades: 6–12; age: 9–19 years) from the US.	Multiple - Internet, television, newspapers and stores	22007	Current cigarette use	Dr. R. Auf was supported by a fellowship from Florida International. No other funding was received to support this study.	However, FIU had no role in the study design, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication. None to be declared
Beleva 2019	The purpose of the current investigation was to examine how the share of advertising voice (SAV) for specific types of tobacco products advertised near schools influences AHS students' tobacco use. Specifically, the authors wanted to understand whether SAV moderates the relationship between adolescent exposure to point of sale (POS) advertising and the use of tobacco products 1 year later.	USA	Cohort	School	School-aged adolescents	Schools were eligible if they had at least 100 AHS students and were within 100 miles of the program offices in Claremont, California.	Point of sale	746	Current e-cigarette use, Current cigarette use	Reported: National Institute of Child Health and Human Development (NICHD); US Food and Drug Administration (FDA) Center for Tobacco Products (R01HD077560).	None declared
Booth 2019	This study explored the potential for e-cigarette advertisements to (1) enhance attitudes towards cigarettes and/or (2) reduce barriers to e-cigarettes uptake. The study tested whether exposure to an online electronic cigarette advertisement changed attitudes towards cigarettes and e-cigarettes in smokers, non-smokers, e-cigarette users and dual users (smokers who also use e-cigarettes).	UK, USA	Cross-sectional studies or surveys	Community	Young adults and adults	Minimum age- 18 years, Participants were smokers, non-smokers, e-cigarette users or dual users	Internet/online	964	Knowledge, attitudes, and beliefs relating to e-cigarette use	Cancer Research UK grant number C54622/A20485.	DF and IPA are both investigators on a randomised controlled trial funded by Allen Carrs Easyway. This trial is comparing the Allen Carr Easway stop-smoking method to local NHS 1-1 stop smoking counselling service (ISRCTN23584477).

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Camenga 2018	The primary aim of this study was to use longitudinal data collected from middle and high schools in Connecticut to examine whether baseline (wave 1) exposure to e-cigarette advertisements (on social networking sites, traditional media, and in retail stores) was associated with subsequent e-cigarette use at wave 2 among adolescents without a history of using e-cigarettes.	USA	Cohort	School	Others	Not reported clearly	Multiple - social networking sites such as Facebook, Twitter, YouTube, Pinterest/Google Plus; traditional media such as television, radio, magazines, billboards; and retail stores such as convenience stores, mall kiosks, and tobacco shops.	1742	Ever e-cigarette use	Funding for this study was provided by grants to Dr. Krishnan-Sarin through the National Institutes of Health (NIH)/National Institute on Drug Abuse (NIDA) grants P50DA009241 and P50DA36151 (Yale TCORS). Dr. Simon's efforts were supported by T32DA019426 and L40DA042454. Dr. Guttierez's effort was supported T32 DA19426. Drs. Camenga and Kong's efforts were also supported by K12DA033012, CTSA grants UIR000142, and K12 TR000140 from the National Center for Advancing Translational Science (NCATS), Components of the NIH, and NIH Roadmap for Medical Research. Dr. Kong's effort was also supported by National Center on Addiction and Substance Abuse at Columbia University (CASA Columbia). Grant agencies had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.	The authors declared that they had no competing interests.
Case 2020	The objectives of the study are to 1) examine predictors of JUUL and other tobacco product initiation, 2) compare these predictors across product type, and 3) describe cross sectional characteristics of JUUL initiators, including reasons to use.	USA	Cross-sectional studies or surveys	School	School-aged adolescents	Sample of adolescents living in the four largest cities in Texas.	Multiple - television, radio/internet, billboard, and point-of-sale	1365	Uptake/initiation of e-cigarettes	The funding for this study was done by National cancer institute 9P50 CA180906) (R01-CA239097), FDA center for tobacco products.	Dr. Harrell is a consultant in litigation involving the vaping industry. Other authors have no conflicts of interest to disclose.

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Cavazos 2021	The objective of this study was to examine the association between engaging in social media behaviors and patterns of electronic nicotine delivery systems (ENDS) and tobacco use at a 1-year follow-up among 11 279 adolescents from the PATH (Population Assessment of Tobacco and Health) study.	USA	Cohort	Community	School-aged adolescents	The PATH study is a nationally representative, longitudinal cohort study of 45,971 adults and adolescents in the United States aged 12 years and older. It included young adults aged 18–24, and African Americans.	Social Media Platforms	11,279	Uptake/initiation of e-cigarettes	National Institutes of Health (K02 DA043657, R21 AA025689, R01 DA042195, F32 AA027941).	Reported: Dr. Borodovsky is a member of the board of directors and treasurer of MySafeRx Inc., a nonprofit scientific research organisation. He received no financial compensation from this organisation.
Chen Sankey 2019	To estimate the longitudinal association between e-cigarette marketing exposure and e-cigarette experimentation among US youth and young adult never tobacco users.	USA	Cohort	Community	School-aged adolescents and young adults	Non-institutionalised Youth (ages 12–17; n = 8121) and young adult (ages 18–24; n = 1683) responders completed both 2nd and 3rd survey waves and had never used any type of tobacco products (cigarettes, e-cigarettes, cigars, hookah, smokeless tobacco, tobacco pipes, bidis, and kreteks) at wave 2 of PATH study, in the United States.	Multiple - Websites and events, Billboards, newspapers, magazines, websites, social media, radio, television	9804	Intentions to use e-cigarettes	Dr Chen-Sankey and Dr Choi were supported by the National Institute on Minority Health and Health Disparities Division of Intramural Research. Funded by the National Institutes of Health (NIH).	The authors declared that they had no competing interests.
Cho 2019	This study aims to examine youth exposure to and perceptions of vaping ads in Canada, England, and the US, three countries with varying vaping product advertising regulations.	Canada, USA, UK	Cross-sectional studies or surveys	NR	Young adults	Youth aged 16 to 19 years in the US, Canada, and England were recruited from the Nielsen Consumer Insights Global Panel and their partners' panels, both directly and indirectly through their parents.	Multiple - Shops/stores that sell cigarettes, Websites or social media, Television or radio, Billboards or posters, Kiosk or temporary sales locations, Print newspapers or magazines, Events, Leaflets/flyers, Email or text messages, postal mails, movies	13,468	Knowledge, attitudes, and beliefs relating to e-cigarette use	Reported: This research was supported by a P01 Grant (1P01CA200512-01) from the US National Institutes of Health. Additional support was provided by a Canadian Institutes of Health Research (CIHR)- Public Health Agency of Canada (PHAC) Applied Public Health Research Chair (Dr. Hammond).	Not reported

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Cho 2020	To compare exposure to and use of certain cigarette and vaping product marketing among adult smokers and vapers in four countries with contrasting regulations-- Australia, Canada, England, and the US.	Australia, Canada, England, USA	Cross-sectional studies or surveys	NR	Adults	Respondents were aged 18 years or older; smokers who had smoked at least 100 cigarettes who smoke at least monthly, or less than monthly but occasionally; former smokers who had quit smoking within the past 24 months; vapers who vape at least weekly.	Point of sale	12,294	Current e-cigarette use, Current cigarette use	NR	Not reported
Dai 2016	To examine the associations between the level of exposure to e-cigarette ads from different channels (Internet, newspaper/magazine, store, and TV/movies) and e-cigarette use (never, former, and current) among a nationally representative sample of middle and high school students. Among current e-cigarette users, we further evaluated the impacts of e-cigarette advertisement exposure to the intensity of e-cigarette use (high, medium, and low).	USA	Cross-sectional studies or surveys	School	School-aged adolescents	Not reported clearly	Multiple	21,491	Current e-cigarette use, Frequency of e-cigarette use,	No funding was secured for this study.	The authors declared that they had no competing interests.
Dai 2017	To assess the association between e-cigarette promotions and prevalence of e-cigarette use and examine the association between e-cigarette promotions and frequency of e-cigarette use.	USA	Cross-sectional studies or surveys	Community	School-aged adolescents	Adults aged 18 years or older in the 50 US states and the District of Columbia.	Direct marketing channels	1,960 for mail promotion, and 3,422 for email promotion.	Current e-cigarette use, Frequency of consumption of e-cigarette	No funding was secured for this study.	The authors declared that they had no competing interests.
Do 2020	To identify factors associated with past 30-day tobacco use among a sample youth.	USA	Cross-sectional studies or surveys	School	School-aged adolescents	Data were obtained from the Virginia Youth Survey.	Multiple - in-person at retail locations known to sell tobacco products, commonly referred to as tobacco retail outlets (i.e. convenience store, supermarket, gas station).	379,331	Current cigarette use , Current dual use of e-cigarette and combustible cigarette	The study was funded by the U.S. Centers of Disease Control and Prevention, the Virginia Department of Health in collaboration with the Virginia Foundation for Healthy Youth, with support from the Department of Education.	The authors declared that they had no competing interests.

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Donaldson 2017	To examine the relationship between media exposure and tobacco product addiction beliefs.	USA	Cross-sectional studies or surveys	NR	Young adults	Adults aged 18 and older in the US civilian non-institutionalized population	Multiple - Active media channels include news websites, newspaper, magazine, health websites, government websites, and social media. Passive media channels include television, radio, billboard, public transportation, mailings, community event and at the point of sale.	3738	Current e-cigarette use, Current cigarette use	Reported: HINTS-FDA was funded by the National Cancer Institute, and FDA s Center for Tobacco Products, Office of the Commissioner, and Center for Food Safety and Applied Nutrition via inter agency agreements with NCI, and by contract from NCI to Westat, Inc., HHSN261201000064C.	The authors are federal employees; however, the findings and conclusion in this report are those of the authors and do not represent FDA or NIH positions or policies.
Du 2020	To examine the association of US state regulations regarding e-cigarettes with current e-cigarette use among adults in the United States.	USA	Cross-sectional studies or surveys	Community	Young adults	Adults aged 18 years or older living in private residences of, District of Columbia, the Commonwealth of Puerto Rico, Guam.	Self-service displays of e-cigarettes	894,997	Current e-cigarette use	Award P30 ES005605 from the National Institutes of Health.	None reported
D'Angelo 2020	3 objectives: 1) to document national estimates of retail e-cigarette availability, marketing overall and by store type including flavoured products, ads, displays and promotions from 2014-2015. 2) To examine whether differences in state and neighbourhood characteristics were associated with point-of-sale e-cigarette availability, and to examine new availability among stores that did not previously sell e-cigarettes. 3) To examine whether differences in state and neighbourhood characteristics were associated with the presence of point-of-sale e-cigarette promotions and marketing among stores selling e-cigarettes.	USA	Cohort	Community	Others	For stage one Tobacco retailers in the contiguous U.S. (48 states and the District of Columbia, excluding Alaska and Hawaii). For stage 2, tobacco retailers were identified and randomly selected within each county from two commercial retailer lists (Reference USA and Dun & Bradstreet).	Point of sale	2,272 retail stores in the year 2014, 2,126 in 2015. Stage 1: 48 states. Stage 2: 97 countries. Other information NR	Current cigarette use	This work was supported by the National Cancer Institute at the National Institutes of Health (P01 CA225597 to K.M.R., Project name: ASPiRE	The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this study. The funders had no involvement in the study design, collection, analysis, writing, or interpretation.
Ebrahimi 2020	To identify factors associated with e-cigarette susceptibility and curiosity among adolescents who are and are not susceptible to cigarette smoking	USA	Cross-sectional studies or surveys	Community	School-aged adolescents	Adolescents reporting never having used a cigarette and/or e-cigarette	Point of sale	13,428	Intentions to use e-cigarettes	NIH/National Institute on Drug Abuse (F32DA044733) and Stanford Maternal and Child Health Research Institute (1111239-440-JHACT).	The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Etim 2020	To examine the age-varying associations between e-cigarette use and peer use, household use, and exposure to e-cigarette commercials among alternative high school students in Southern California between the ages of 15 and 20 years.	USA	Cohort	School	School-aged adolescents	High school students, between the ages of 15 and 20 years. Schools that had at least 100 students and were within 100 miles of the program offices in Claremont, California.	Multiple - Television, Internet	1060	Current use of e-cigarettes	This work was supported by the National Institute of Child Health and Human Development and the Food and Drug Administration Center for Tobacco Products (R01HD077560).	The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none was reported.
Farrelly 2015	To examine the effects of viewing e-cigarette TV advertisements on adolescents aged 13–17 years in a randomised controlled experiment.	USA	Randomised controlled trial	Community	School-aged adolescents	Adolescents aged 13–17 years	Broadcast - Television	Total number randomised- 5,020. Total number included in final analysis- 4,974	Intentions to use e-cigarettes, knowledge, attitudes, and beliefs relating to e-cigarette use	The Florida Department of Health provided funding for the study.	Not reported
Filippidis 2017	To assess the correlates of self-reported exposure to tobacco products and e-cigarette advertising in the EU.	European Union	Cross-sectional studies or surveys	Community	School-aged adolescents	People aged ≥15 years	Multiple - Point of sale (retail locations like shops or vending machines), billboards, posters or other types of advertising in public spaces, newspapers or magazines, online social networks or blogs, in or around cafes or bars, websites other than the retailers' websites, TV shows or movies, including streaming services, in railway stations or airports, and in inflight magazines.	27,801	Current cigarette use	The study was supported by a grant from the European Commission (Horizon2020 HCO-6-2015; EUREST-PLUS: 681109; Vardavas). EF was partly supported by the Instituto de Salud Carlos III of the Government of Spain and the European Regional Development Fund, ERDF (RTICC RD12/0036/0053) and the Department of Universities and Research, Government of Catalonia (2014SGR999).	None declared.
Giovenco 2016	To test the relationship between exposure to e-cigarette marketing at the point-of-sale near schools and youth e-cigarette use	USA	Cross-sectional studies or surveys	School	School-aged adolescents	High school students. However, the criteria were not defined clearly.	Point of sale	3,909	Ever e-cigarette use, Current e-cigarette use	This project was funded through a contract from the New Jersey Department of Health.	Not reported
Hammig 2016	To examine factors associated with e-cigarette initiation among minority youth in the United States.	USA	Cross-sectional studies or surveys	Community	School-aged adolescents	Middle and high school students in the United States	Multiple - internet, newspapers, magazines, newspapers, convenience store, supermarket, gas station, TV, movies	736,158	Uptake / initiation of e-cigarette	NR	None

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Hammond 2020	Three primary objectives: (1) to examine changes in exposure to e-cigarette marketing before and after implementation of the Tobacco and Vaping Products Act (TVPA), (2) to examine whether exposure differed on the basis of the strength of provincial marketing restrictions, and (3) to test whether exposure to e-cigarette marketing was associated with the prevalence of vaping.	Canada	Cross-sectional studies or surveys	Community	Young adults	Youth aged 16 through 19 at the time of recruitment; Respondents were excluded from the sample if they failed a data integrity check, had missing or invalid data on key variables or had participated in a previous wave of the study.	Multiple - Point of sale, social media platforms, broadcast, events, print media, direct marketing channels.	22,004	Current e-cigarette use	Funded by the National Institutes of Health (NIH), grant 1P01CA200512-01. Dr Hammond is also supported by a Canadian Institutes of Health Research– Public Health Agency of Canada Applied Public Health Research Chair. Funded by the National Institutes of Health (NIH).	Dr Hammond has served as a paid expert witness in legal challenges against tobacco companies; the other authors have indicated they have no potential conflicts of interest to disclose.
Hansen 2018	To investigate the association between exposure to electronic cigarette (e-cigarette) advertisements and use of e-cigarettes, combustible cigarettes and hookahs.	Germany	Cross-sectional studies or surveys	School	School-aged adolescents	Schools representing all types of schools except for schools for students with special needs; Adolescents	Multiple - Type of exposure- Multiple - television commercials and internet e-cigarette advertisements.	6,902	Ever e-cigarette use, Current dual use of e-cigarette and combustible cigarette, Current cigarette use	The study was supported by DAK-Gesundheit, a German health insurance company.	None declared.
Hansen 2020	To investigate the associations between recall of exposure to ecigarette advertisements and initial use of e-cigarettes, conventional cigarettes and hookahs one year later among German adolescents.	Germany	Cohort	School	School-aged adolescents	Secondary school adolescents from grades 5 to 10	Multiple - Television and internet	4,529	Ever e-cigarette use	The study is supported by DAK-Gesundheit (German Health Insurance Company).	The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.
Hébert 2017	The authors seek to fill important gaps in knowledge by describing the prevalence and correlates of youth exposure to and engagement with tobacco- and e-cigarette–related social media among a large, representative sample of Texas adolescents.	USA	Cross-sectional studies or surveys	NR	School-aged adolescents	Participants included adolescents in sixth, eighth, and 10th grades at baseline from a representative sample of 79 schools in five counties that surround the four largest cities in Texas: Austin, San Antonio, Houston, and Dallas/Fort Worth.	Social Media Platforms	3,907	Ever e-cigarette use, Intentions to use e-cigarettes	Reported : Research reported in this publication was supported by grant number [1 P50 CA180906] from the National Cancer Institute and the FDA Center for Tobacco Products (CTP). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the Food and Drug Administration.	None declared

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Herrera 2018	To examine associations between exposure to tobacco marketing via traditional and digital marketing channels and ever use of e-cigarettes among Mexican-American young adults.	USA	Cross-sectional studies or surveys	Community	Young adults	Between 18 and 29 years of age; a resident of Cameron County, Texas; of Mexican heritage, defined as being born in Mexico, having a parent, or at least one grandparent born in Mexico; and able to speak English or Spanish	Multiple - television, radio, billboards or posters, newspapers, magazines, text, internet, and Facebook. Traditional media included television, radio, billboards or posters, newspapers, and magazines. Digital media included ads seen via the internet and Facebook and received via text.	92	Ever e-cigarette use, Frequency of consumption of e-cigarette use	Research reported in this publication was supported by grant number 1P50 CA180906 from the National Cancer Institute and the Food and Drug Administration (FDA) Center for Tobacco Products, and by UT Health (PRIME funding). The content is solely the responsibility of the authors and does not necessarily represent official views of the National Institutes of Health (NIH) or the Food and Drug Administration (FDA). NIH/FDA has no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit for publication.	The authors declare no competing interests.
Kim 2015	To examine adult smokers' awareness of and receptivity to an electronic nicotine delivery system (ENDS) television advert, and whether viewing the advert influenced urge to smoke and intention to try ENDS.	USA	Cross-sectional studies or surveys	Community	dual users	Adult (aged 18 or older) smokers and recent quitters (past 12 months)	Broadcast	519	Quitting combustible cigarette use, knowledge, attitudes, and beliefs relating to e-cigarette use, Intention to use e-cigarette	This work was funded under RTI International's evaluation of the Bureau of Tobacco Free Florida's tobacco prevention and control programme.	None
Kinnunen 2015	To study adolescents' exposure to e-cigarette advertising, and the association of e-cigarette use with interest in smoking cessation among daily smokers.	Finland	Cross-sectional studies or surveys	Community	School-aged adolescents	Nationally representative samples of individuals aged 12, 14, 16 and 18 years were obtained from the national Population Register Centre.	Multiple - Facebook, other internet pages, traditional media, shops, billboards	3,475	Initiation of e-cigarette use	This study was financially supported by the Ministry of Social Affairs and Health (201 310 055), Finland, and the Competitive Research Funding of the Tampere University Hospital (9M090), Tampere, Finland.	Not reported

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Lee 2019	To examine if among youth who were naïve to both ENDS and conventional cigarettes at baseline, those with elevated use of electronic devices (EUED) would be more likely to initiate ENDS use in later years than those without EUED. We also hypothesized that such a finding would still hold after adjustment for exposure to ENDS advertisements and other well-established covariates of ENDS use, such as psychological distress, depressive symptoms, having friends smoking cigarettes or using ENDS, and other substance use.	USA	Cohort	Community	School-aged adolescents	Participants who were 12–17 years old non-institutionalised U.S. residents, and naïve to both conventional cigarettes and ENDS at baseline were sampled.	Multiple - Broadcast, print media, events, social media, internet, point of sale	11,325	Initiation of e-cigarette use	NR	NR
Little 2016	To explore the prevalence of dual and poly-tobacco use, and potential correlates of these groups.	USA	Cross-sectional studies or surveys	Air Force Base	general population	US air force trainees in Technical Training	Free giveaways	13,873	Ever e-cigarette use, Initiation of e-cigarette use	This work was supported by 2 grants from the National Institute on Drug Abuse (grants R01 CA141567, R01 DA036510, and R01 DA036510-S1 to R.C.K.). This study was a collaborative endeavour between the US Air Force and the University of Tennessee Health Science Center via Cooperative Research and Development Agreement (11-118-WHMC-CRADA01).	J.O.E. has received grants for work separate from the present study from JHP Pharmaceuticals; Orexigen Therapeutics, Inc.; and Pfizer, Inc

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Lienemann 2019	The current study examines whether vulnerability factors strengthen the association between tobacco advertisement liking and use.	USA	Cross-sectional studies or surveys	Community adults	Young adults	Adults aged 18-24	Multiple - print, TV, web	9,109	Frequency of e-cigarette use, Current e-cigarette use	This work was supported in part by grant number P50CA180905 from the US National Cancer Institute (NCI) and the US Food and Drug Administration (FDA) Center for Tobacco Products (CTP) for Cruz, Unger, Lienemann and Baezconde-Garbanati; grant number T32CA009492-29 from NCI for Lienemann; grant number P30CA014089 from NCI for Baezconde-Garbanati; grant number U54CA189222 under a subcontract to Westat from NCI, FDA, and the Center for Evaluation and Coordination of Training and Research (CECTR) in Tobacco Regulatory Science for Rose; and grant number P50CA180907 from the NCI and FDA CTP for Byron.	None to declare
Loukas 2019	To examine how recall of ENDS marketing through 5 different channels predicted subsequent ENDS initiation up to 2.5 years later among youth (ages 12–17 years) and young adults (ages 18–29 years).	USA	Cohort	School, University	School-aged adolescents and young adults	School-going youth (ages 12–17 years at baseline) and young adults (ages 18–29 years at baseline)never using ENDS at baseline	Multiple - television (TV), radio or Internet radio, billboards, retail stores, and the Internet	4,711	Initiation of e-cigarette use	Supported by the National Institutes of Health (1 P50 CA180906) from the National Cancer Institute and the US Food and Drug Administration Center for Tobacco Products. Support for Dr Li was also provided by the National Institute on Alcohol Abuse and Alcoholism (R01 AA019511). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or the US Food and Drug Administration. Funded by the National Institutes of Health (NIH).	The authors have indicated they have no potential conflicts of interest to disclose.

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Majmundar 2021	To examine associations between self-reported levels of exposure to music videos with any e-cigarette product placement or imagery and susceptibility to use e-cigarettes and e-cigarette use.	USA	Cross-sectional studies or surveys	Community	Young adults	Young adults (18–24 years of age), residing in California.	Social Media Platforms	1,280	Ever e-cigarette use, Current e-cigarette use, Intentions to use e-cigarettes	This project was partially supported by funds provided by The Regents of the University of California, Research Grants Program Office, Tobacco-Related Diseases Research Program, Grant Number No. 28KT-0003. The opinions, findings, and conclusions herein are those of the authors and do not necessarily represent those of The Regents of the University of California or any of its programs.	The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.
Maloney 2016	Does exposure to vaping cues in e-cigarette advertisements decrease daily and intermittent smokers' (a) self-efficacy to quit smoking tobacco cigarettes, (b) attitudes toward quitting smoking, and (c) behavioral intentions to quit smoking? Does exposure to vaping cues in e-cigarette advertisements decrease former smokers' (a) self-efficacy to continue abstaining from smoking tobacco cigarettes, (b) attitudes toward smoking abstinence, and (c) behavioral intentions to continue abstaining from smoking?	USA	Non-randomised controlled trials	Community	Adults	American adult (over 18 years old) daily smokers, intermittent smokers, and former smokers to participate. All participants must have smoked at least 100 cigarettes within their lifetime.	Multiple - Google, YouTube, and e-cigarette brand sites	884	Knowledge, attitudes, and beliefs relating to e-cigarette use	This work was supported by the National Cancer Institute (grants P50CA095856 and 1U01CA154254).	None
Mantey 2016	The study aims to determine the association between exposure to e-cigarette marketing through multiple channels (internet, print, retail and TV/movies) and e-cigarette use and susceptibility to use.	USA	Cross-sectional studies or surveys	School	School-aged adolescents	Middle school and high school students in the United States	Multiple - internet; when reading newspapers or magazines; at a convenience store, supermarket or gas station; when watching TV	22,007	Ever e-cigarette use, Current e-cigarette use, Intentions to use e-cigarettes	This work was supported by grant number [1 P50 CA180906-01] from the National Cancer Institute at the National Institutes of Health and the Food and Drug Administration, Center for Tobacco Products (CTP).	Not reported
Mantey 2019	To examine the association of point of sale e-cigarette marketing specifically advertising and product displays on young adult cigarette smoking cessation behaviours.	USA	Cohort	University	Young adults	18-29 years old, being a full- or part-time, degree or certificate seeking undergraduate student attending a 2- or 4-year college/university.	Point of sale	813	Quitting e-cigarette and combustible cigarette use	NR	Not reported

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Marion 2020	To understand the effect of pro-tobacco marketing on electronic cigarette and combustible cigarette dual use among US middle and high school students under 18 years of age.	USA	Cross-sectional studies or surveys	School	School-aged adolescents	Public and private middle and high school students under 18 years of age	Internet/online	20,189	Current dual use of e-cigarette and cigarette	The authors received no financial support for the research, authorship, and/or publication of this article.	The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.
Mays 2016	To examine the effects of e-cigarette warnings on perceptions of e-cigarettes and cigarettes and other cognitive precursors to tobacco use among young adult non-smokers.	USA	Randomised controlled trial	Community	Young adults and adults	Non-smokers ages 18 to 30 were eligible to participate. Age outside the target age range and those reporting smoking ≥ 100 lifetime cigarettes and now smoking every day or some days excluded.	Multiple - broadcast, print media, point of sale	436	Knowledge, attitudes, and beliefs relating to e-cigarette use, Intentions to use e-cigarettes	This study was supported by the National Institutes of Health (NIH) and the Food and Drug Administration (FDA) Center for Tobacco Products under NIH grant number K07CA172217. This work was also supported in part by the Georgetown Lombardi Comprehensive Cancer Center Support grant number P30CA051008. Manuscript preparation was also supported in part by a scholarship from The Mary Elizabeth Groff Surgical Medical Research and Education Charitable Trust. The study sponsors had no role in the study design; in the collection, analysis and interpretation data; in the writing of the report; and in the decision to submit the paper for publication. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the FDA.	The authors declare that they have no competing interests

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Nagelhout 2016	To determine if noticing advertisements for e-cigarettes is associated with current use of e-cigarettes, disapproval of smoking, quit smoking attempts and quit smoking success.	Netherlands	Cohort	General population aged 16+ or community (For consistency across extraction sheets)	Young adults	Current smokers aged 16+ who smoked at least monthly and had smoked at least 100 factory-made cigarettes and/or roll-your-own cigarettes in their lives.	Multiple - TV, in newspapers or magazines.	1,198	Current e-cigarette use, Quitting cigarette use	Tobacco Products (CTP). The ITC Netherlands Surveys were supported by grants from the Netherlands Organisation for Health Research and Development (ZonMw) (#200130002). A set of extra questions in the ITC Netherlands Survey wave 8 about alternative tobacco and nicotine products was funded by the National Cancer Institute and FDA Center for Tobacco Products (CTP) (#3PO1CA138389-06S2). Bryan W. Heckman was supported by K12DA031794. KMC has received grant funding from the Pfizer, Inc., to study the impact of a hospital based tobacco cessation intervention. KMC also receives funding as an expert witness in litigation filed against the tobacco industry.	Tobacco Products (CTP). The other authors declare that they have no conflicts of interest.
Nicksic 2017a (Recall of E-cigarette Advertisements and Adolescent E-cigarette Use)	To determine if recall of e-cigarette advertising on TV, radio, billboards, retail stores, and the Internet is related to adolescent perceived harm of e-cigarettes, ever and current e-cigarette use, and susceptibility to use e-cigarettes.	USA	Cohort	School	School-aged adolescents	12–17 year-old, middle and high school students	Multiple - TV, radio, billboards, retail stores, and internet	3,907 initial survey and 2,488 in follow up survey	Ever e-cigarette use, Current e-cigarette use, Intentions to use e-cigarettes	Research reported in this publication was supported by grant number [1 P50 CA180906] from the National Cancer Institute and the FDA Center for Tobacco Products (CTP). This study was funded, in part, by the Michael & Susan Dell Foundation through resources provided at the Michael & Susan Dell Center for Healthy Living, The University of Texas School of Public Health, Austin Campus. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the Food and Drug Administration.	None declared

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Nicksic 2017b (Tobacco Marketing, E-cigarette Susceptibility, and Perceptions among Adults)	To determine the association between the recall of tobacco marketing (tobacco advertisements and receipt of product coupons) and susceptibility to future e-cigarette and combustible cigarette use, as well as perceptions of e-cigarettes among adult combustible cigarette smokers and non-smokers.	USA	Cross-sectional studies or surveys	General population aged 18+	Young adults	Adults aged 18+ who are either current smokers or non-smokers. Former smokers were ineligible.	Multiple - internet, in a convenience store, supermarket or gas station, and on billboards	1,027	Knowledge, attitudes, and beliefs relating to e-cigarette use, Intentions to use e-cigarettes	National Institute on Drug Abuse of the National Institutes of Health and the Centre for Tobacco products of the US Food and Drug Administration. Also funding from the National Cancer Institute.	None to disclose
Padon 2018	To test whether exposure to e-cigarette ads will have a positive impact on explicit and implicit measures of youth susceptibility to trying e-cigarettes or tobacco cigarettes compared to youth exposed to control ads; and whether exposure to e-cigarette ads with high youth appeal will have a greater positive impact on measures of youth susceptibility to trying e-cigarettes or tobacco cigarettes compared to e-cigarette ads with low youth appeal or control ads.	USA	Randomised controlled trial	Community	School-aged adolescents	Youth (age 13–17 years). Other details not defined clearly	Broadcast	1,267 randomised (465 in low youth appeal, 428 high youth appeal, and 374 in control group). Final analysis: 134 in low youth appeal, 138 in high youth appeal and 145 in the control ad group).	Knowledge, attitudes, and beliefs relating to e-cigarette use, Intentions to use e-cigarettes	Research reported in this publication was supported by the National Cancer Institute (NCI) of the National Institutes of Health (NIH) and U.S. Food and Drug Administration (FDA) Center for Tobacco Products (CTP) under Award Number P50CA179546. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the Food and Drug Administration (FDA).	None declared
Papaleontiou 2020	To explore the combined effect of exposure to both traditional tobacco advertising and e-cigarette advertising on youth's current use of traditional tobacco products and e-cigarettes.	USA	Cross-sectional studies or surveys	Community	School-aged adolescents	Middle school (grades 6-8) and high school (grades 9-12) students in the U.S.	Multiple - Broadcast, internet websites, print media, Point of sale	17,711	Current e-cigarette use, Current cigarette use	This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.	The authors have no conflicts of interest to disclose.

Author YYYY	Study objective (as mentioned in the study)	Country/ ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Pesko 2017	To evaluate the influence of sociodemographics and tobacco control policy environments on adolescent tobacco use in urban versus rural areas, as well as to identify the effect of e-cigarettes on traditional patterns of urban rural tobacco use.	USA	Cross-sectional studies or surveys	Community	School-aged adolescents	Youths aged 11-17 years were included. Individuals aged 9 and 10 years were excluded from the analysis as outliers due to a small sample size. Individuals aged 18 years and older were also excluded to limit the sample to respondents affected by legal minimum purchase age restrictions. Finally, individuals missing any of the tobacco use outcomes measured or missing age were excluded.	Multiple - Broadcast, internet websites, print media, Point of sale	71,012	Current e-cigarette use	NR	The authors have no conflicts of interest to disclose.
Petrescu 2017	To test whether exposing children to glamorous e-cigarette adverts increases the appeal of tobacco smoking. To test whether exposing children to healthful e-cigarette adverts that emphasise the potential health benefits of e-cigarettes over tobacco cigarettes reduces the appeal of tobacco smoking.	United Kingdom	Randomised controlled trial	Community	School-aged adolescents	Children aged 11–16 years selected across from UK.	Others - glamour adverts in print	564 randomised, 411 in final analysis	Current e-cigarette use, Intentions to use e-cigarettes	The study was funded by the Department of Health Policy Research Programme (Policy Research Unit in Behaviour and Health (PR-UN-0409-10109)).	All authors have completed the Unified Competing Interest form and declare: First three authors and last author have no competing interests to declare; fourth author has a royalty interest in a store mapping and audit system owned by the University of North Carolina at Chapel Hill, but these systems were not used in this study.
Pierce 2018	To investigate whether receptivity to tobacco advertising among youth and young adults is associated with a progression (being a susceptible never user or ever use) to use the product advertised, as well as conventional cigarette smoking.	USA	Cohort	General	School-aged adolescents and young adults	Never tobacco users aged 12 to 24	Multiple - Print, direct mail and television ads	10,989	Ever e-cigarette use, Initiation of e-cigarette use , Intentions to use e-cigarettes	This article was supported with Federal funds from the National Institute on Drug Abuse (NIDA), National Institutes of Health, and the Center for Tobacco Products, US Food and Drug Administration (FDA), Department of Health and Human Services, under contract HHSN271201100027C to Westat.	None to disclose

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Pike 2019	To investigate whether commercials for e-cigarettes influence the use of e-cigarettes, cigarettes and cigar among high-risk youth in Southern California.	USA	Cohort	High school students	School-aged adolescents	High school students from alternative high schools.	Multiple - newspaper and magazine ads, posters and signs, radio spots; and Web banners	1,060	Current e-cigarette use, frequency of e-cigarette use	Research reported in this publication was supported by the NICHD and FDA Center for Tobacco Products (R01HD077560).	None to disclose
Pokhrel 2015	To investigate the associations among exposure and receptivity to e-cigarette marketing, low e-cigarette-related harm perceptions, and recent e-cigarette use in a sample of college students.	USA	Cross-sectional studies or surveys	College/University	Young adults	Undergraduate 4- and 2-year college students.	Multiple - newspapers, magazines, the Internet, television, billboards, sporting or cultural events, convenient stores, gas stations, grocery stores, and malls	124 never smokers, 112 current smokers, and 90 experimenter/former smokers invited for the survey. 114 never smokers, 107 current smokers, and 86 experimenter/former smokers completed the survey.	Ever e-cigarette use, Current e-cigarette use	The research was supported by a seed grant awarded to Pallav Pokhrel by the University of Hawaii Cancer Center. The authors thank Nick Muranaka for help with data collection and Grant Uyeda and Brad Nitta for administrative support.	No conflicts of interest to report
Pokhrel 2017	To compare the following measures pertaining to e-cigarette marketing, on their relationships with each other and with e-cigarette use and susceptibility: cued recall, self-reported exposure, receptivity, liking, and frequency of convenience store visit.	USA	Cross-sectional studies or surveys	University	School-aged adolescents and young adults	18–25 year-old students	Multiple - Majority were print magazine ads and 1 video still image	470	Initiation of e-cigarettes, Current e-cigarette use, Intentions to use e-cigarettes	This study was funded by research grant (R01CA20227702) from the National Cancer Institute	No conflicts of interest
Pokhrel 2019	To test whether exposure to e-cigarette advertising increases e-cigarette use susceptibility among nonsmoking young adults by promoting explicit and implicit attitudes toward e-cigarettes as a safer and healthier alternative to combustible cigarettes.	USA	Randomised controlled trial	College	Young adults	18–29 years old, have never used an e-cigarette, and smoked less than 100 cigarettes in their lifetime and none in the past year.	Multiple - Internet, including social media sites such as Facebook and Instagram, and young-adult-oriented print magazines	Health condition (n = 137), Social condition (n = 139), and Control condition (n = 117) -Total - n = 393	Knowledge, attitudes, and beliefs relating to e-cigarette use, intentions to use e-cigarettes	This research was supported by grants 3P30CA71789-13S1/16S2 and R01CA202277	None declared
Pu 2017	This study aimed to fill in the gap by further examining the associations between exposure to e-cigarette advertising and the perception, interest, and use of e-cigarettes among US adolescents.	USA	Cross-sectional studies or surveys	School	School-aged adolescents	Participants aged between 11 to 18 years, in grades 6–12.	Multiple - internet, newspaper, magazines, convenience store, supermarket or gas station, TV, and movies	21,595	Current e-cigarette use, Intentions to use e-cigarettes	The author received no financial support for the research, authorship, and/or publication of this article.	The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Rath 2017	The aim of this study was to examine awareness and likeability of e-cigarette print advertisements in a national sample of young adults and to examine ad likeability as a correlate of intended e-cigarette use among never e-cigarette users.	USA	Randomised controlled trial	Community	Young adults and adults	Adults aged between 18 and 34 years.	Multiple - tobacco company website, tobacco social media page and direct mail/email of product ads, and online display	2,110	Intentions to use e-cigarettes	The study was funded by Truth Initiative. No financial disclosures were reported by the authors.	The authors declared that they have no conflicts of interest.
Ratneswaran 2019	To assess the impact of e-cigarette advertising on the perceived social acceptability of cigarette and e-cigarette smoking and on using either cigarettes or e-cigarettes.	United Kingdom	Cross-sectional studies or surveys	University	Young adults	Inclusion criteria were fluent English, student, age 18–80 years and both genders.	Multiple - online banner/video advertising, news and music or sports websites, print ads, TV/Radio, and direct emails	106	Quitting cigarette use, Knowledge, attitudes, and beliefs relating to e-cigarette use, Intentions to use e-cigarettes	No external sources of funding to declare.	No direct conflict or competing interests to declare. Lead author is a co-founder of remarxs.com. A social network which supports academic work through peer and senior mentorship. All authors declared no conflict of interest.
Reinhold 2017	To examine exposure to e-cigarette advertising and its effect on e-cigarette attitudes and use among transitional age college students.	USA	Cross-sectional studies or surveys	University	Young adults	The study included only transitional age youth (18–24 years)	Multiple - internet, newspaper, magazines, retail store, billboard, vehicle, event, TV, and movie	6,819. (5,983 after exclusions)	Knowledge, attitudes, and beliefs relating to e-cigarette use, Intentions to use e-cigarettes	Funding was provided in part by the Ohio Department of Mental Health and Addiction Services (Ohio MHAS), which played no part in the design or analysis of the study.	The authors declared no conflict of interest.

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Sanders-Jackson 2015	To examine young adults' knowledge of e-cigarette constituents and regulation and its association with product use and self-reported exposure to marketing.	USA	Cross-sectional studies or surveys	Community - U.S. households	Young adults	Young adults aged between 18–34 years, including an oversample of Blacks and Hispanics.	Multiple - convenience store, liquor store, or gas station, social media such as Facebook, Twitter, or YouTube, television or cable shows, and newspapers or magazines	1,247	Knowledge, attitudes, and beliefs relating to e-cigarette use	The study was supported by the National Cancer Institute (grant number R01-CA067850) and the National Heart, Lung and Blood Institute (grant number T32-HL007034). The second author conducted this study while a postdoctoral fellow at the Center of Excellence in Cancer Communication Research at the University of Pennsylvania Annenberg School for Communication (supported by P20CA095856). The National Institutes of Health did not have any role in the design and conduct of the study, in the collection, analysis, and interpretation of the data, and in the preparation, review, or approval of the manuscript.	No conflict of interest declared.
Sawdey 2017	Determine whether e-cigarette use is associated with exposure to e-cigarettes on social media in college students.	USA	Cross-sectional studies or surveys	College students/ University	Young adults	College students (no additional info mentioned) participants were asked not to participate if they were younger than age 18.	Social Media Platforms	258	Ever e-cigarette use, Current e-cigarette use,	Mr. Sawdey is a trainee with the Center for the Study of Tobacco Products at Virginia Commonwealth University research is supported by the National Institute on Drug Abuse of the National Institutes of Health under Award Number P50DA036105 and the Center for Tobacco Products of the US Food and Drug Administration. Dr. Prom-Wormley's research is supported by R01 DA025109.	None to declare
Singh 2016	To examine the association between e-cigarette advertisement exposure and current e-cigarette use among a nationally representative sample of US middle and high school students.	USA	Cross-sectional studies or surveys	School	School-aged adolescents	The sample criteria included middle school students, high school students, respondents who indicated ungraded or other grade, and respondents who did not indicate a grade.	Multiple - internet, newspaper, magazines, retail stores, TV, and movies	22,007	Current e-cigarette use	No sources of funding, direct or indirect, for the reported research.	The authors declared no potential conflicts of interest

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Shadel 2020	To examine the association between the appeal of advertising for 5 classes of tobacco product (including e-cigarettes) and future intentions to use those products amongst homeless youth that indicated any level of lifetime use.	USA	Cross-sectional studies or surveys	Community adults	School-aged adolescents and young adults	(1) aged 13-25 (2) not currently living with a parent or guardian, (3) not getting most of their support for food and housing from family or a guardian, (4) spent the previous night in a shelter, outdoor or public place, hotel or motel room rented with friends (because of nowhere else to go) or other place not intended as a domicile, (e) have used any type of cigarette, ENDS or other tobacco product in the past 30 days.	Multiple - retail stores, television, posters	Main sample: 354. Sample focusing on LGBQA youth: 115	Intentions to use e-cigarettes	National Cancer Institute, Grant Number R01CA204004	None to declare
Smith 2015	To assess whether exposure to ads for e-cigarettes or a comparison product (snus), showed differences in interest to try e-cigarettes among both cigarette smokers and non-smokers.	USA	Cross-sectional studies or surveys	Community	Young adults and adults	Eligible participants aged between 18 and 65, current US residents, able to read and write in English.	Print media	875 people began the survey, and 600 completed the survey in full.	Intentions to use e-cigarettes,	Funding for this work was supported by Roswell Park Cancer Institute and National Cancer Institute (NCI) grant #P30 CA016056.	Fourth author received research grant from Pfizer, manufacturer of smoking cessation medications. Third author is a member of the Food and Drug Administration (FDA) Tobacco Products Scientific Advisory Committee. The authors declared no other competing interests.
Stroup 2018	To understand if ad exposure and perceptions of use influence intention to use e-cigarettes in youth smokers and non-smokers who have never tried e-cigarettes.	USA	Cross-sectional studies or surveys	School	School-aged adolescents	Selective schools that included middle school (grades 6–8) and high school students (grades 9–12).	Multiple - internet, newspaper, magazines, convenience store, supermarket, gas station, TV, and movies.	17,286	Intentions to use e-cigarettes	This work was supported, in part, by a fellowship grant awarded by FDA/NIH/P50-DA-036107 and by 1R21CA181962-01A1. The FDA and NIH had no role in the analysis or interpretation of these data, writing the manuscript, or the decision to submit the paper for publication.	The authors reported no conflicts of interest.

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Trumbo 2015	To test if the appeal of e-cigarette advertisements and beliefs about the addictiveness of e-cigarettes may affect their uptake among college students.	USA	Cross-sectional studies or surveys	University	Young adults	College students were of interest. Approximately half of young adults in the U.S. attend a college or university, and studies had shown a high degree of social acceptability for e-cigarette use by college students.	Social Media Platforms	296	Intentions to use e-cigarettes	None reported.	Authors declared that they have no conflicts of interest.
Unger 2018	To estimate the prevalence of exposure to tobacco websites and the associations between website exposure and tobacco product use and susceptibility among adolescents.	USA	Cross-sectional studies or surveys	Community	School-aged adolescents	Adolescents aged between 12 and 17	Internet/online	13,651	Ever e-cigarette use, Current e-cigarette use, Intentions to use e-cigarettes,	funded by the Food and Drug Administration and National Institutes of Health (grant #3P50CA180905). PATH data collection was supported by the National Institutes of Health and the Food and Drug Administration, under a contract to Westat (Contract No. HHSN271201100027C.	None declared
Vasiljevic 2016	To determine the impact on appeal of tobacco smoking after exposure to advertisements for e-cigarettes with and without candy like flavours.	United Kingdom	Randomised controlled trial	School	School-aged adolescents	Non-smoking children aged 11-16 years attending two schools, one in Cambridge and one in Hampshire.	Print media	598- Total number Randomised. 471- Total number included in final analysis	Intentions to use e-cigarettes, Knowledge, attitudes, and beliefs relating to e-cigarette use	Funded by Department of Health policy Research Programme (Policy Research and Health).	None declared
Vasiljevic 2017	To replicate and extent recent findings showing that children perceive the harms of occasional tobacco smoking to be lower after exposure to e-cigarette advertisements.	United Kingdom	Randomised controlled trial	School	School-aged adolescents	Non-smoking children aged 11-16 years attending two schools, one in Cambridge and one in Hampshire.	Print media	1,449-Total number Randomised 1,057-Total number included in final analysis	Intentions to use e-cigarettes, Knowledge, attitudes, and beliefs relating to e-cigarette use	This report is an independent research commissioned and funded by the National Institute for Health Research Policy Research Programme (Policy Research Unit in Behaviour and Health (PR-UN-0409-10109)).	None declared
Villanti 2016	To assess the impact of brief exposure to four electronic cigarette (e-cigarette) print advertisements (ads) on perceptions, intention, and subsequent use of e-cigarettes and cigarettes in US young adults.	USA	Randomised controlled trial	Community	general population	Not defined clearly	Multiple - Print media and online display	Total randomised 4,288: 2,110 in the intervention group and 2,178 in the control group. Total included in the final analysis 3,196: 1,583 in the intervention group and 1,613 in the control group.	Initiation of e-cigarette, Knowledge, attitudes, and beliefs relating to e-cigarette use, intentions to use e-cigarettes	This study was funded by Truth Initiative and conducted by Truth Initiative employees. No financial disclosures were reported by the authors of this article.	None declared

Author YYYY	Study objective (as mentioned in the study)	Country/ies	Study design	Setting	Population Subgroup	Eligibility Criteria for participants (as mentioned)	Type of marketing/sponsorship medium	Sample size	Outcomes	Study Funding	Conflict of Interest
Vogel 2020	The present study had two purposes: (1) to assess the relationship between adolescents' social media use intensity in daily life and their thoughts and intention around e-cigarettes and (2) to experimentally test the effects of brief exposure to e-cigarette social media content on adolescents' subsequent thoughts and intention to use e-cigarettes.	USA	Randomised controlled trial	Community	School-aged adolescents	Aged 13-18 living in California	Social Media Platforms	135	Intentions to use e-cigarettes, Knowledge, attitudes, and beliefs relating to e-cigarette use, intentions to use e-cigarettes	This study was funded by the Tobacco-Related Disease Research Program, the National Heart, Lung and Blood Institute and the Food and Drug Administration (FDA) Center for Tobacco Products (U54HL14712), and the Marilyn Reed Lucia Foundation (7700056).	EAV, KLD, SD, and CC have no conflicts of interest to disclose. DER has DER has consulted for Carrot, Inc; which makes a tobacco cessation device. JJP has provided consultation to pharmaceutical (Pfizer, Achieve Life Sciences) and technology (Carrot, MD Revolution) companies that make medications and other treatments for quitting smoking and has served as an expert witness in lawsuits against tobacco and e-cigarette companies. MLR left UCSF on June 30, 2019 and started as an employee of JUUL Labs as of July 8, 2019. He met criteria for authorship prior to leaving UCSF and he had no role in revising the paper after leaving UCSF and joining JUUL Labs.

Appendix 2 of evidence evaluation report

Effects of e-cigarette advertising, promotion, and sponsorship on people's attitudes, beliefs, perceptions, intentions, and behaviours: a mixed-methods systematic review

Characteristics of included qualitative studies

Study ID	Aim	Design	Country	Participant/population criteria	Specific sub-groups focus	Phenomenon of Interest	Description of advertisement, promotion and marketing of interest in the qualitative study	Funding sources	Declarations of interest
Amin 2020	To explore how e-cigarette users in Australia accessed e-cigarette information and advertising on social media platforms	Interviews	Australia	18 years or older, competent with English, residing in Australia, current or past user of e-cigarettes	No	Perceptions about advertisements	Advertisements on social media	Nursing Endowment Fund, School of Nursing, University at Buffalo,	The authors declared no competing interests
Alpert 2020	To understand how exposure to e-cigarettes on social media might influence attitudes and perceptions towards e-cigs among young adults	Focus groups	United States of America	18-24 year olds who were current, former or never smokers in the US who were current users of social media	Young adults	Attitudes towards and perceptions of advertisements	Social media promotion of e-cigarettes	This work was supported by University of Florida College of Journalism and Communications Dean's Seed Award	The authors declared no competing interests
Chen 2020	To explore adolescent non-e-cigarette users' interpretation of e-cigarette advertisement and their engagement with e-cigarette information	Focus groups	United States	Non e-cigarette users aged 12-17	Adolescents	Attitudes towards e-cigarette advertisements	Exposure to e-cigarette marketing and advertising	Partnership to Improve Community Health (PITCH) grant from the CDC	The authors declared no competing interests
Cowgill 2020	To learn about deaf and hard of hearing students' knowledge and misconceptions and tobacco and e-cigarettes, as well as their use of these products and how they obtain information about these products	Key informant interviews and focus groups	United States	Students from California's two schools for the deaf, and students from mainstream schools. Students in grades 6-9 and 9-12 invited to participate, as well as key personnel working with the students including administrators, teachers and other support staff members	Deaf and hard of hearing youth	Knowledge about tobacco and e-cigarette products	Convenience and liquor stores; online and social media advertising	Tobacco-Related Disease Prevention Program (Grant No. 26IP-0034; principal investigator Barbara Berman) and the UCLA Jonsson Comprehensive Cancer Center (principal investigator Burton Cowgill).	Not reported

Study ID	Aim	Design	Country	Participant/population criteria	Specific sub-groups focus	Phenomenon of Interest	Description of advertisement, promotion and marketing of interest in the qualitative study	Funding sources	Declarations of interest
Park 2019	To understand adolescent perceptions of e-cigarettes and where adolescents receive information about them	Semi-structured interviews	United States of America	Between 10 and 18 years old, able to communicate in English and interested and willing to share their perspectives about e-cigarettes	Adolescents	Perceptions of and information sources about e-cigarettes	Where participants receive information about e-cigarettes	This study was supported by Patricia H. Garman Behavioral Health Nursing Endowment Fund, School of Nursing, University at Buffalo, The State University of New York.	Not reported
Laestadius 2020	To qualitatively explore how young adults, interpret health, modified-risk and cessation related hashtags on Instagram	Focus groups	United States of America	Active Instagram users between the ages of 18 and 24 who were English speakers.	Three focus groups with e-cigarette users, three with dual users, three with smokers and three with non-tobacco users	Interpretation and appeal of e-cigarette advertisements	Instagram posts with possible cessation, harm reduction and smoke-free claims in their hashtags	This work was supported by the National Cancer Institute at the National Institutes of Health and the U.S. Food and Drug Administration Center for Tobacco Products (Grant No. R03CA216528).	The authors declared no competing interests
Kim 2020	To determine how young adults respond to e-cigarette advertisements featuring diverse peer crowds	Semi-structured interviews	United States of America	Young adult tobacco users (18-29 years old) residing in California, that had used more than one tobacco product (cigarettes, e-cigarettes and/or smokeless tobacco) within the past 30 days	No	Liking of the advertisements	Still image and text advertisements featuring one or more human characters using the promoted product.	Funded by the National Cancer Institute (R01CA141661) and the Food and Drug Administration/National Cancer Institute (P50CA180890, U54HL147127).	The authors declared no competing interests

Technical Report for effects of e-cigarette advertising, promotion, and sponsorship on people's attitudes, beliefs, perceptions, intentions, and behaviours: a mixed-methods systematic review

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<u>The technical report and the evidence evaluation report</u>

<u>should be read in conjunction with each other.</u>

Contents

Brief background

Electronic cigarettes (e-cigarettes) were first introduced into markets in 2004[1], and their use has steadily increased. In Australia, it is estimated that 2.6% of the population are current e-cigarette users, up from 1.2% in 2016.[2] The uptake of e-cigarettes in Australia is lower than in many culturally similar countries such as the United States and the United Kingdom.[3][4] This difference in uptake could be attributed to Australia's current tobacco prevention control measures, including those relating to the sale and supply of nicotine-containing e-cigarettes.[5] Australia's low tobacco smoking rates may have also contributed to the relatively low uptake of e-cigarettes.[6] Non-nicotine e-cigarettes are available for sale in all jurisdictions except Western Australia, where any product that resembles a tobacco product is banned.[7]

While some proponents of e-cigarettes argue they are an effective smoking cessation tool,[8] their impacts remain equivocal[9] and a growing body of research supports the proposition that e-cigarettes may act as a gateway to cigarette smoking, particularly among youth.[10][11] Due to the relatively recent emergence of e-cigarettes, there is a lack of evidence from longitudinal studies on their health effects.[8] However, shorter-term studies have identified harmful respiratory and cardiovascular outcomes.[12] On the basis of the available evidence, the World Health Organisation recommends "preventing or restricting advertising, promotion, and sponsorship" of e-cigarettes.[13]

E-cigarette companies commonly circumvent restrictions on e-cigarette advertising through online and social media advertising due to the lack of regulation of these platforms[14]. Research shows that e-cigarettes are frequently promoted on mediums such as Twitter and Instagram,[14][15] and websites that sell e-cigarettes use common marketing and promotional techniques such as discounting, competitions, prizes, and loyalty schemes[16]. This is problematic, as exposure to e-cigarette advertising has been associated with subsequent e-cigarette use among non-smokers, particularly youth and young adults.[17][18] This aligns with the literature in the broader discipline of addiction research, which demonstrates that exposure to alcohol and tobacco advertising is associated with increased alcohol consumption[19] and tobacco use[20], respectively.

Review objective

The objective of this review was to systematically appraise the qualitative and quantitative evidence on the effects of e-cigarette marketing, promotion, and sponsorship on a range of attitudinal and behavioural outcomes. This review is required due to a growing body of evidence suggesting that e-cigarette marketing influences a range of e-cigarette-related outcomes including knowledge, intentions, and behaviours, yet no summary of the findings of this evidence base and its quality is currently available to inform policy decisions. In particular, this review will provide

insights into whether specific types of e-cigarette advertising have greater impacts on e-cigarette outcomes, which can assist in the prioritisation of regulatory efforts.

Research questions

This systematic review aimed to understand the influence of advertising, promotion, and sponsorship of e-cigarettes on:

- Knowledge, attitudes, perceptions, and beliefs (what people think)
- Intentions (what people think they will do)
- Behaviours (what people have done, e.g. uptake and use of e-cigarettes).

The systematic review used a mixed methods approach wherein quantitative and qualitative research syntheses were performed in a segregated manner, with a final synthesis done at the end (convergent-segregated approach).[21] Such an approach is useful for examining different aspects of the phenomenon being investigated to provide confirmation/refutation and complementarity that enables a more comprehensive understanding of the literature.

The specific research questions addressed in the review were:

3. What is the impact of advertising, promotion, and sponsorship on knowledge, attitudes, belief, intentions, and behaviours related to e-cigarettes?
4. What are people's perceptions of e-cigarette advertising, promotion, and sponsorship and the effects of these activities?

For the review, the term "e-cigarettes" referred to any electronic nicotine delivery system (ENDS), electronic non-nicotine delivery system (ENNDS), or alternative nicotine delivery system (ANDS). This included, but was not limited to, personal vaporisers, e-hookahs, vape pens, and vapes. Heated tobacco products or any other traditional tobacco products were not within the purview of the review.

The standard definition of e-cigarette advertising, promotion, and sponsorship as per Article 13 of the WHO Framework Convention on Tobacco Control (WHO FCTC)[22] was used for conducting the review:

- E-cigarette advertising and promotion: "any form of commercial communication, recommendation, or action with the aim, effect, or likely effect of promoting e-cigarette use either directly or indirectly".
- E-cigarette sponsorship: "any form of contribution to any event, activity, or individual with the aim, effect, or likely effect of promoting e-cigarette use either directly or indirectly".

Mediums for e-cigarette advertising, promotion, and sponsorship included but were not limited to the following:

- Point of sale (tobacco/e-cigarette retail outlets, duty-free stores),
- Social media platforms (e.g. Facebook, Twitter, Instagram)
- Internet websites
- Print media (e.g. newspapers, magazines)
- Broadcast (e.g. radio, television, movies)
- Streaming services or over-the-top media
- Commercial communication through health service providers or quit support groups
- Word of mouth or peer communications

Methodology

The protocol was registered a *priori* with PROSPERO (CRD42021264018) and Open Science Registry (DOI 10.17605/OSF.IO/8U2QT). The study is reported in accordance with PRISMA 2020 guideline and the PRISMA checklist is presented in Appendix 1.

Eligibility criteria for quantitative studies

Studies that met the following criteria were included:

- Population:
  Studies involving at least one of the following population groups, with no age restrictions were included:
    - General population, regardless of smoking status
    - Current e-cigarette smokers (nicotine or non-nicotine) (used within the past 30 days
    - Former e-cigarette smokers (nicotine or non-nicotine) (tried/used e-cigarettes but not used in the past 30 days)
    - Never e-cigarette users
    - Current tobacco-only smokers (not e-cigarette users) (used within the past 30 days)
    - Former smokers (tried/used any form of smoking tobacco, but not in the past 30 days)
    - Never smokers (never used any form of smoking tobacco)
    - Non-tobacco smokers (never and former users together)
    - Dual users (used both e-cigarettes and combustible cigarettes in the past 30 days)

- Exposures:

  Studies on exposure to any type of e-cigarette advertising, promotion, and sponsorship were included, irrespective of the media of dissemination. Studies on regulations of e-cigarette advertising, promotion, and sponsorship were considered for inclusion. Studies that assessed the effects of advertisements featuring harm-reduction themes to promote e-cigarettes were included, as this is a potential marketing strategy for e-cigarettes. Studies on the effects of social marketing initiatives designed to prevent harm from e-cigarette use (by health authorities or non-government organisations) were out of scope of the review Studies were included irrespective of the duration of exposure and/or intensity/frequency of exposure.

- Comparators:

  Studies were included irrespective of whether there was a defined comparator group used in analyses.

- Outcomes:

  Studies reporting the following outcomes were included:

  - **Primary Outcomes**

    Behaviours among the specified population groups:

    - Uptake/initiation of e-cigarette use (nicotine or non-nicotine) and/or combustible cigarette use
    - Frequency and/or intensity/quantity of consumption of e-cigarettes (nicotine or non-nicotine) and/or combustible cigarettes use
    - Continuation or maintenance of e-cigarette use and/or combustible cigarette use
    - Quitting combustible cigarette use and/or e-cigarette use

  - **Secondary Outcomes**

    - Total nicotine consumption
    - Knowledge, attitudes, and beliefs about e-cigarettes among the specified population groups
    - Intentions to use e-cigarettes (nicotine or non-nicotine) among the specified population groups

    Outcomes related to specific user-behaviour (uptake and consumption) of e-cigarettes or combustible cigarette were classified as primary outcomes as they are measurable outcomes related to use. All other outcomes were treated as secondary outcomes. No exercise to rank or prioritise outcomes was undertaken as this was beyond the scope of this review.

    The primary outcome related to continuation or maintenance of e-cigarette and/or combustible cigarette use was reported as current use of e-cigarettes.

The outcome of intention to use e-cigarettes was broadly construed to include e-cigarette experimentation and susceptibility.

The outcome measurement methods included but were not limited to self-reported questionnaires (web-based, postal, face-to-face, email) and observations at tobacco retail outlets. The outcome measures were based on the use of different rating scales, such as Likert scales or yes/no questions. The outcome measures generally included questions related to the duration and frequency of use of e-cigarettes and cigarettes. Example questions included: "Have you ever tried using an electronic cigarette?"

The time-points of the outcomes measured were determined by the included studies and were explicitly mentioned in the review report. Outcome time-points were captured up to the longest period of follow-up. An inclusive outcome measurement/definition approach was followed to enable capturing of maximal evidence such that outcomes measured in terms of frequency/proportion or any other modality were included. Studies that reported exclusively on health outcomes associated with use of e-cigarettes or prevalence of uptake/use of e-cigarettes generally (not associated with the impact of advertising/marketing) were not included.

- <u>Study Design:</u>
  Primary studies with the following study designs were eligible for inclusion:
  - Intervention study designs:

    - Randomised controlled trials, cluster-randomised trials, quasi-randomised trials
    - Non-randomised controlled trials
    - Controlled before and after studies
    - Interrupted time series (with multiple time points before and after an intervention)
    - Pre-post study designs

  - Observational study designs:

    - Cohort studies
    - Cross-sectional studies or surveys (analytical)
    - Case-control studies

  - Quantitative components of mixed methods studies provided they had any of the following afore-mentioned quantitative designs

    Observational study designs were included because of the scarcity of intervention study designs. Conducting interventional research is challenging because of the wide array of factors implicated in behaviours around tobacco and e-cigarette use, and the diffuse and pervasive nature of advertising,

promotion, and marketing strategies. We did not include any other study designs (e.g., case-series) as they cannot be used to determine association.

- Setting
  Only studies from Australia, Canada, the European Union, New Zealand, the UK, and the US were included. Multi-country studies were excluded that did not present data in a disaggregated manner to provide access to results from the specified countries/regions.

- Other restrictions
  Only studies published from January 01, 2015 onwards were included. The cut-off date was determined by the NHMRC Electronic Cigarettes Working Committee on the basis that almost all literature on e-cigarette advertising has been published from 2015 onwards. Studies published in non-English languages (where a publicly available translation was not available), studies that were published in abstract form only (with no full-length publication available), and non-peer reviewed studies, were not included.

Eligibility criteria for qualitative studies

Studies meeting the following criteria were included:

- Types of phenomena of interest:
  Studies with a specific focus on beliefs, perceptions, and attitudes towards advertising, promotion, and sponsorship of e-cigarettes were included. There were no limits in terms of the duration of promotion, the intensity (frequency) of the advertising, or the numbers and types of media employed. Content analyses related to audience behaviours/reactions were included. Studies that primarily focussed on other aspects of e-cigarette use, including the perceived impacts and harms of e-cigarettes, were excluded. Studies that only analysed the content of advertisements with no analysis of audience behaviours/reactions were excluded as they do not provide any information relevant to the research questions.

- Study design:
  Studies that used relevant and valid qualitative approaches for both data collection and data analyses were included. Focus groups, individual in-depth interviews, and ethnographic interviews were considered as valid and relevant tools for qualitative data collection; narrative analysis, thematic analysis, and grounded theory were considered relevant and valid methods for qualitative analyses. Studies that used qualitative methods for data collection but did not analyse the data qualitatively were excluded. Qualitative components of mixed-methods study design were included, provided they met other criteria.

- Participants:

  Studies involving at least one of the following population groups were included:

  - General population, regardless of smoking status
  - Current e-cigarette smokers (nicotine or non-nicotine) (used within the past 30 days
  - Former e-cigarette smokers (nicotine or non-nicotine) (tried/used e-cigarettes but not used in the past 30 days)
  - Never e-cigarette users
  - Current tobacco-only smokers (not e-cigarette users) (used within the past 30 days)
  - Former smokers (tried/used any form of smoking tobacco but not in the past 30 days)
  - Never smokers (never smoked any form of smoking tobacco)
  - Non-tobacco smokers (never and former users together)
  - Dual users (used both e-cigarettes and combustible cigarettes in the past 30 days)

  If a study did not provide information on the definition of current or former use, it was included and the impact of inclusion of such studies was explored through sensitivity analyses. Meta-analysis where presented has had no appreciable impact on effect sizes in sensitivity analysis. Studies had similar risk of bias ratings.

- Setting:
  Only studies published from January 01, 2015 onwards and from Australia, Canada, the European Union, New Zealand, the UK, and the US were included. The cut-off date was determined by the NHMRC Electronic Cigarettes Working Committee on the basis that almost all literature on e-cigarette advertising has been published from 2015 onwards. Multi-country studies where results were not presented in a disaggregated manner to report on the specified countries were excluded.

- Other restrictions:
  Studies published in non-English languages (where a publicly available translation was not available), studies that were published in abstract form only (with no full-length publication available), and non-peer reviewed studies were not included.

Information sources

Electronic database search

The following databases were searched on 28th June 2021:

- PubMed (https://pubmed.ncbi.nlm.nih.gov)
- EMBASE (https://www.embase.com/landing)
- CINAHL (https://www.ebsco.com/products/research-databases/cinahl-full-text)
- PsycINFO (https://www.wolterskluwer.com/en/solutions/ovid/apa-psycinfo-139)
- Cochrane Central Register of Controlled Trials (CENTRAL) (https://www.cochranelibrary.com/advanced-search)
- clinicaltrials.gov (https://clinicaltrials.gov/)

We could not search WHO ICTRP as planned as the same was not available by the date data extraction commenced on 5th July 2021. No ongoing studies were identified in the searched databases, including CENTRAL and clinicaltrials.gov. All the search strategies are presented in Appendix 2.

Other methods for searching

The reference lists of studies that met eligibility criteria and were retrieved by other modalities of search were manually screened for identifying newer studies.

Screening process

In the first phase, at least two authors (JT/SM/NG/MM/SB) independently screened each retrieved study based on titles and/or abstracts and marked each record as "exclude" or "include". Disagreements if any at this phase were resolved by discussion with a third author acting as an arbiter. The first phase of screening was conducted in a cloud-based platform (Rayyan - https://rayyan.qcri.org/) that allowed simultaneous screening by multiple people without the need for multiple datasets. Outcomes specified in the protocol were not used for study selection at the title and/or abstract phase but were used to determine inclusion and exclusion in the full text review stage.

In the next phase of screening, full texts of all studies marked as "include" by consensus in the previous phase were obtained and reviewed independently by two authors (JT/SM/NG/MM) for consideration for inclusion based on the eligibility criteria. Disagreements if any at this phase were resolved by discussion, with a third author acting as an arbiter (SB).

Data management

At least two authors extracted data and independently conducted risk of bias assessments. Disagreements were resolved by consensus between two authors. Authors of studies were not contacted for additional data and only data as reported in published versions was included. Important details of all included studies relevant to the review were extracted. These included the country where the study was conducted, study design, setting, eligibility criteria for study participants, participants' characteristics, type of advertising/marketing medium, exposures and comparators (where applicable), confounders or covariates, exposure and outcome measurement methods, effect estimates and results relevant to the outcomes of interest, source of study funding, and conflicts of interest. All the extracted information was cross-checked.

Risk of bias in included quantitative studies

The following risk of bias assessment tools developed by Cochrane (UK) and Joanna Briggs Institute (JBI, Australia) were used (these two entities are norm-setting organisations in evidence synthesis globally):

- For randomised controlled trials, cluster-randomised trials and quasi-randomised trials: Cochrane Risk of Bias 1.0 tool [23]

- For other interventional study designs: JBI Critical Appraisal Checklist for Quasi-Experimental Studies (non-randomised experimental studies)[24]

- For observational studies: JBI Critical Appraisal Checklist for cohort, analytical cross-sectional, and case-control studies.[24]

We used the Cochrane Risk of Bias 1.0 tool over the more recent Cochrane Risk of Bias 2.0 tool for randomised and quasi-randomised trials because the latter has not been implemented in the RevMan 5 (desktop) and is available only for Cochrane authors through RevMan web. ROBINS-E (for risk of bias assessment of exposures) is another tool suitable for this review, which was considered but is still under development. As such, critical appraisal tools developed by JBI Australia that have stable guidance and are widely used globally were preferred. Risk of bias was assessed by two reviewers independently, with a third reviewer involved for consensus decisions if required.

In terms of the critical appraisal approach for quasi-experimental and observational studies, the reviewers agreed prior to commencing the appraisal process on what would be deemed an acceptable level of information within a study for it to receive a positive rather than a negative or unclear rating. When determining the quality of a study using the JBI critical appraisal tool, an overall score summarising the individual scores from each item in the checklist is not used as a way to rate the quality of the study. Rather, it is best practice to consider a combination of criteria to rate the overall

quality of a study, including the method of selection of participants, the exposure and outcome measurements used, the presence and measurement of confounders and whether appropriate statistical analysis is used. This is the approach taken by the reviewers for this study.

Risk of bias assessment of included qualitative studies

Risk of bias assessment of included qualitative studies was undertaken by using the Critical Appraisal Skills Programme (CASP) tool for qualitative studies (Critical Appraisal Skills Programme 2018)[24]. This tool was recommended by the Cochrane Qualitative & Implementation Methods Group for risk of bias assessment of qualitative studies when conducting evidence synthesis[25]. Risk of bias was assessed by two reviewers independently, with a third reviewer involved for consensus decisions if required.

Synthesis for quantitative studies

The systematic review was broad. Meta-analysis was conducted whenever it was appropriate to pool results. Results were not pooled for studies that had substantial differences in populations (e.g. age-groups – adolescents, young adults, adults in general), exposure types, study designs, or outcome metrics, or had poor reporting (described in the text, e.g. confidence limits were not reported), or if there was methodological heterogeneity that could not be explained. Under such circumstances, a narrative synthesis was conducted with the data arranged in a tabular format to enable inspection and assessment of the potential patterns within the data.

Where possible, the association between the exposures and outcomes of interest was investigated by combining similar measures of risk derived from the included studies in meta-analysis. Where possible, the results have been pooled in statistical meta-analysis using inverse variance method (RevMan 5.4.1, The Cochrane Collaboration). Effect estimates (majority of the studies reported odds ratios, and this was used) and 95% confidence intervals (CIs) were extracted and entered in the calculator in RevMan, which then converted these values into natural logarithms (as a log odds ratio and CIs, and the standard error (SE) of the log odds ratio).For cluster-randomised trials, the plan was to report the authors' methods for adjusting their analyses for the intracluster correlation coefficient (ICC) if they used individual participants as the unit of analysis. In the case of multi-arm studies, the plan was to combine all relevant exposure groups into a single large group. However, the review did not find any non-standard study designs (cluster RCTs and interrupted time series) and multi-arm studies in the evidence base.

A random effects model with 95% CI as per Cochrane (Chapter 10.3.2) and JBI guidelines (Chapter 3.3.2) for each exposure-outcome pair separately was used for meta-analysis and exploring heterogeneity. Heterogeneity of included studies of a particular exposure-outcome pair was assessed by visual inspection of forest plots,

the standard Chi^2 test (p value), or the I^2 statistic[26]. A p value of less than 0.10 was considered statistically significant in terms of heterogeneity for the standard Chi^2 test. For the I^2 statistic, heterogeneity was determined according to the following criteria:

- 0% to 40%: might not be important
- 30% to 60%: may represent moderate heterogeneity
- 50% to 90%: may represent substantial heterogeneity
- 75% to 100%: considerable heterogeneity

Heterogeneity was explored if there was substantial heterogeneity. This was done using various strategies (including but not limited to using fixed-effects models and subgroup analyses) in alignment with the guidance from the Cochrane handbook (Chapter 10.10.2) and JBI guidelines (Chapter 3.3.10.2).

Effect modification (i.e., different effects for different groups) was explored through sub-group analyses. Sub-group analyses were conducted to explain heterogeneity and are described within the text of main report. Where possible, the data have been presented relevant to the age subgroups of interest (i.e. adolescents and young adults). In addition, sensitivity analyses were planned based on the quality of the studies (i.e. high or moderate risk of bias). However, as there were not enough studies in the meta-analyses that addressed each of the outcomes, sensitivity analyses based on the quality of studies could not be conducted. We conducted sensitivity analysis based on exposure duration (past 30 days, six months, or 12 months) and the follow-up period (1 year or 2.5 years), which was a deviation from the protocol.

Reporting biases

We planned to assess reporting bias by a funnel plot if enough studies (at least 10) were available [26] for a particular exposure-outcome type for a population group. However, since this was not available, reporting bias could not be assessed. As a result, studies were not rated down for reporting bias, as reporting bias remained undetected.

Outcome reporting bias was only assessed for studies that had *a priori* registrations or protocols available. Selective reporting within studies was checked for but no instances were found. The searches were restricted to studies published in English language due to the time required to locate, acquire, and translate articles in languages other than English. The searches were restricted to specific locations as determined by the NHMRC which commissioned the systematic review.

Sub-group and sensitivity analysis

Effect modification (i.e. different effects for different groups) was explored through sub-group analyses and stratified analyses. Stratified analyses were only possible if included studies mentioned effect modification in-text. Effect modifiers included age,

gender, race/ethnicity, income level, and education level. Where possible, the data have been presented relevant to the subgroups of interest (i.e. adolescents and young adults). In addition, sensitivity analyses were planned based on the quality of the studies (i.e. high or moderate risk of bias). However, as there were not enough studies in the meta-analyses that addressed each of the outcomes, sensitivity analyses based on the quality of studies could not be conducted. We conducted sensitivity analysis based on exposure duration (past 30 days, six months, or 12 months) and the follow-up period (1 year or 2.5 years), which was a deviation from the protocol.

We could not do subgroup analysis for the following parameters as included studies did not report outcomes for these groups:

- Aboriginal and Torres Strait Islander or Indigenous people

- Culturally and Linguistically Diverse people

- Socially disadvantaged populations (e.g. people on low incomes, people experiencing homelessness)

- People with chronic co-morbidities (e.g. mental illness, substance use disorders, HIV positive)

- Those involved in the criminal justice system

- High dependence smokers

- Smokers wishing to quit

- Social smokers

We conducted sensitivity analysis based on exposure duration (past 30 days, six months, or 12 months) and the follow-up period (1 year or 2.5 years), which was a deviation from the protocol.

Investigators for included studies were not contacted to obtain any missing numerical outcome data owing to the time frame in which the systematic review was conducted. As such, when missing data was encountered, estimations were made as per methods described in the Cochrane Handbook (Chapter 10.12.2)[26]. Where this was not possible, we presented the available data along with a note on the issue. If missing data was calculated, the impact of including such studies was planned through sensitivity analyses. However, there were insufficient studies to conduct sensitivity analyses based on missing data. Of the 14 included cohort studies, only a few reported missing data for individual participants in terms of losses to follow-up. Most of the studies that presented the number of dropouts reported no significant differences between participants with complete data and those with missing data, as there was minimal loss to follow up. The studies that reported on missing data used several methods to handle missing data in the exposure-outcome analyses; however, the reporting of the analyses was inconsistent and incomplete.

Synthesis for qualitative studies

The RETREAT framework was used to guide the choice of qualitative evidence syntheses approach (Box 1)[27]. Thematic synthesis as outlined by Thomas and Harden[28] was the appropriate synthesis approach for the review. Content analyses of audience reactions/behaviours were included as a part of the qualitative evidence synthesis.

We followed standard methods wherein the entire text labelled as 'results' or 'findings' in included studies was used verbatim for analyses. Broadly, thematic synthesis consisted of the following steps:

- Coding text and developing descriptive themes – two review authors independently conducted line-by-line coding using NVivo for a set of three articles and developed a hierarchical coding framework for application. After every third article, the coding framework was discussed between two reviewers and a consensus coding framework developed. The process continued until all articles were exhausted. Constant comparison of similarities and differences between codes to develop descriptive themes was undertaken.
- Development of analytical themes - in the final level of synthesis, higher-level analytical themes were developed in alignment with the research questions.

Subgroup analyses as originally planned was not undertaken due to the very small number of qualitative studies identified and the resulting inadequate quantity of data for any sub-group of interest. We had planned to understand how the phenomenon being investigated were different according to the following characteristics or in the following groups:

- o Gender (male and female)
- o Age (youth/young adults and adults)
- o Geographic location
- o Aboriginal and Torres Strait Islander or Indigenous people
- o Culturally and Linguistically Diverse people
- o Socially disadvantaged populations (e.g. people on low incomes, people who experienced homelessness)
- o People with chronic co-morbidities (e.g. mental illness, substance use disorders, HIV positive)
- o Pregnant and new mothers
- o Those involved in the criminal justice system
- o High dependence smokers
- o Smokers wishing to quit
- o Social smokers

We also noted whether qualitative studies were conducted in conjunction with an intervention or as a stand-alone study.

BOX 1: RETREAT APPROACH FOR SELECTING QUALITATIVE EVIDENCE SYNTHESIS APPROACHES

Review question: What influence does e-cigarette advertising, promotion, and sponsorship have on the general population, existing and former e-cigarette users, existing smokers, former smokers, non-smokers, and dual users?

Epistemology: Critical realism with the lens of pragmatism

Time/ Timeframe: 3 months, rapid

Resources: Funded project with access to databases and availability of qualitative software.

Expertise: Qualitative evidence synthesis and primary research skills; specialist subject expertise; advice from NHMRC committee

Audience and objective: Inform policy decisions of the NHMRC

Types of data: Preliminary scoping indicates availability of some conceptually rich and adequately thick studies.

Chosen method: Thematic synthesis as outlined by Thomas & Harden

Rationale for choice: This systematic review did not seek to contribute to existing theory but aimed to inform current practice and policy. The rapid nature of the review and the team expertise were other factors that guided the choice of method

Certainty of evidence from quantitative studies

For quantitative studies, we used the GRADE approach to assess certainty of the quantitative evidence as per the GRADE handbook[29]. We used the GRADE Pro GDT software (https://gradepro.org) to create a 'Summary of findings' table for all primary outcomes. In the GRADE approach, certainty of evidence is classified as very low, low, moderate, and high through consensus within the review team (involving at least two authors for each study). These levels, and their interpretations, are:

- High certainty: very confident that the true effect lies close to that of the estimate of the effect.
- Moderate certainty: 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: confidence in the effect estimate is limited; the true effect may be substantially different from the estimate of the effect.

- Very low certainty: have very little confidence in the effect estimate; the true effect is likely to be substantially different from the estimate of effect.

Randomised controlled trials started with a high quality rating, and observational studies started with a low quality rating. The certainty of evidence was reduced or downgraded based on the factors listed below, using methods described in the GRADE handbook.

Five factors that could lower confidence in the estimate of an effect, i.e. that could lower the certainty of evidence were:

- Study limitations (Risk of Bias)
- Inconsistency of results
- Indirectness of evidence
- Imprecision
- Publication bias

Three factors that could increase confidence in the estimate of an effect (i.e. that could increase the certainty of evidence) were:

- Large magnitude of an effect
- Dose-response gradient
- Effect of plausible residual confounding

Certainty of evidence from qualitative studies

For qualitative studies, we used the GRADE CERQual (Confidence in the Evidence from Reviews of Qualitative Research) approach[30-36] to summarise confidence in the findings. The process involved assessing the following domains:

- Methodological limitations of included studies
- Coherence of the review findings to the review question
- Adequacy of the data in supporting the review finding
- Relevance of the included studies to the review question

After assessing each of the four components, the review team by consensus (involving at least two authors) made a judgement about their confidence in the evidence supporting the review findings as high, moderate, low, or very low in alignment with the GRADE CERQual guidelines[31].

- High confidence - Highly likely that the review finding is a reasonable representation of the phenomenon of interest.
- Moderate confidence - Likely that the review finding is a reasonable representation of the phenomenon of interest.

- Low confidence - Possibility that the review finding is a reasonable representation of the phenomenon of interest.
- Very low confidence - Unclear whether the review finding is a reasonable representation of the phenomenon of interest.

The certainty of evidence for quantitative and qualitative studies was based on the GRADE and GRADE CERQual approach, respectively, which consider several factors in upgrading or downgrading the evidence for each outcome of interest. All reasons for upgrading and downgrading are provided in the footnotes of the GRADE Summary of Findings tables for quantitative studies and in the tables for qualitative studies.

Integration of quantitative and qualitative evidence

The findings of the two different synthesis processes were configured in accordance with the JBI methodology,[21] which involved complementary quantitative evidence and qualitative evidence being juxtaposed and organised into a line of argument to provide an overall configured result. The approach recognised that quantitative and qualitative forms of evidence addressed different aspects of the same phenomenon of interest and hence could not be directly combined but could be organised into a coherent meaning. Where configuration was not possible, only a narrative description of different results (completed in the previous steps) was provided. There is currently no guidance on assessing the confidence of findings after integration of evidence[21]. As such, the GRADE and GRADE-CERQual assessments for informing recommendations were provided in a segregated fashion.

Results

Study selection

This has been reported in the main evidence evaluation report. Reasons for exclusion at full text level are presented in Appendix 3.

Characteristics of included quantitative studies

This has been reported in the main evidence evaluation report, including the corresponding appendix.

Characteristics of included qualitative studies

This has been reported in the main evidence evaluation report, including the corresponding appendix.

Risk of bias in randomised controlled trials

Support for judgements for the risk of bias rating is presented in Appendix 4

Risk of bias in cohort, cross-sectional and quasi-experimental studies

Support for judgements for the risk of bias rating is presented in Appendix 5

Risk of bias in qualitative studies

Support for judgements for the risk of bias rating is presented in Appendix 6

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Results of syntheses of qualitative studies

The Summary of Findings Table for GRADE CERQual is presented in Table 1

Table 1: GRADE CERQual Summary of Findings showing confidence in review findings

Summary of review findings	Number of Studies	Assessment of methodological limitation	Assessment of the relevance research question	Assessment of coherence of the data	Assessment of the adequacy of data	Overall CERQual assessment of confidence	Explanation of judgement
Theme 1: Exposure to e-cigarette advertising occurred both actively and passively, resulting in changed perceptions of the risk profile of e-cigarettes (moderate confidence in findings)	Six Studies {Alpert 2020; Amin 2020; Chen 2020; Cowgill 2020; Park 2019; Laestadius 2020}.	Moderate methodological limitation Included studies had concerns around recruitment strategy, reflexivity, concern about ethical issues and data analysis processes	No concern Studies included were all relevant to the research question	No concern Review findings well supported by underlying studies	No concern Studies gave moderately rich data	Moderate Confidence	Included studies in general support the findings, moderate concern about methodological limitations, no concern about relevance, coherence, or data adequacy.
Theme 2: Strategies used to enhance the appeal and believability of advertisements are effective in influencing perceptions (moderate confidence in findings)	Five studies {Alpert 2020; Chen 2020; Kim 2020; Laestadius 2020; Park 2020}.	Moderate methodological limitation Included studies had concerns around recruitment strategy, reflexivity, concern about ethical issues and data analysis processes	No concern Studies included were all relevant to the research question	No concern Review findings well supported by underlying studies	No concern Studies gave moderately rich data	Moderate Confidence	Included studies in general support the findings, moderate concern about methodological limitations, no concern about relevance, coherence, data adequacy.
Theme 3: Exposure to individuals doing 'vape tricks' on social media	Three studies {Amin 2020; Cowgill 2020; Park 2020}	Moderate methodological limitation Included studies had concerns around recruitment strategy, reflexivity, concern about ethical issues and data analysis processes	No concern Studies included were all relevant to the research question	No concern Review findings well supported by underlying studies	Some concern Studies offered thin data	Low Confidence	Included studies in general support the findings, moderate concern about methodological limitations, some concern about data adequacy and no concern about relevance or coherence.

Results of syntheses of quantitative studies

The GRADE Summary of Finding Tables for different types of exposure are presented below (Tables 2-28). They are arranged in accordance with exposure category types.

Summary of Findings Table for radio advertising in adolescents

Question: What is the effect of e-cigarette advertisements on radio on e-cigarette and cigarette-related primary outcomes?

Setting: Adolescents in high income countries

Table 2 Summary of Findings for radio advertising in adolescents

№ of studies	Certainty assessment						Effect		Certainty Importance
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Odds ratio (95% CI)	
Uptake/initiation of e-cigarettes (never smoker adolescents 12-17 years, cohort study, follow-up period 2.5 years)									
1	observational study {Loukas 2019}	not serious	not serious	very serious[a]	serious[b]	all plausible residual confounding would reduce the demonstrated effect [c]	2288	1.24,95% CI 0.76–2.01	⊕◯◯◯ VERY LOW
Current e-cigarette use (adolescents 12-17 years, cohort study, follow up period 6 months)									
1	observational study {Nicksic 2017a}	not serious	not serious	very serious[a]	serious[b]	all plausible residual confounding would reduce the demonstrated effect [d]	2488	0.95, 95% CI 0.51–1.79	⊕◯◯◯ VERY LOW
Ever e-cigarette use (adolescents 12-17 years, cohort study, follow up period- 6 months)									
1	observational study {Nicksic 2017a}	not serious	not serious	very serious[a]	very serious [e]	all plausible residual confounding would reduce the demonstrated effect [f]	2488	0.82, 95% CI 0.31–2.18	⊕◯◯◯ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. The 95% CI of the included study overlaps the line of no effect (i.e. CI includes 1.0)
c. Adjusted for baseline sex, race and/or ethnicity, grade level, past-30-day or current other tobacco use, sensation seeking, and peer e-cigarette use
d. Adjusted for sex, race/ethnicity, grade level, current other tobacco use, and current e-cigarette use
e. The optimal information size is not met, and the 95% CI overlaps the line of no effect
f. Adjusted for sex, race/ethnicity, grade level, and current other tobacco use

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for radio advertising in young adults

Question: What is the effect of e-cigarette advertisements on radio on e-cigarette and cigarette-related primary outcomes?

Setting: Young adults in high income countries

Table 3 Summary of Findings for radio advertising in young adults

№ of studies	Certainty assessment						Effect		Certainty Importance
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Odds ratio (95% CI)	
Uptake/initiation of e-cigarettes (never smoker young adults 12-29 years, cohort study, follow-up period 2.5 years)									
1	observational study {Loukas 2019}	not serious	not serious	very serious[a]	serious[b]	all plausible residual confounding would reduce the demonstrated effect [c]	2423	0.99, 95% CI 0.77–1.27	⊕○○○ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. The 95% CI of the included study overlaps the line of no effect (i.e. CI includes 1.0)
c. Adjusted for baseline sex, race and/or ethnicity, grade level, past-30-day or current other tobacco use, sensation seeking, and peer e-cigarette use.

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for e-cigarette television and radio (combined) advertising in adolescents

Question: What is the effect of e-cigarette advertisements on television and radio (combined) on e-cigarette and cigarette-related primary outcomes?

Setting: Never users of e-cigarette, adolescents studying in school in high-income countries

Table 4 Summary of Findings for e-cigarette television and radio (combined) advertising in adolescents

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	No. of individuals	Odds Ratio (95% CI)	
Ever e-cigarette use (never users of e-cigarette adolescent students, cohort study, follow-up period 9 months)									
1	observational study {Camenga 2018}	not serious	not serious	very serious[a]	very serious[b]	none	1742	0.85, 95% CI 0.43-1.69	⊕◯◯◯ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. The optimal information size is not met, and the 95% CI overlaps the line of no effect (i.e. CI includes 1.0)

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for television e-cigarette advertising in adolescents

Question: What is the effect of e-cigarette advertisements on television on e-cigarette and cigarette-related primary outcomes?

Setting: Adolescents in high-income countries

Table 5 Summary of Findings for television e-cigarette advertising in adolescents

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Effect size (95% CI)	
Uptake/initiation of e-cigarettes (never smoker adolescents 12-17 years, cohort study, maximal follow-up period 3 years)									
2	observational studies {Lee 2019} {Loukas 2019}	not serious	not serious	very serious[a]	serious[b]	None	16,036	Odds ratio – 1.11 95% CI 0.80-1.55	⊕◯◯◯ VERY LOW
Ever e-cigarette use (adolescents 12-17 years, cohort study, follow up period 6 months)									
1	observational study {Nicksic 2017a}	not serious	not serious	very serious[a]	serious[b]	all plausible residual confounding would reduce the demonstrated effect [c]	2488	Odds ratio 1.36, 95% CI 0.58–3.19	⊕◯◯◯ VERY LOW
Current e-cigarette use (adolescents 11- 18 years, cross-sectional study)									
1	observational study {Pu 2017}	not serious	not serious	very serious[a]	not serious	all plausible residual confounding would reduce the demonstrated effect [c]	21595	Odds ratio 1.38, 95% CI 1.20–1.60	⊕◯◯◯ VERY LOW
Current e-cigarette use (adolescents 12-17 years, cohort study, follow up period 6 months)									
1	observational study {Nicksic 2017a}	not serious	not serious	very serious[a]	serious[b]	all plausible residual confounding would reduce the demonstrated effect [c]	3907	Odds ratio 1.09, 95% CI 0.67–1.79	⊕◯◯◯ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. The 95% CI of the included study overlaps the line of no effect (i.e., CI includes 1.0)

c. The included study did not address all plausible confounding factors and as a result the demonstrated effect might be reduced

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for television e-cigarette advertising in young adults

Question: What is the effect of e-cigarette advertisements on television on e-cigarette and cigarette-related primary outcomes?

Setting: Young adults in high-income countries

Table 6 Summary of Findings for television e-cigarette advertising in young adults

№ of studies	Certainty assessment						Effect		Certainty
	Study design	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations***	**№ of individuals**	**Effect size (95% CI)**	
Uptake/initiation of e-cigarettes (never smoker young adults 18-29 years, cohort study, follow-up period 2.5 years)									
1	observational study {Loukas 2019}	not serious	not serious	very serious[a]	not serious	none	2423	Odds ratio 1.29, 95% CI 1.03–1.63	⊕○○○ VERY LOW

Explanations

    a. The included study was from only one country and was downgraded for lack of directedness by two levels

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for television e-cigarette advertising in adults

Question: What is the effect of e-cigarette advertisements on television on e-cigarette and cigarette-related primary outcomes?

Setting: Adults (>18 years) in high-income countries

Table 7 Summary of Findings for television e-cigarette advertising in adults

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Effect size (95% CI)	
Ever e-cigarette use (cross-sectional study)									
1	observational study {Ali 2021}	not serious	not serious	very serious[a]	not serious	dose response gradient and all plausible confounding would reduce the demonstrated effect[b]	98746	Regression coefficient 0.02, 95% CI 0.0-0.03, P < 0.05	⊕⊕◯◯ LOW
Current e-cigarette use (cross-sectional study)									
1	observational study {Ali 2021}	not serious	not serious	very serious[a]	not serious	dose response gradient and all plausible confounding would reduce the demonstrated effect[b]	98709	Regression coefficient 0.02, 95% CI 0.01-0.04, P < 0.05	⊕⊕◯◯ LOW
Current e-cigarette use (cohort study, follow up period- 5 months)									
1	observational study {Agaku 2017}	not serious	not serious	very serious[a]	not serious	all plausible residual confounding would reduce the demonstrated effect[c]	2191	Odds ratio 1.57, 95% CI 1.04–2.37	⊕◯◯◯ VERY LOW
Current cigarette use (cross-sectional study)									
1	observational study {Ali 2021}	not serious	not serious	very serious[a]	not serious	dose response gradient and all plausible confounding would reduce the demonstrated effect[b]	98503	Regression coefficient 0.02, 95% CI 0.01, 0.03, P < 0.05	⊕⊕◯◯ LOW
Frequency/intensity of consumption of combustible cigarette (cross-sectional study)									
1	observational study {Ali 2021}	not serious	not serious	very serious[a]	not serious	all plausible confounding would suggest spurious effect while no effect was observed[d]	12361	Regression coefficient 0.00, 95% CI 0.00-0.01	⊕⊕◯◯ LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. Increased exposure was associated with increased effect size, thus demonstrating dose response. All plausible confounders would reduce the demonstrated effect
c. All plausible confounders would reduce the demonstrated effect
d. All plausible confounding would suggest spurious effects while no effect was observed

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for e-cigarette advertising on TV and movies combined for adolescents

Question: What is the effect of e-cigarette advertising in TV and movies?

Setting: Adolescents in high-income countries

Table 8 Summary of Findings for e-cigarette advertising on TV and movies combined for adolescents

№ of studies	Certainty assessment						Effect			Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	№ of participants	Odds ratio (95% CI)		
Current e-cigarette use among school-aged adolescents										
1	observational study {Mantey 2016}	not serious	not serious	very serious[a]	not serious	none	22,007	1.41, 95% CI 1.22-1.62 Exposure sometimes/most of the time/always categorised as exposure to multiple sources vs never/rarely as no exposure, within the past 30 days		⊕◯◯◯ VERY LOW
Current e-cigarette use among school-aged adolescents										
1	observational study {Dai 2016}	not serious	not serious	very serious[a]	not serious	none	21,491	Study did not report confidence intervals but reported an OR of 0.9, not statistically significant for most of the times/always vs never/rarely within the past 30 days and an OR of 1.1, not statistically significant for sometimes vs never/rarely within the past 30 days		⊕◯◯◯ VERY LOW
Current e-cigarette use among middle school students										
1	observational study {Singh 2016}	not serious	not serious	very serious[a]	serious[b]	dose response gradient[c]	9027	OR 1.80 (1.30-2.49) for exposure to e-cigarette advertising most of the time/always vs never/rarely among middle school students Dose response was seen as the OR was 1.25, 95% CI 0.87-1.80 for exposure to e-cigarette advertising in retail stores sometimes vs never/rarely among middle school students		⊕◯◯◯ VERY LOW
Current e-cigarette use among high school students										
1	observational study {Singh 2016}	not serious	not serious	very serious[a]	not serious	dose response gradient[c]	10265	OR was 1.54 (1.28-1.86) for exposure to e-cigarette advertising most of the time/always vs never/rarely among middle school students. Dose response was seen as OR was 1.24, 95% CI 1.04-1.50 for exposure to e-cigarette advertising sometimes vs never/rarely among high school students		⊕◯◯◯ VERY LOW
Ever e-cigarette use among school-aged adolescents										
1	observational study {Mantey 2016}	not serious	not serious	very serious[a]	not serious	none	22,007	1.20, 95% CI 1.07-1.35		⊕◯◯◯ VERY LOW

Explanations

a. The included study was only from one country and was downgraded for lack of directness by two levels
b. Imprecision graded down by one level as confidence interval includes the line of no effect (i.e., CI includes 1.0)
c. Increased exposure was associated with increased effect size, thus demonstrating dose response

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence

Summary of Findings Table for e-cigarette advertisements on billboards/posters in adolescents

Question: What is the effect of e-cigarette advertisements on billboards/posters on e-cigarette and cigarette-related primary outcomes?

Setting: Adolescents in high-income countries

Table 9 Summary of Findings for e-cigarette advertisements on billboards/posters in adolescents

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Odds ratio (95% CI)	Importance
Uptake/initiation of e-cigarettes (never smoker adolescents 12-17 years, cohort study, follow-up period 2.5 years)									
1	observational study {Loukas 2019}	not serious	not serious	very serious[a]	serious[b]	all plausible residual confounding would reduce the demonstrated effect[c]	2288	1.30,95% CI 0.89–1.91	⊕○○○ VERY LOW
Current e-cigarette use (adolescents 12-17 years, cohort study, follow up period 6 months)									
1	observational study {Nicksic 2017a}	not serious	not serious	very serious[a]	serious[b]	all plausible residual confounding would reduce the demonstrated effect[d]	2488	0.75, 95% CI 0.42–1.33	⊕○○○ VERY LOW
Ever e-cigarette use (adolescents, cohort study, follow-up period 6-9 months)									
2	observational studies {Camenga 2018, Nicksic 2017a}	not serious	not serious	very serious[a]	serious[b]	none	4230	1.08, 95%CI 0.65 to 1.81	⊕○○○ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. The 95% CI of the included study overlaps the line of no effect (i.e., CI includes 1.0)
c. Adjusted for baseline sex, race and/or ethnicity, grade level, past-30-day or current other tobacco use, sensation seeking, and peer e-cigarette use.

d. Adjusted for sex, race/ethnicity, grade level, current other tobacco use, and current e-cigarette use.

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for e-cigarette advertisements on billboards/posters in young adults

Question: What is the effect of e-cigarette advertisements on billboards/posters on e-cigarette and cigarette-related primary outcomes?

Setting: Young adults in high-income countries

Table 10 Summary of Findings for e-cigarette advertisements on billboards/posters in young adults

№ of studies	Certainty assessment						Effect		Certainty Importance
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Odds ratio (95% CI)	
Uptake/initiation of e-cigarettes (never smoker young adults-18-29 years, cohort study, follow-up period 2.5 years)									
1	observational study {Loukas 2019}	not serious	not serious	very serious[a]	serious[b]	all plausible residual confounding would reduce the demonstrated effect[c]	2423	1.10, 95% CI 0.87–1.41	⊕◯◯◯ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. The 95% CI of the included study overlaps the line of no effect (i.e., CI includes 1.0)
c. Adjusted for baseline sex, race and/or ethnicity, grade level, past-30-day or current other tobacco use, sensation seeking, and peer e-cigarette use. All plausible residual confounding would reduce the demonstrated effect

*Publication bias could not be assessed due the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for e-cigarette advertisements in print media in adolescents

Question: What is the effect of e-cigarette advertisements in print media on e-cigarette and cigarette-related primary outcomes?

Setting: Adolescents in a high-income countries

Table 11 Summary of Findings for e-cigarette advertisements in print media in adolescents

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Effect size (95% CI)	
Ever e-cigarette use (in never users of e-cigarette adolescent students, cohort study, follow-up period 9 months)									
1	observational study {Camenga 2018}	not serious	not serious	very serious[a]	very serious[b]	none	1742	Odds ratio 0.88, 95% CI 0.59-1.30	⊕◯◯◯ VERY LOW
Ever e-cigarette use (adolescents 12-17 years, cross-sectional study)									
1	observational study {Mantey 2016}	not serious	not serious	very serious[a]	not serious	all plausible residual confounding would reduce the demonstrated effect[f]	22007	Odds ratio 1.22, 95% CI 1.07-1.39	⊕⊕⊕◯ MODERATE
Current e cigarette use (adolescents 12-17 years, cross-sectional study)									
1	observational study {Dai 2016}	not serious	not serious	very serious[a]	serious	all plausible residual confounding would reduce the demonstrated effect[c] dose response gradient[d]	21491	Odds ratio 0.9, p value not statistically significant, exact p value and CI not reported. High exposure (defined as read newspapers or magazines most of the time/always) to e-cigarette advertising on print media compared to low exposure (defined as don't read newspapers or magazines). Odds ratio 0.8, p value not statistically significant, exact p value and CI not reported Medium exposure (defined as read newspapers or magazines sometimes) to e-cigarette advertising on print media compared to low exposure (defined as don't read newspapers or magazines).	⊕⊕⊕◯ MODERATE
Current e-cigarette use (adolescents 12-17 years, cross-sectional studies)									

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Effect size (95% CI)	
2	observational studies {Mantey 2016, Pu 2017}	not serious	not serious	very serious[a]	not serious	all plausible residual confounding would reduce the demonstrated effect[g]	43602	Pooled odds ratio: 1.33, 95% CI1.19-1.48	⊕⊕⊕◯ MODERATE
Current e-cigarette use (middle school students grades 6 to 8, cross-sectional study)									
1	observational study {Singh 2016}	not serious	not serious	very serious[a]	not serious	all plausible residual confounding would reduce the demonstrated effect[g] dose response gradient[d]	6418	Odds ratio 1.87,95% CI 1.21–2.87 Most of the time/always exposure to e-cigarette advertising in print media compared to never/rarely among middle school students 0.93, 95% CI 0.63–1.37 Sometimes exposure to e-cigarette advertising in print media compared to never/rarely among middle school students	⊕⊕⊕⊕ HIGH
Current e-cigarette use (high school students grades 9 to 12, cross-sectional study)									
1	observational study {Singh 2016}	not serious	not serious	very serious[a]	not serious	all plausible residual confounding would reduce the demonstrated effect[g] dose response gradient[d]	8312	Odds ratio 1.71, 95% CI 1.25–2.33 Most of the time/always exposure to e-cigarette advertising in print media compared to never/rarely among middle school students 1.26, 95% CI 1.01–1.55 Sometimes exposure to e-cigarette advertising in print media compared to never/rarely among middle school students	⊕⊕⊕⊕ HIGH
Current e-cigarette use in adolescents with exposure to 'e-cigarettes as glamorous' advertisements									
1	randomised trial {Petrescu 2017}	not serious	not serious	very serious[a]	serious[e]	none	373	U=7461.000, Z=−2.213, p=0.027, r=0.136	⊕◯◯◯ VERY LOW
Current e-cigarette use in adolescents exposed to 'e-cigarettes as healthy' advertisements versus 'e-cigarettes as glamourous' advertisements									
1	randomised trial {Petrescu 2017}	not serious	not serious	very serious[a]	serious[e]	none	377	U=7981.500, Z=−2.334, p=0.020, r=0.140	⊕◯◯◯ VERY LOW
Current e-cigarette use in adolescents with exposure to 'e-cigarettes as healthy' advertisement versus no advertisements									

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Effect size (95% CI)	
1	randomised trial {Petrescu 2017}	not serious	not serious	very serious[a]	serious[e]	none	378	U=9003.000, Z=−0.153, p=0.879, r=0.009	⊕◯◯◯ VERY LOW
Frequency of e-cigarette use (adolescents 12-17 years, cross-sectional study)									
1	observational study {Dai 2016}	not serious	not serious	very serious[a]	not serious	all plausible residual confounding would reduce the demonstrated effect[c] strong association dose response gradient[d]	2017	Odds ratio 3.4, p < 0.001, CI not reported. High exposure (defined as read newspapers or magazines most of the time/always) to e-cigarette advertising in print media compared to low exposure (defined as read newspapers or magazines never/rarely). Odds ratio 2.1, p < 0.01, CI not reported Medium exposure (defined as read newspapers or magazines sometimes) to e-cigarette advertising in print media compared to low exposure (defined as don't read newspapers or magazines).	⊕⊕⊕⊕ HIGH

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. The optimal information size is not met, and the 95% CI overlaps the line of no effect (i.e., CI includes 1.0)
c. Adjusted for age, gender, education, ethnicity
d. Greater frequency of exposure associated with increased frequency/intensity of uptake
e. The 95% CI of the included study overlaps the line of no effect (i.e., CI includes 1.0)
f. Adjusted for sex, grade, race/ethnicity, and past 30-day use of other tobacco products including cigarettes, cigars/cigarillos, snuff, pipe, bidis, and hookah.
g. Adjusted for gender, race/ethnicity, grade, and other tobacco use (cigarettes, cigars, hookah, smokeless, snus, pipes, bidis, dissolvables).

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for e-cigarette advertisements in print media in adults

Question: What is the effect of e-cigarette advertisements in print media on e-cigarette and cigarette-related primary outcomes?

Setting: Adults in a high-income country

Table 12 Summary of Findings for e-cigarette advertisements in print media in adults

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Effect size (95% CI)	
Ever e-cigarette use (adults, cross-sectional study)									
1	observational study {Ali 2021}	None	not serious	very serious[a]	not serious	all plausible confounding would suggest spurious effects, while no effect was observed[b]	98746	Regression coefficient 0.01, 95% CI -0.00, 0.01	⊕◯◯◯ VERY LOW
Current e-cigarette use (adults, cross-sectional study)									
1	observational study {Ali 2021}	None	not serious	very serious[a]	not serious	all plausible confounding would suggest spurious effects, while no effect was observed[b]	98746	Regression coefficient -0.02, 95%CI -0.04, -0.01, P < 0.05	⊕◯◯◯ VERY LOW
Current cigarette use (adults, cross-sectional study)									
1	observational study {Ali 2021}	None	not serious	very serious[a]	not serious	dose response gradient and all plausible confounding would reduce the demonstrated effect[c]	98746	Regression coefficient was 0.02, 95% CI 0.01, 0.02, P < 0.05	⊕⊕◯◯ LOW
Frequency of combustible cigarette use (adults, cross-sectional study)									
1	observational study {Ali 2021}	None	not serious	very serious[b]	not serious	all plausible confounding would suggest spurious effects, while no effect was observed[c]	98746	Regression coefficient was -0.00, 95% CI -0.00, 0.00	⊕◯◯◯ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. All plausible confounding would suggest spurious effects, while no effect was observed
c. A dose response gradient was seen, and all plausible confounding would reduce the demonstrated effect

 *Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for e-cigarette advertisements disseminated via social media in adolescents

Question: What is the effect of e-cigarette advertisements disseminated via social media on e-cigarette- and cigarette-related primary outcomes?

Setting: Adolescents in a high-income country

Table 13 Summary of Findings for e-cigarette advertisements disseminated via social media in adolescents

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Effect size (95% CI)	
Uptake/initiation of e-cigarettes (adolescents, cohort study, maximal follow-up period 3 years)									
2	observational studies {Lee 2019} {Cavazos 2021}	not serious	serious	very serious[a]	not serious	strong association, dose response gradient, all plausible residual confounding would reduce the demonstrated effect[b]	22604	OR –2.60, 95% CI 1.56-4.35 The dose response was seen in Lee 2019. It found that the OR for daily exposure advertising was 3.56 95%CI, 1,99-6.38, for weekly exposure OR was 2.16, 95%CI 1.14-4.08, for monthly exposure the OR was 2.30, 95%CI 1.10–4.83, when compared to no exposure.	⊕⊕⊕◯ MODERATE
Ever e-cigarette use (adolescents, cross-sectional study)									
1	observational study {Hebert 2017}	not serious	not serious	very serious[a]	serious[c]	all plausible residual confounding would reduce the demonstrated effect[d]	3907	1.16, 95% CI 0.82–1.63	⊕◯◯◯ VERY LOW
Current e-cigarette use (adolescents, cross-sectional study)									
1	observational study {Hebert 2017}	not serious	not serious	very serious[a]	serious[c]	all plausible residual confounding would reduce the demonstrated effect[d]	3907	0.92, 95% CI 0.54–1.55	⊕◯◯◯ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two level
b. Increased exposure was associated with increased effect size, thus demonstrating dose response. The effect size was large and all plausible residual confounding would reduce the demonstrated effect, upgraded accordingly.
c. The effect size crossed the line of no effect (i.e., CI includes 1.0) and hence was rated down by one for imprecision
d. All plausible residual confounding would reduce the demonstrated effect, upgraded accordingly.

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for e-cigarette advertisements disseminated via Facebook in adolescents

Question: What is the effect of e-cigarette advertisements on Facebook on e-cigarette- and cigarette-related primary outcomes?

Setting: Adolescents in a high-income country

Table 14 Summary of Findings for e-cigarette advertisements disseminated via Facebook in adolescents

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Rate (95% CI)	
Ever e-cigarette use (never users of e-cigarette adolescents, cohort study, follow-up period 9 months)									
1	observational study {Camega 2018}	not serious	not serious	very serious [a]	serious[b]	strong association	1742	2.20, 95% CI 1.37-3.52	⊕○○○ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. The study sample size was not adequate for optimal information size so the study was downgraded by one level.

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for e-cigarette advertisements disseminated via Twitter in adolescents

Question: What is the effect of e-cigarette advertisements on Twitter on e-cigarette- and cigarette-related primary outcomes?

Setting: Adolescents in a high-income country

Table 15 Summary of Findings for e-cigarette advertisements disseminated via Twitter in adolescents

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Rate (95% CI)	
Ever e-cigarette use (never users of e-cigarette adolescents, cohort study, follow-up period 9 months)									
1	observational study {Camega 2018}	not serious	not serious	very serious[a]	very serious[b]	none	1742	1.23, 95% CI 0.82-1.84	⊕○○○ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. The study sample size was not adequate for optimal information size, and the 95% CI overlaps the line of no effect (i.e., CI includes 1.0)

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for e-cigarette advertisements disseminated via YouTube in adolescents

Question: What is the effect of e-cigarette advertisements on YouTube on e-cigarette- and cigarette-related primary outcomes?

Setting: Adolescents in a high-income country

Table 16 Summary of Findings for e-cigarette advertisements disseminated via YouTube in adolescents

№ of studies	Certainty assessment						Effect		Certainty Importance
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Rate (95% CI)	
Ever e-cigarette use (never users of e-cigarettes, adolescents, cohort study, follow-up period 9 months)									
1	observational study {Camega 2018}	not serious	not serious	very serious[a]	very serious[b]	none	1742	1.28, 95% CI 0.53-3.09	⊕○○○ VERY LOW

Explanations

    a. The included study was from only one country and was downgraded for lack of directedness by two levels
    b. The study sample size was not adequate for optimal information size, and the 95% CI overlaps the line of no effect (i.e., CI includes 1.0)

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for e-cigarette advertisements disseminated via Pinterest/Google Plus in adolescents

Question: What is the effect of e-cigarette advertisements on Pinterest/Google Plus on e-cigarette- and cigarette-related primary outcomes?

Setting: Adolescents in a high-income country

Table 17 Summary of Findings for e-cigarette advertisements disseminated via Pinterest/Google Plus in adolescents

№ of studies	Certainty assessment						Effect		Certainty Importance
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Rate (95% CI)	
Ever e-cigarette use (e-cigarette naive adolescent, cohort study, follow-up period 9 months)									
1	observational study {Camega 2018}	not serious	not serious	very serious[a]	very serious[b]	none	1742	1.30, 95% CI 0.54-3.13	⊕○○○ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. The study sample size was not adequate for optimal information size, and the 95% CI overlaps the line of no effect (i.e., CI includes 1.0)

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for e-cigarette advertisements disseminated via Social media in Young adults

Question: What is the effect of e-cigarette advertisements disseminated via social media on e-cigarette and cigarette-related primary outcomes?

Setting: Young adults in a high-income country

Table 18 Summary of Findings for e-cigarette advertisements disseminated via social media in young adults

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Effect size (95% CI)	
Ever e-cigarette use (young adults, cross-sectional study)									
1	observational study {Sawdey 2017}	not serious	not serious	very serious[a]	serious[b]	strong association all plausible residual confounding would reduce the demonstrated effect[c]	258	3.01; 95% CI 1.63–9.05)	⊕○○○ VERY LOW
Current e-cigarette use (young adults, cross-sectional study)									
1	observational study {Sawdey 2017}	not serious	not serious	very serious[a]	very serious[d]	strong association all plausible residual confounding would reduce the demonstrated effect[c]	258	2.63; 95% CI 0.73–9.48	⊕○○○ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. The study sample size did not meet the optimal information size
c. A large magnitude of effect was seen and hence the study was upgraded by one level
d. d. The study sample size did not meet the optimal information size, and the 95% CI overlaps the line of no effect (i.e., CI includes 1.0)

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for e-cigarette advertisements disseminated via YouTube in Young adults

Question: What is the effect of e-cigarette advertisements on YouTube on e-cigarette and cigarette-related primary outcomes?

Setting: Young adults in a high-income country

Table 19 Summary of Findings for e-cigarette advertisements disseminated via YouTube in Young adults

№ of studies	Certainty assessment						Effect		Certainty Importance
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Rate (95% CI)	
Ever e-cigarette use (young adults, cross-sectional study)									
1	observational study {Majmundar 2021}	not serious	not serious	very serious[a]	serious[b]	strong association and all plausible residual confounding would reduce the demonstrated effect[c]	1280	2.81,95% CI 1.72, 4.59,	⊕○○○ VERY LOW
Current e-cigarette use (young adults, cross-sectional study)									
1	observational study {Majmundar 2021}	not serious	not serious	very serious[a]	Serious[b]	association and all plausible residual confounding would reduce the demonstrated effect[c]	1280	3.64, 95% CI 2.19, 6.04	⊕○○○ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. The study sample size did not meet the optimal information size and hence the study was downgraded by one level
c. A large magnitude of effect was seen and hence the study was upgraded by one level. The study did not adjust for all plausible confounders and this might reduce the effect.

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for point of sale (POS) e-cigarette advertising in adolescents and young adults

Question: What is the effect of e-cigarette POS advertising on e-cigarette and cigarette-related primary outcomes?

Setting: Adolescents and young adults in high-income countries

Table 20 Summary of Findings for point of sale (POS) e-cigarette advertising in adolescents and young adults

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
Initiation of e-cigarettes among school-aged adolescents (cohort study, follow up 2.5 years)									
1	observational study {Loukas 2019}	not serious	not serious	very serious[a]	not serious	dose response gradient[b]	2288	OR was 1.99, 95% CI 1.25-3.1 for exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days.	⊕◯◯◯ VERY LOW
Initiation of e-cigarettes among young adults (cohort study, follow up 2.5 years)									
1	observational study {Loukas 2019}	not serious	not serious	very serious[a]	not serious	dose response gradient[b]	2423	OR was 1.30; 95% CI: 1.05-1.61 for exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Initiation of e-cigarettes among young adults (cross-sectional study)									
1	observational study {Pokhrel 2017}	not serious	not serious	very serious[a]	very serious[c]	dose response gradient[b]	470	OR was 1.27, 95% CI 0.79–2.04 for exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Current use of e-cigarettes among school-aged adolescents									

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
1	observational study {Dai 2016}	not serious	not serious	very serious[a]	not serious	dose response gradient[b]	21,491	An OR 1.9, p < .0001 (statistically significant) for most of the times/always vs never/rarely within the past 30 days. Dose response was seen as the OR was 1.3, p < 0.01 (statistically significant) for sometimes vs never/rarely within the past 30 days (Confidence intervals were not reported)	⊕◯◯◯ VERY LOW
Ever e-cigarette use among school-aged adolescents (cross-sectional study)									
1	observational study {Mantey 2016}	not serious	not serious	very serious[a]	not serious	dose response gradient[b]	22,007	1.61, 95% CI 1.43-1.80 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕⊕◯◯ LOW
Ever e-cigarette use among school-aged adolescents (cohort study, follow up 6 months)									
1	observational study {Nicksic 2017a}	not serious	not serious	very serious[a]	not serious	strong association[d] dose response gradient[b]	2,488	2.99, 95% CI 1.50-5.97 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Ever e-cigarette use among school-aged adolescents (never users, cohort study, follow up 9 months)									
1	observational study {Camenga 2018}	not serious	not serious	very serious[a]	very serious[b]	none	1,742	0.91, 95% CI 0.38-2.15 0.80, 95% CI 0.47-1.36 (E-cigarette naïve adolescents with exposure in convenience stores and in tobacco shops)	⊕◯◯◯ VERY LOW
Ever e-cigarette use among high school students (cross-sectional study)									
1	observational study {Giovenco 2016}	not serious	not serious	very serious[a]	not serious	dose response gradient[b]	3,909	1.25 (95% CI (1.14-1.36) Adjusted prevalence ratios (aPR) reported	⊕◯◯◯ VERY LOW

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
Current e-cigarette use among school-aged adolescents (cross-sectional study)									
2	observational studies {Mantey 2016, Pu 2017}	not serious	not serious	very serious[a]	not serious	dose response gradient[b]	43,602	1.48, 95% CI 1.08-2.03 Pooled OR Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Current e-cigarette use among school-aged adolescents (cohort study, follow up 6 months)									
1	observational study {Nicksic 2017a}	not serious	not serious	very serious[a]	not serious	strong association[d] dose response gradient[b]	2,488	2.03, 95% CI 1.11-3.72 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕⊕◯◯ LOW
Current e-cigarette use among school-aged adolescents (exclusive vapers, cross-sectional study)									
1	observational study {Cho 2019}	not serious	not serious	very serious[a]	not serious	dose response gradient[b]	12,064	1.89, 95% CI 1.48-2.41 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Continuation or maintenance of current e-cigarette use among smokers in Australia, Canada, England, USA (vs exclusive smokers)									
1	observational study {Cho 2020}	not serious	not serious	very serious[a]	not serious	none	12,294	1.6, 95% CI 1.4- 1.9	⊕◯◯◯ VERY LOW
Continuation or maintenance of current e-cigarette use among smokers in Australia, Canada, England, USA (vs exclusive former smokers)									
1	observational study {Cho 2020}	not serious	not serious	very serious[a]	not serious	none	12,294	1.0, 95% CI 0.8-1.2	⊕◯◯◯ VERY LOW
Continuation or maintenance of current e-cigarette use among smokers in Australia, Canada, England, USA (vs exclusive vapers)									

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
1	observational study {Cho 2020}	not serious	not serious	very serious[a]	not serious	none	12,294	1.5, 95% CI 1.2-1.9	⊕◯◯◯ VERY LOW
Current e-cigarette use among middle school students (exposure most of the time/always vs never/rarely, cross-sectional study)									
1	observational study {Singh 2016}	not serious	not serious	very serious[a]	not serious	strong association[d] dose response gradient[b]	8988	2.34, 95% CI 1.70–3.23 Exposure to e-cigarette advertising in retail stores most of the time/always vs never/rarely among middle school students	⊕⊕◯◯ LOW
Current e-cigarette use among middle school students (exposure sometimes vs never/rarely cross-sectional study)									
1	observational study {Singh 2016}	not serious	not serious	very serious[a]	not serious	strong association[d] dose response gradient[b]	8988	1.78 (1.30-2.45) Exposure to e-cigarette advertising in retail stores sometimes vs never/rarely among high school students	⊕◯◯◯ VERY LOW
Current e-cigarette use among high school students (cross-sectional study)									
1	observational study {Singh 2016}	not serious	not serious	very serious[a]	not serious	dose response gradient[b]	10,310	1.91; 95% CI 1.56-2.35 Exposure to e-cigarette advertising in retail stores most of the time/always vs never/rarely among middle school students 1.37 (1.08–1.73) Exposure to e-cigarette advertising in retail stores sometimes vs never/rarely among high school students	⊕◯◯◯ VERY LOW
Current e-cigarette use among high school students (exposure to every additional e-cigarette advertisement, cross-sectional study)									
1	observational study {Giovenco 2016}	not serious	not serious	very serious[a]	not serious	dose response gradient[b]	3,909	For every additional e-cigarette advertisement, the probability of past-month e-cig use increased by 1% (p =.031)	⊕◯◯◯ VERY LOW
Current e-cigarette use among alternative high school students (cohort study)									

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
1	observational study {Beleva 2019}	not serious	not serious	very serious[a]	serious[e]	dose response gradient[b]	609	Beta coefficient regression (β) 0.25, Standard Error (SE)) 0.05, $p < 0.001$ Frequent exposure (two or three times a week/almost every day/two or three times a month vs once a month/once a week/never)	⊕◯◯◯ VERY LOW
Current cigarette use among school-aged adolescents (cross-sectional studies)									
2	observational studies {Cho 2019, Do 2020}	not serious	not serious	not serious	not serious	dose response gradient[b]	391,395	1.69, 95% CI 1.06-2.68 Pooled OR Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕⊕⊕◯ MODERATE
Current cigarette use among alternative high school students (cohort study)									
1	observational study {Beleva 2019}	not serious	not serious	very serious[a]	serious[e]	dose response gradient[b]	609	Beta coefficient regression (β) 0.30, Standard Error (SE)) 0.04, $p < 0.001$ Frequent exposure (two or three times a week/almost every day/two or three times a month vs once a month/once a week/never)	⊕◯◯◯ VERY LOW
Current cigarette use (state level, cohort study, follow up not reported)									
1	observational study {D'Angelo 2020}	not serious	not serious	very serious[a]	not serious	none	2126	1.03, 95% CI 1.0-1.06 Prevalence ratio (PR)	⊕◯◯◯ VERY LOW
Current dual use among school-aged adolescents (sometimes/most of the time/always vs never/rarely, cross-sectional study)									

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
1	observational study {Do 2020}	not serious	not serious	very serious[a]	not serious	dose response gradient[b]	3,79,331	1.5, 95% CI 1.0-2.1 Dual use (e-cigarettes and combustible cigarettes) Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Current dual use among school-aged adolescents (dual users vs never users, cross-sectional study)									
1	observational study {Cho 2019}	not serious	not serious	very serious[a]	not serious	dose response gradient[b]	12,064	1.83, 95% CI 1.43-2.35 At retail stores that sell cigarettes 1.88, 95% CI 1.47-2.40 At kiosks and temporary locations Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Current dual use among school-aged adolescents (former users vs never users, cross-sectional study)									
1	observational studies {Cho 2019}	not serious	not serious	very serious[a]	not serious	dose response gradient[b]	12,064	1.53, 95% CI 1.37-1.70 At retail stores that sell cigarettes 1.33, 95% CI 1.19-1.49 At kiosks and temporary locations Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Quitting cigarette use among young adults (cohort study, follow up 6 months)									
1	observational study {Mantey 2019}	not serious	not serious	very serious[a]	very serious[c]	dose response gradient[b]	813	0.85, 95% CI 0.72-1.01 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. Increased exposure was associated with increased effect size, thus demonstrating dose response
c. Imprecision graded down by two levels as the OIS criterion is not met and the 95% CI includes the line of no effect (i.e., CI includes 1.0)
d. Large magnitude of effect based on direct evidence, with no plausible confounders
e. Imprecision graded down by one level as the OIS criterion is not met

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence

Summary of Findings Table for POS advertising in adults

Question: What is the effect of e-cigarette POS advertising on e-cigarette and cigarette-related primary outcomes?

Setting: Adults in a high-income country

Table 21 Summary of Findings for POS advertising in adults

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
Continuation or maintenance of current e-cigarette use (State laws prohibiting self-service displays of e-cigarettes vs those without the prohibition law)									
1	observational study {Du 2020}	not serious	not serious	very serious[a]	serious[b]	none	8,94,997	1.04, 95% CI 0.99-1.09	⊕○○○ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. Imprecision graded down by one level as CI includes the line of no effect (i.e., CI includes 1.0)

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for internet e-cigarette advertising in adolescents and young adults

Question: What is the effect of e-cigarette internet advertising on adolescents and young adults?

Setting: School-aged adolescents and young adults in high-income countries

Table 22 Summary of Findings for internet e-cigarette advertising in adolescents and young adults

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
Initiation of e-cigarette use among school-aged adolescents (cohort study, follow up 2.5 years)									
1	observational study {Loukas 2019}	not serious	not serious	very serious[a]	serious[b]	dose response gradient[c]	2288	0.85, 95% CI 0.61–1.18 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Initiation of e-cigarette use among young adults (cohort study, follow up 2.5 years)									
1	observational study {Loukas 2019}	not serious	not serious	very serious[a]	serious[b]	dose response gradient[c]	2423	1.20, 95% CI 0.97–1.48 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Ever e-cigarette use among school-aged adolescents (cross-sectional study)									
1	observational study {Mantey 2016}	not serious	not serious	very serious[a]	not serious	dose response gradient[c]	22,007	1.61, 95% CI 1.41-1.83 Exposure to e-cigarette advertisements on general internet websites sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Ever e-cigarette use among school aged adolescents (cross-sectional study)									
1	observational study {Unger 2018}	not serious	not serious	very serious[a]	not serious	strong association[d]	13,651	3.20, 95% CI 2.30-4.50 Advertisement exposure to five specific tobacco brand product internet websites in the past 6 months	⊕◯◯◯ VERY LOW
Ever e-cigarette use among school-aged adolescents (cohort study, 6 months)									

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
1	observational study {Nicksic 2017a}	not serious	not serious	very serious[a]	serious[b]	dose response gradient[c]	2488	1.24, 95% CI 0.92–1.69 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕○○○ VERY LOW
Current e-cigarette use among school-aged adolescents (cross-sectional studies)									
2	observational studies {Mantey 2016, Pu 2017}	not serious	not serious	very serious[a]	not serious	dose response gradient[c]	43,602	1.59, 95% CI 1.44-1.75 Advertisement exposure on general internet websites sometimes/most of the time/always vs never/rarely in the past 30 days	⊕⊕○○ LOW
Current e-cigarette use among school-aged adolescents (cross-sectional study)									
1	observational study {Unger 2018}	not serious	not serious	very serious[a]	not serious	strong association[d]	13,651	3.0, 95% CI 1.90-4.70 Advertisement exposure to five specific tobacco brand product internet websites	⊕○○○ VERY LOW
Current e-cigarette use among school-aged adolescents (cohort study, follow up 6 months)									
1	observational study {Nicksic 2017a}	not serious	not serious	very serious[a]	serious[b]	dose response gradient[c]	2488	1.20 (95% CI 0.70–2.07 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕○○○ VERY LOW
Current use of e-cigarettes among school-aged adolescents (exposure most of the times/always vs never/rarely)									
1	observational studies {Dai 2016}	not serious	not serious	very serious[a]	not serious	dose response gradient[c]	21,491	An OR of 1.9, p < 0.001 (statistically significant) for most of the times/always vs never/rarely within the past 30 days An OR 1.4, p < 0.01 (statistically significant) for sometimes vs never/rarely within the past 30 days (Confidence intervals were not reported.	⊕⊕○○ LOW
Current e-cigarette use among school-aged adolescents (exposure sometimes vs never/rarely)									
1	observational study {Singh 2016}	not serious	not serious	very serious[a]	not serious	dose response gradient[c]	9009-middle school students, 10,303- high school students	1.44, 95% CI 1.03–2.00 Exposure to e-cigarette advertising in retail stores sometimes vs never/rarely among middle school students 1.49, 95% CI 1.22–1.84 Exposure to e-cigarette advertising in retail stores sometimes vs never/rarely among high school students	⊕⊕○○ LOW

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
Current e-cigarette use among school-aged adolescents (exposure most of the time/always vs never/rarely)									
1	observational study {Singh 2016}	not serious	not serious	very serious[a]	not serious	strong association[d] dose response gradient[c]	9009-middle school students, 10,303- high school students	2.91, 95% CI 1.89– 4.47 Exposure to e-cigarette advertising in retail stores most of the time/always vs never/rarely among middle school 2.02, 95% CI 1.66–2.46 Exposure to e-cigarette advertising in retail stores most of the time/always vs never/rarely among high school students	⊕⊕◯◯ Low
Current dual use among school-aged adolescents									
1	observational study {Marion 2020}	not serious	not serious	very serious[a]	not serious	none	15,328	1.73 95% CI 1.39-2.17	⊕◯◯◯ VERY LOW
Current cigarette use among school-aged adolescents									
1	observational study {Unger 2018}	Not serious	not serious	very serious[a]	not serious	strong association[d]	13,651	Current cigarette use 3.2, 95% CI 2.2-4.8	⊕◯◯◯ VERY LOW

Explanations

a. The included study was from one country only and was downgraded for lack of directedness by two levels
b. Imprecision graded down by one level as confidence interval includes the line of no effect (i.e., CI includes 1.0)
c. Increased exposure was associated with increased effect size, thus demonstrating dose response
d. Large magnitude of effect based on direct evidence, with no plausible confounders (odds ratio > 2), so the study was upgraded by one level

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence

Summary of Findings Table for e-mail advertising for adults

Question: What is the effect of e-cigarette email advertising on e-cigarette and cigarette-related primary outcomes?

Setting: Adults in high income countries

Table 23 Summary of Findings for e-mail advertising for adults

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Odds ratio (95% CI)	
Current e-cigarette use (adults, cross-sectional study)									
1	observational study {Dai 2017}	not serious	not serious	very serious[a]	not serious	strong association[b]	3422	2.6, 95% CI 2.1–3.1	⊕⊕◯◯ LOW
Frequency of consumption of e-cigarette (every day, adults, cross-sectional study)									
1	observational study {Dai 2017}	not serious	not serious	very serious[a]	not serious	strong association[b]	3422	2.0, 95% CI 1.4–3.0	⊕⊕◯◯ LOW
Frequency of consumption of e-cigarette (some days, adults, cross-sectional study)									
1	observational study {Dai 2017}	not serious	not serious	very serious[a]	not serious	none	3422	1.5, 95%CI 1.1–2.2	⊕⊕◯◯ LOW

Explanations

  a. The included study was from only one country and was downgraded for lack of directedness by two levels.
  b. The adjusted effect size is >2 hence upgraded for a large magnitude of effect

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for postal mail advertising for adults

Question: What is the effect of e-cigarette postal mail advertising on e-cigarette and cigarette-related primary outcomes?

Setting: Adults in high income countries

Table 24 Summary of Findings for postal mail advertising for adults

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Odds ratio (95% CI)	
Current e-cigarette use (adults, cross-sectional study)									
1	observational study {Dai 2017}	not serious	not serious	very serious[a]	very serious[b]	none	1960	1.2, 95% CI 1.0–1.6	⊕◯◯◯ VERY LOW
Frequency of consumption of e-cigarettes (every day, adults, cross-sectional study)									
1	observational study {Dai 2017}	not serious	not serious	very serious[a]	very serious[b]	none	1960	1.7, 95% CI 1.0–2.7	⊕◯◯◯ VERY LOW
Frequency of consumption of e-cigarettes (some days, adults, cross-sectional study)									
1	observational study {Dai 2017}	not serious	not serious	very serious[a]	very serious[b]	none	1960	1.5. 95% CI 1.0-2,3	⊕◯◯◯ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. The 95% CI of the included study includes the line of no effect (i.e. CI includes 1.0)

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for postal and or e-mail advertising for adults

Question: What is the effect of e-cigarette postal mail or email advertising on e-cigarette and cigarette-related primary outcomes?

Setting: Adults in high income countries

Table 25 Summary of Findings for postal and or e-mail advertising for adults

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	№ of individuals	Odds ratio (95% CI)	
Current e-cigarette use (adults, cross-sectional study)									
1	observational study {Dai 2017}	not serious	not serious	very serious[a]	not serious	none	5382	2.0, 95% CI 1.7–2.4	⊕⊕◯◯ LOW
Frequency of consumption of e-cigarettes (every day, adults, cross-sectional study)									
1	observational study {Dai 2017}	not serious	not serious	very serious[a]	not serious	none	5382	1.7, 95% CI 1.2–2.4	⊕⊕◯◯ LOW
Frequency of consumption of e-cigarettes (someday, adults, cross-sectional study)									
1	observational study {Dai 2017}	not serious	not serious	very serious[a]	not serious	none	5382	1.6, 95% CI 1.1–2.2	⊕⊕◯◯ LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Summary of Findings Table for e-cigarette advertising from multiple exposure sources/channels in adolescents and young adults

Question: What is the effect of e-cigarette advertising via multiple media sources on e-cigarette and cigarette-related primary outcomes?

Setting: School-aged adolescents and young adults in high-income countries

Table 26 Summary of Findings for e-cigarette advertising from multiple exposure sources/channels in adolescents and young adults

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
Initiation of e-cigarette use in school-aged adolescents (cohort studies, follow up range 1-2.5 years)									
3	observational studies {Lee 2019, Loukas 2019, Pierce 2018}	not serious	not serious	not serious	not serious	dose response gradient[a]	27,025	1.64, 95% 1.45-1.86 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕⊕⊕○ MODERATE
Experimentation with e-cigarettes in school-aged adolescents (cross-sectional study)									
1	observational study {Hammig 2016}	not serious	not serious	very serious[b]	not serious	dose response gradient[a]	7,36,158	1.64, 95% CI: 1.07–2.50 High exposure to e-cigarette advertisements compared to no exposure 1.23, 95% CI 1.02–1.50 Moderate exposure to e-cigarette advertisements compared to no exposure	⊕○○○ VERY LOW
Initiation of e-cigarette use in school-aged adolescents and young adults (cross-sectional studies)									
2	observational studies {Kinnunen 2015, Pokhrel 2017}	not serious	not serious	serious[c]	serious[d]	all plausible residual confounding would reduce the demonstrated effect dose response gradient[a]	3,945	1.32, 95% CI 0.93-1.88 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕⊕○○ LOW
Initiation of e-cigarette use (brand JUUL) among school-aged adolescents									

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
1	observational study {Case 2020}	not serious	not serious	very serious[b]	not serious	none	1,365	1.64, 95% CI 1.17–2.29 Relative risk ratio (RRR)	⊕○○○ VERY LOW
Initiation of e-cigarette use among young adults who were never users of e-cigarettes (RCT, follow up at 6 months)									
1	randomised controlled trial {Villanti 2016}	not serious	not serious	very serious[b]	serious[d]	not serious	3,196	1.53, 95% CI 0.98–2.39	⊕⊕○○ LOW
Initiation of cigarette use among school-aged adolescents (cross-sectional)									
1	observational study {Case 2020}	not serious	not serious	very serious[b]	not serious	strong association[e]	1,365	2.10, 95% CI 1.08-4.07 Relative risk ratio (RRR)	⊕○○○ VERY LOW
Initiation of cigarette use among school-aged adolescents (cohort study, follow up 1 year)									
1	observational study {Pierce 2018}	not serious	not serious	very serious[b]	not serious	dose response gradient[a]	10,989	1.43, 95% CI 1.23-1.65 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕○○○ VERY LOW
Ever use of e-cigarettes among school-aged adolescents (cohort study, follow up 1 year)									
1	observational study {Pierce 2018}	not serious	not serious	very serious[b]	not serious	dose response gradient[a]	10,989	1.45, 95% CI 1.19-1.77 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕○○○ VERY LOW
Ever use of e-cigarettes among school-aged adolescents (cohort studies, follow up 2.5 years)									
2	observational studies {Hansen 2020, Nicksic 2017a}	not serious	serious[f]	serious[c]	not serious	dose response gradient[a]	5,606	1.19, 95 CI 1.02-1.39 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕○○○ VERY LOW
Ever use of e-cigarettes among school-aged adolescents and young adults (cross-sectional studies)									

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
4	observational studies {Hansen 2018, Herrera 2018, Mantey 2016, Pokhrel 2015}	not serious	very serious[g]	not serious	not serious	dose response gradient[a]	28,944	1.22, 95% CI 1.08-1.39 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕○○○ VERY LOW
Ever use of cigarettes among youth and young adults (cohort studies)									
2	observational studies {Hansen 2020, Pierce 2018}	not serious	not serious	serious[c]	not serious	dose response gradient[a]	14,107	1.49, 95 CI 1.19-1.87 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕⊕○○ LOW
Ever use of cigarettes among school aged adolescents (cross-sectional study)									
1	observational study {Hansen 2018}	not serious	not serious	very serious[b]	not serious	dose response gradient[a]	6,538	1.2, 95% CI 1.0-1.4 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕○○○ VERY LOW
Ever dual use among school aged adolescents (cross-sectional study)									
1	observational study {Hansen 2018}	not serious	not serious	very serious[b]	not serious	dose response gradient[a]	6,538	1.6, 95% CI 1.3-1.9 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕○○○ VERY LOW
Current e-cigarette use among adolescents (cohort studies)									
3	observational studies {Donaldson 2017, Nagelhout 2016, Nicksic 2017a}	not serious	not serious	not serious	serious[d]	none	7,064	0.99, 95% CI 0.83-1.18 Subgroups 1.09, 95% CI 0.92–1.30 (2 studies, n = 2254) Exposure duration for past 6 months 0.86, 95% CI 0.69–1.07 (1 study {Donaldson 2017, n = 3738) Exposure duration for past 30 days	⊕○○○ VERY LOW
Current e-cigarette use with exposure to multiple ad sources (≤3 sources) vs no exposure among youth and young adults (cross sectional studies)									

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
3	observational studies {Hansen 2018, Lienemann 2019, Pokhrel 2017}	not serious	not serious	not serious	not serious	strong association[e] dose response gradient[a]	16,117	2.11, 95% CI 1.77-2.52 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕⊕⊕⊕ HIGH
Current e-cigarette use with exposure to multiple ad sources (>3 sources) vs no exposure among youth (cross sectional studies)									
4	observational studies {Hammond 2020, Mantey 2016, Papaleontiou 2020, Pu 2017}	not serious	not serious	not serious	not serious	dose response gradient[a]	83,317	1.28, 95% CI 1.18-1.39 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕⊕○○ LOW
Current e-cigarette use with exposure to multiple ad sources (>3 sources) vs no exposure among young adults (cross sectional study)									
1	observational study {Pokhrel 2015}	not serious	not serious	not serious	very serious[h]	dose response gradient[a]	307	1.01, 95% CI 0.93-1.10 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕○○○ VERY LOW
Current e-cigarette use with exposure to multiple ad sources (>3 sources) vs no exposure among youth (multi-country study)									
1	observational study {Cho 2019}	not serious	not serious	not serious	not serious	dose response gradient[a]	12,064	2.57, 95% CI 2.02- 3.27 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕⊕⊕⊕ HIGH
Current e-cigarette use among adolescents and young adults (cross-sectional study, county-level exposure)									
1	observational study {Pesko 2017}	not serious	not serious	very serious[b]	not serious	very strong association[i] dose response gradient[a]	71,702	6.42, 95% CI 2.28-18.11 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕⊕⊕○ MODERATE
Current e-cigarette use among school-aged adolescents from alternative high schools (cohort study, follow up 1 year)									

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
1	observational study {Pike 2019}	not serious	not serious	very serious[b]	not serious	none	923	(unstandardised beta co-efficient (b) 0.20, standard error (SE) 0.03, p < .001 One unit change in exposure to e-cigarette advertising associated with a 21.8% increase in the number of times adolescents used e-cigarettes one year later	⊕◯◯◯ VERY LOW
Current cigarette use among adolescents and young adults (cross-sectional studies, measured as cumulative exposure in past 30 days)									
4	observational studies {Auf 2018, Cho 2019, Hansen 2018, Papaleontiou 2020}	not serious	not serious	not serious	not serious	dose response gradient[a]	58,320	1.40, 95% CI 1.27-1.55 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕⊕⊕◯ MODERATE
Current cigarette use among young adults (cross-sectional studies, measured as daily media exposure in past 30 days)									
1	observational study {Donaldson 2017}	not serious	not serious	very serious[b]	serious[d]	dose response gradient[a]	3738	0.99, 95% CI 0.56-1.75 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Current cigarette use among school-aged adolescents (cross-sectional studies) (measured as cumulative exposure in past 12 months)									
1	observational study {Filippidis 2017}	not serious	not serious	very serious[b]	Not serious	dose response gradient[a]	27,801	1.11, 95% CI 1.01-1.18 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Current dual use among school aged adolescents (cross-sectional study)									
1	observational study {Hansen 2018}	not serious	not serious	very serious[b]	not serious	strong association[e] dose response gradient[a]	6,538	2.4, 95% CI 1.5-4.1 Exposure to e-cigarette advertisements sometimes/most of time vs never/rarely in the past 30 days	⊕◯◯◯ VERY LOW
Current cigarette use among school-aged adolescents (cross-sectional study, county level exposure)									

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
1	observational study {Pesko 2017}	not serious	not serious	very serious[e]	not serious	strong association[e] dose response gradient[a]	71,012	3.28, 95% CI 1.96-5.49 Exposure to e-cigarette advertisements sometimes/most of the time/always vs never/rarely in the past 30 days	⊕⊕◯◯ LOW
Current cigarette use among school-aged adolescents from alternative high schools (cohort study, follow up 1 year)									
1	observational study {Pike 2019}	not serious	not serious	very serious[b]	not serious	none	923	(unstandardised beta co-efficient (b) 0.10, standard error (SE) 0.02, p < .001 One unit change in exposure to e-cigarette advertising associated with a 10.1% increase in the number of times adolescents used e-cigarettes one year later	⊕◯◯◯ VERY LOW

Explanations

a. Increased exposure was associated with increased effect size, thus demonstrating dose response
b. The included study was from only one country and was downgraded for lack of directedness by two levels
c. The included studies were from two countries and were downgraded for lack of directedness by one level
d. Imprecision graded down by one level as confidence interval includes the line of no effect (i.e., CI includes 1.0)
e. Large magnitude of effect based on direct evidence, with no plausible confounders
f. Moderate heterogeneity observed between the two studies and so was downgraded by one level
g. Considerable heterogeneity observed between the studies and so was downgraded by two levels
h. Imprecision graded down by two levels as OIS not met and confidence interval includes the line of no effect (i.e., CI includes 1.0)
i. Very large magnitude of effect based on direct evidence with no serious problems with risk of bias or precision

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence

Summary of Findings Table for e-cigarette advertising from multiple exposure sources/channels in adults

Question: What is the effect of e-cigarette advertising via multiple media sources on e-cigarette and cigarette-related primary outcomes?

Setting: Adults in high-income countries

Table 27 Summary of Findings for e-cigarette advertising from multiple exposure sources/channels in adults

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of participants	Rate/effect estimate (95% CI)	
Ever use of e-cigarettes among pregnant women who were dual users (cross-sectional study)									
1	observational study {Ashford 2017}	not serious	not serious	very serious[a]	not serious	none	194	1.04, 95 CI 1.00-1.08	⊕◯◯◯ VERY LOW
Current e-cigarette use among adult exclusive vapers (cross-sectional study)									
1	observational study {Cho 2020}	not serious	not serious	very serious[a]	not serious	strong association[b]	12,246	2.4, 95% CI 1.7-3.2	⊕◯◯◯ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels
b. Large magnitude of effect based on direct evidence, with no plausible confounders

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence

Summary of Findings Table for other forms of e-cigarette advertising in adults

Question: What is the effect of other forms of e-cigarette advertisements on e-cigarette and cigarette-related primary outcomes?

Setting: Adults in high-income countries

Table 28 Summary of Findings for other forms of e-cigarette advertising in adults

№ of studies	Certainty assessment						Effect		Certainty
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations*	№ of individuals	Effect size (95% CI)	
Exposure: free giveaways at bars or social events Uptake/initiation of e-cigarettes (adults, cross-sectional study, follow up 12 months)									
1	observational study {Little 2016}	not serious	not serious	very serious[a]	none	none	13,873	OR 1.48, 95% CI 1.21-1.82	⊕◯◯◯ VERY LOW

Explanations

a. The included study was from only one country and was downgraded for lack of directedness by two levels

*Publication bias could not be assessed due to the small number of studies. This was not considered sufficient to downgrade evidence.

Availability of data and other materials

All data associated with the review is presented.

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Appendices of technical report: PRISMA checklist

Effects of e-cigarette advertising, promotion, and sponsorship on people's attitudes, beliefs, perceptions, intentions, and behaviours: a mixed-methods systematic review

Appendix 1 of technical report: PRISMA checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Yes
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	To be sent with final report
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Yes
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Yes
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Yes
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Yes
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Yes, and additionally part of technical report
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Yes
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Yes
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Yes
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Yes
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Yes

Section and Topic	Item #	Checklist item	Location where item is reported
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Yes
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Yes
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Yes
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Yes
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Yes
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Yes
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Yes
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Yes
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Yes
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Yes
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Yes, and additionally part of technical report
Study characteristics	17	Cite each included study and present its characteristics.	Yes
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Yes, and additionally part of technical report
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimates and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Yes, and additionally part of technical report
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Yes
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Yes
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Yes
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Yes

Section and Topic	Item #	Checklist item	Location where item is reported
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Yes
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Yes
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Yes
	23b	Discuss any limitations of the evidence included in the review.	Yes
	23c	Discuss any limitations of the review processes used.	Yes
	23d	Discuss implications of the results for practice, policy, and future research.	Yes
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Yes
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Yes
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Yes
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Yes
Competing interests	26	Declare any competing interests of review authors.	Yes, declared to NHMRC

Appendix 2 of technical report: search strategies for electronic databases

Contents

PubMed 28th June 2021 - https://pubmed.ncbi.nlm.nih.gov/

No.	Search terms	No of hits
#1	"Electronic Nicotine Delivery Systems"[MeSH] OR "Electronic Nicotine Delivery System"[tw] OR "Electronic Cigarette*"[tw] OR "E-Cig*"[tw] OR "E Cigarette*"[tw] OR "Electronic-Cigarette*"[tw] OR "e-hookah"[tw] OR Vaping[MeSH] OR Vape[tw] OR Vaping[tw] OR Juul[tw] OR Blu[tw] OR "E-Lites"[tw] OR Vuse[tw] OR "Mark Ten"[tw] OR Vype[tw] OR Puritane[tw] OR "Shion Pod"[tw] OR "Cuvie"[tw] OR "Cuvie plus"[tw]	8,646
#2	Advertising[MeSH] OR Communication[MeSH] OR "Mass Media"[MeSH] OR "Social Media"[MeSH] OR "Television"[Mesh] OR "Radio"[Mesh] OR "Motion Pictures"[Mesh] OR "Direct-to-Consumer Advertising"[Mesh]	376,956

No.	Search terms	No of hits
#3	advertise*[tw] OR marketing[tw] OR sponsorship[tw] OR event[tw] OR "sport*"[tw] OR concert[tw] OR fashion[tw] OR merchandise[tw] OR discount[tw] OR "product placement"[tw] OR packaging[tw] OR "point of sale*"[tw] OR retail*[tw] OR "duty-free" [tw] OR tobacconist[tw] OR celebrity[tw] OR endorsement[tw] OR movie[tw] OR "motion picture*"[tw] OR radio[tw] OR poster[tw] OR billboard[tw] OR "mass media"[tw] OR "mass medium"[tw] "mass communication"[tw] OR television[tw] OR broadcast[tw] OR magazine*[tw] OR newspaper*[tw] OR telemarketing[tw] OR tele-marketing[tw] OR broadcast*[tw] OR e-mail[tw] OR "electronic mail"[tw] OR handbill[tw] OR flyer[tw] OR pamphlet[tw] OR flier[tw] OR postcard[tw] OR coupon[tw] OR console OR "online gam*"[tw] OR online[tw] OR internet [tw] OR digital[tw] OR "social media"[tw] OR "social network"[tw] OR "new media"[tw] OR advergam*[tw] OR twitter[tw] OR tweet[tw] OR Instagram [tw] OR "YouTube"[tw] OR tiktok [tw] OR Facebook[tw] OR Netflix[tw] OR "amazon prime"[tw] OR "over-the-top"[tw] OR streaming[tw] OR OTT[tw] OR blog*[tw] OR influencer*[tw] OR "commercial communication"[tw] OR "peer"[tw] OR "direct-to-consumer advertising"[tw] OR "communications media"[tw]	573,817
#4	#2 OR #3	885,482

No.	Search terms	No of hits
#5	Australia[MeSH] OR "New Zealand"[MeSH] OR "United Kingdom"[MeSH] OR "United States"[MeSH] OR Canada[MeSH] OR "European Union"[MeSH] OR Austria[MeSH] OR Belgium[MeSH] OR Bulgaria[MeSH] OR Croatia[MeSH] OR Cyprus[MeSH] OR "Czech Republic"[MeSH] OR Denmark[MeSH] OR Estonia[MeSH] OR Finland[MeSH] OR France[MeSH] OR Germany[MeSH] OR Greece[MeSH] OR Hungary[MeSH] OR Ireland[MeSH] OR Italy[MeSH] OR Latvia[MeSH] OR Lithuania[MeSH] OR Luxembourg[MeSH] OR Malta[MeSH] OR Netherlands[MeSH] OR Poland[MeSH] OR Portugal[MeSH] OR Romania[MeSH] OR Slovakia[MeSH] OR Slovenia[MeSH] OR Spain[MeSH] OR Sweden[MeSH] OR Australia[tw] OR "New Zealand"[tw] OR "United Kingdom"[tw] OR "United States"[tw] OR Canada[tw] OR England[tw] OR Scotland[tw] OR Wales[tw] OR "Northern Ireland"[tw] OR Austria[tw] OR Belgium[tw] OR Bulgaria[tw] OR Croatia[tw] OR Cyprus[tw] OR "Czech Republic"[tw] OR Denmark[tw] OR Estonia[tw] OR Finland[tw] OR France[tw] OR Germany[tw] OR Greece[tw] OR Hungary[tw] OR Ireland[tw] OR Italy[tw] OR Latvia[tw] OR Lithuania[tw] OR Luxembourg[tw] OR Malta[tw] OR Netherlands[tw] OR Poland[tw] OR Portugal[tw] OR Romania[tw] OR Slovakia[tw] OR Slovenia[tw] OR Spain[tw] OR Sweden[tw]	3,349,026
#6	#1 AND #4 AND #5	646
#7	#1 AND #4 AND #5 Filters: Published 2015-2021	**583**

No.	Search terms	No of hits
#1	(MH Electronic Cigarettes OR MH Vaping) OR TX ("Electronic Cigarette*" OR Vaping OR "Electronic Nicotine Delivery Systems" OR "Electronic Nicotine Delivery System" OR "E-Cig*" OR "E Cigarette*" OR "Electronic-Cigarette*" OR "e-hookah" OR Vape OR Juul OR Blu OR "E-Lites" OR Vuse OR "Mark Ten" OR Vype OR Puritane OR "Shion Pod" OR "Cuvie" OR "Cuvie plus")	9,041
#2	MH "Advertising" OR MH "Communication" OR MH "Mass Media" OR MH "Social Media" OR MH "Television" OR MH "Radio" OR MH "Motion Pictures" OR MH "Direct-to-Consumer Advertising"	123,816
#3	TX (advertise* OR marketing OR sponsorship OR event OR "sport*" OR concert OR fashion OR merchandise OR discount OR "product placement" OR packaging OR "point of sale*" OR retail* OR "duty-free" OR tobacconist OR celebrity OR endorsement OR movie OR "motion picture" OR radio OR poster OR billboard OR "mass media" OR "mass medium" OR "mass communication" OR television OR broadcast OR magazine* OR newspaper* OR telemarketing OR tele-marketing OR broadcast* OR e-mail OR "electronic mail" OR handbill OR flyer OR pamphlet OR flier OR postcard OR coupon OR console OR "online gam*" OR online OR internet OR digital OR "social media" OR "social network" OR "new media" OR advergam* OR twitter OR tweet OR Instagram OR "YouTube" OR tiktok OR Facebook OR Netflix OR "amazon prime" OR "over-the-top" OR streaming OR OTT OR blog* OR influencer* OR communication OR "peer" OR "motion pictures" OR "communications media" OR "direct-to-consumer advertising")	6,055,856
#4	#2 OR #3	6,057,258

No.	Search terms	No of hits
#5	(MH Australia OR MH "New Zealand" OR MH "United Kingdom" OR MH "United States" OR MH Canada OR MH "European Union" OR MH Austria OR MH Belgium OR MH Bulgaria OR MH Croatia OR MH Cyprus OR MH "Czech Republic" OR MH Denmark OR MH Estonia OR MH Finland OR MH France OR MH Germany OR MH Greece OR MH Hungary OR MH Ireland OR MH Italy OR MH Latvia OR MH Lithuania OR MH Luxembourg OR MH Malta OR MH Netherlands OR MH Poland OR MH Portugal OR MH Romania OR MH Slovakia OR MH Slovenia OR MH Spain OR MH Sweden) OR TX (Australia OR "New Zealand" OR "United Kingdom" OR "United States" OR Canada OR England OR Scotland OR Wales OR "Northern Ireland" OR Austria OR Belgium OR Bulgaria OR Croatia OR Cyprus OR "Czech Republic" OR Denmark OR Estonia OR Finland OR France OR Germany OR Greece OR Hungary OR Ireland OR Italy OR Latvia OR Lithuania OR Luxembourg OR Malta OR Netherlands OR Poland OR Portugal OR Romania OR Slovakia OR Slovenia OR Spain OR Sweden)	3,934,194
#6	#1 AND #4 AND #5	5,753
#7	#1 AND #4 AND #5 Filters: Published 2015-2021, Exclude Medline Records	**2,417**

APA PsycInfo (Ovid) 28th June 2021 - https://www.wolterskluwer.com/en/solutions/ovid/apa-psycinfo-139

No.	Search terms	No of hits
#1	(Electronic Nicotine Delivery System OR Electronic Cigarette OR E Cig OR E Cigarette OR e hookah OR Vape OR Vaping OR Juul OR Blu OR E Lites OR Vuse OR Mark Ten OR Vype OR Puritane OR Shion Pod OR Cuvie OR Cuvie plus).mp.	2185

No.	Search terms	No of hits
#2	(advertise OR advertising OR advertisement OR marketing OR sponsorship OR event OR sport OR sports OR concert OR fashion OR merchandise OR discount OR product placement OR packaging OR point of sale OR point of sales OR retail OR duty-free OR tobacconist OR celebrity OR endorsement OR movie OR motion picture OR radio OR poster OR billboard OR mass media OR mass medium OR mass communication OR television OR broadcast OR magazine OR magazines OR newspaper OR newspapers OR telemarketing OR tele-marketing OR broadcast OR e-mail OR electronic mail OR handbill OR flyer OR pamphlet OR flier OR postcard OR coupon OR console OR online game OR online gaming OR online games OR online OR internet OR digital OR social media OR social network OR new media OR advergam OR twitter OR tweet OR Instagram OR YouTube OR tiktok OR Facebook OR Netflix OR amazon prime OR over-the-top OR streaming OR OTT OR blog OR blogs OR influencer OR influencers OR commercial communication OR peer OR motion pictures OR communications media OR direct-to-consumer advertising).mp.	501,708
#3	(Australia OR New Zealand OR United Kingdom OR United States OR Canada OR European Union OR Austria OR Belgium OR Bulgaria OR Croatia OR Cyprus OR Czech Republic OR Denmark OR Estonia OR Finland OR France OR Germany OR Greece OR Hungary OR Ireland OR Italy OR Latvia OR Lithuania OR Luxembourg OR Malta OR Netherlands OR Poland OR Portugal OR Romania OR Slovakia OR Slovenia OR Spain OR Sweden).mp.	439,028
#4	#1 AND #2 AND #3	193
#5	#1 AND #2 AND #3 4 AND 2015:2021.(sa_year)	**174**

Searching for a term by specifying .mp. searches following fields for this database: ti,ab,hw,tc,id,ot,tm,mh (abstract (ab), key Concepts (id), original Title (ot), test & measures (tm), heading word (hw), MeSH (mh), table of contents (tc), title (ti).

No.	Search terms	No of hits
#1	Mesh descriptor: [Electronic Nicotine Delivery Systems] OR Mesh descriptor: [vaping] OR ("Electronic Nicotine Delivery System" OR "Electronic Cigarette*" OR E-Cig* OR "E Cigarette*" OR "Electronic-Cigarette*" OR e-hookah OR Vape OR Vaping OR Juul OR Blu OR E-Lites OR Vuse OR "Mark Ten" OR Vype OR Puritane OR "Shion Pod" OR Cuvie OR "Cuvie plus") All text	1256
#2	Mesh descriptor: [Communication] OR Mesh descriptor: [Mass Media] OR Mesh descriptor: [Social Media] OR Mesh descriptor: [Television[OR Mesh descriptor: [Radio] OR Mesh descriptor: [Motion Pictures] OR Mesh descriptor: [Direct-to-Consumer Advertising] OR (advertise* OR marketing OR sponsorship OR event OR sport* OR concert OR fashion OR merchandise OR discount OR product placement OR packaging OR "point of sale*" OR retail* OR duty-free OR tobacconist OR celebrity OR endorsement OR movie OR "motion picture" OR radio OR poster OR billboard OR mass media OR television OR broadcast OR magazine* OR newspaper* OR telemarketing OR tele-marketing OR broadcast* OR e-mail OR electronic mail OR handbill OR flyer OR pamphlet OR flier OR postcard OR coupon OR console OR online gam* OR online OR internet OR digital OR "social media" OR social network OR new media OR advergam* OR twitter OR tweet OR Instagram OR YouTube OR tiktok OR Facebook OR Netflix OR "amazon prime" OR over-the-top OR streaming OR OTT OR blog* OR influencer* OR "commercial communication" OR peer OR communications media OR "mass communication") All text	255248

No.	Search terms	No of hits
#3	Mesh descriptor: [Australia] OR Mesh descriptor: [New Zealand] OR Mesh descriptor: [United Kingdom] OR Mesh descriptor: [United States] OR Mesh descriptor: [Canada] OR Mesh descriptor: [European Union] OR Mesh descriptor: [Austria] OR Mesh descriptor: [Belgium] OR Mesh descriptor: [Bulgaria] OR Mesh descriptor: [Croatia] OR Mesh descriptor: [Cyprus] OR Mesh descriptor: [Czech Republic] OR Mesh descriptor: [Denmark] OR Mesh descriptor: [Estonia] OR Mesh descriptor: [Finland] OR Mesh descriptor: [France] OR Mesh descriptor: [Germany] OR Mesh descriptor: [Greece] OR Mesh descriptor: [Hungary] OR Mesh descriptor: [Ireland] OR Mesh descriptor: [Italy] OR Mesh descriptor: [Latvia] OR Mesh descriptor: [Lithuania] OR Mesh descriptor: [Luxembourg] OR Mesh descriptor: [Malta] OR Mesh descriptor: [Netherlands] OR Mesh descriptor: [Poland] OR Mesh descriptor: [Portugal] OR Mesh descriptor: [Romania] OR Mesh descriptor: [Slovakia] OR Mesh descriptor: [Slovenia] OR Mesh descriptor: [Spain] OR Mesh descriptor: [Sweden] OR (Australia OR "New Zealand" OR "United Kingdom" OR "United States" OR Canada OR England OR Scotland OR Wales OR "Northern Ireland" OR Austria OR Belgium OR Bulgaria OR Croatia OR Cyprus OR "Czech Republic" OR Denmark OR Estonia OR Finland OR France OR Germany OR Greece OR Hungary OR Ireland OR Italy OR Latvia OR Lithuania OR Luxembourg OR Malta OR Netherlands OR Poland OR Portugal OR Romania OR Slovakia OR Slovenia OR Spain OR Sweden) All text	584,480
#4	#1 AND #2 AND #3	310
#5	#1 AND #4 AND #5 AND Trials	**210**
#6	#1 AND #4 AND #5 Filters: Published 2015-2021; Trials	190
#7	#1 AND #4 AND #5 Filters: Published 2015-2021; Trials; Excluding PubMed, Embase and CINAHL. Includes CT.gov (n=13) and ICTRP (n=4)	**17**

No.	Search terms	No of hits
#1	"electronic cigarette"/exp OR Vaping/exp OR "Electronic Nicotine Delivery System" OR "Electronic Cigarette*" OR "E-Cig*" OR "E Cigarette*" OR "Electronic-Cigarette*" OR "e-hookah" OR Vape OR Vaping OR Juul OR Blu OR E-Lites OR Vuse OR "Mark Ten" OR Vype OR Puritane OR "Shion Pod" OR "Cuvie" OR "Cuvie plus"	17,338
#2	Advertising/exp OR "Mass medium"/exp OR "Mass communication"/exp OR "Social Media"/exp OR Television/exp OR Radio/exp OR Movie/exp OR "Direct-to-Consumer Advertising"/exp	627,299
#3	advertise* OR marketing OR sponsorship OR event OR sport* OR concert OR fashion OR merchandise OR discount OR "product placement" OR packaging OR "point of sale*" OR retail* OR duty-free OR tobacconist OR celebrity OR endorsement OR movie OR "motion picture" OR radio OR poster OR billboard OR "mass media" OR "mass medium" OR "mass communication" OR communication OR television OR broadcast OR magazine* OR newspaper* OR telemarketing OR tele-marketing OR broadcast* OR e-mail OR "electronic mail" OR handbill OR flyer OR pamphlet OR flier OR postcard OR coupon OR console OR "online gam*" OR online OR internet OR digital OR "social media" OR "social network" OR "new media" OR advergam* OR twitter OR tweet OR Instagram OR "YouTube" OR tiktok OR Facebook OR Netflix OR "amazon prime" OR "over-the-top" OR streaming OR OTT OR blog* OR influencer* OR "commercial communication" OR peer OR "communications media"	2,920,033
#4	#2 OR #3	3,224,186

No.	Search terms	No of hits
#5	(Australia/exp OR New Zealand/exp OR United Kingdom/exp OR United States/exp OR Canada/exp OR European Union/exp OR Austria/exp OR Belgium/exp OR Bulgaria/exp OR Croatia/exp OR Cyprus/exp OR "Czech Republic"/exp OR Denmark/exp OR Estonia/exp OR Finland/exp OR France/exp OR Germany/exp OR Greece/exp OR Hungary/exp OR Ireland/exp OR Italy/exp OR Latvia/exp OR Lithuania/exp OR Luxembourg/exp OR Malta/exp OR Netherlands/exp OR Poland/exp OR Portugal/exp OR Romania/exp OR Slovakia/exp OR Slovenia/exp OR Spain/exp OR Sweden/exp) OR (Australia OR "New Zealand" OR "United Kingdom" OR "United States" OR Canada OR England OR Scotland OR Wales OR "Northern Ireland" OR Austria OR Belgium OR Bulgaria OR Croatia OR Cyprus OR "Czech Republic" OR Denmark OR Estonia OR Finland OR France OR Germany OR Greece OR Hungary OR Ireland OR Italy OR Latvia OR Lithuania OR Luxembourg OR Malta OR Netherlands OR Poland OR Portugal OR Romania OR Slovakia OR Slovenia OR Spain OR Sweden)	33,642,315
#6	#1 AND #4 AND #5	4,293
#7	#6 AND [2015-2021]/py AND [embase]/lim NOT [medline]/lim	**984**

clinicaltrials.gov 30th June 2021 - https://clinicaltrials.gov/

No.	Search terms	No of hits
#1	(Electronic Nicotine Delivery System) OR (Electronic Cigarette) OR (E Cig) OR (E Cigarette) OR (e hookah) OR Vape OR Vaping OR Juul OR Blu OR (E Lites) OR Vuse OR (Mark Ten) OR Vype OR Puritane OR (Shion Pod) OR Cuvie OR (Cuvie plus)	Filters: Completed, Unknown status Studies	Studies With Results	First posted from 01/01/2015 to 07/01/2021	49

Appendix 3 of technical report: reasons for exclusion at full text level

No.	Citation	Reason for exclusion
1.	Abadi S, Couch ET, Chaffee BW, Walsh MM. Perceptions Related to Use of Electronic Cigarettes among California College Students. Journal of Dental Hygiene. 2017;91(1):35-43	Exposure of interest not relevant. The study referred to exposure to e-cigarette-related information from health professionals but did not assess the impact of exposure of interest
2.	Abdel Magid HS, Bradshaw PT, Ling PM, et al. Association of Alternative Tobacco Product Initiation With Ownership of Tobacco Promotional Materials Among Adolescents and Young Adults. *JAMA Netw Open* 2019;2(5):e194006. doi: 10.1001/jamanetworkopen.2019.4006	Wrong outcome of interest: the study has outcomes for all alternative tobacco products which includes-e cigarettes but no disaggregated outcome data for e-cigarettes
3.	Alcalá HE, Shimoga SV. It Is About Trust: Trust in Sources of Tobacco Health Information, Perceptions of Harm, and Use of E-Cigarettes. Nicotine Tob Res. 2020;22(5):822-6	Wrong exposure of interest: the exposure of interest was related to sources of information that participant's trust
4.	Al-Hamdani M, Hopkins DB, Hardardottir A, Davidson M, Perceptions and Experiences of Vaping Among Youth and Young Adult E-Cigarette Users: Considering Age, Gender, and Tobacco Use. Journal of Adolescent Health. 2021;68(4):787-793	The outcomes of interest are unclear. Study examines the perceptions and experiences of vaping among youth and young adult e-cigarette users. Analyses related to their behaviours was not reported

No.	Citation	Reason for exclusion
5.	Ali FRM, Xu X, Tynan MA, et al. Use of Price Promotions Among U.S. Adults Who Use Electronic Vapor Products. *Am J Prev Med* 2018;55(2):240-43. doi: 10.1016/j.amepre.2018.04.020	Wrong outcome of interest: the outcome measured is whether current e-cigarette users used price promotions (coupons, rebates etc.)
6.	Allem JP, Dormanesh A, Majmundar A, Unger JB, Kirkpatrick MG, Choube A, et al. Topics of Nicotine-Related Discussions on Twitter: Infoveillance Study. J Med Internet Res. 2021;23(6):e25579	Exposure of interest unclear. The study analysed public, anonymised data from Twitter, and it is therefore unclear whether the tweets were from e-cigarette companies to market and promote their products. The outcomes of interest were unclear as well. The study mainly categorised the tweets into broad categories of topics related to nicotine. Wrong outcome of interest: analyses related to audience behaviours/reactions was not reported
7.	Bandara N. Would e-cigarette regulation alone improve adolescents' health? Ottawa, Ontario: Joule Inc.; 2018. p. 1106	Published in abstract form only, as a letter. No full-length publication available. Refers to another article
8.	Bar S, Leia Roditis M, Halpern-Felsher B. A look into 9th and 12th graders' access to electronic cigarettes. Journal of Adolescent Health. 2015;56(2):S30-S1	Conference poster abstract. Published in abstract form only, with no full-length publication available

No.	Citation	Reason for exclusion
9.	Barker JO, Rohde JA. Topic Clustering of E-Cigarette Submissions Among Reddit Communities: A Network Perspective. Health Educ Behav. 2019;46(2_suppl):59-68	The outcomes of interest were unclear. The study analysed topics related to e-cigarettes and vaping on Reddit. The study explored topics related to e-cigarettes and examined the extent to which the topics were clustered across distinct communities. Analyses relating to audience behaviours or reactions was not reported
10.	Barnes AJ, Bono RS, Rudy AK, Hoetger C, Nicksic NE, Cobb CO. Effect of e-cigarette advertisement themes on hypothetical e-cigarette purchasing in price-responsive adolescents. Addiction. 2020;115(12):2357-68	The study assessed changes in willingness to pay in response to e-cigarette advertising exposure only among a subsample that was already identified as exhibiting price responsiveness. It may not be possible to assess advertising effects across the sample
11.	Begay C, Soto C, Baezconde-Garbanati L, Barahona R, Rodriguez YL, Unger JB, et al. Cigarette and E-Cigarette Retail Marketing on and Near California Tribal Lands. Health Promot Pract. 2020;21(1_suppl):18s-26s	Outcomes of interest were not included. The study examined cigarette and e-cigarette availability, advertising, and price promotions in retail settings but included no relevant outcomes
12.	Berry C, Burton S, Howlett E. The impact of e-cigarette addiction warnings and health-related claims on consumers' risk beliefs and use intentions. Journal of Public Policy & Marketing. 2017;36(1):54-69	Wrong exposure of interest: the study was related to health-related and addiction warning claims, not advertising/promotion exposure

No.	Citation	Reason for exclusion
13.	Best C, Haseen F, Currie D, Ozakinci G, Mackintosh AM, Haw S. Effect of seeing e-cigarettes in small shops on probability of e-cigarette experimentation by 1 year follow up in adolescents in Scotland, UK. Tobacco Induced Diseases. 2018;16:88	Conference abstract. Published in abstract form only, with no full-length publication available
14.	Best C, van der Sluijs W, Haseen F, et al. Does exposure to cigarette brands increase the likelihood of adolescent e-cigarette use? A cross-sectional study. *BMJ Open* 2016;6(2):e008734. doi: 10.1136/bmjopen-2015-008734	Wrong exposure of interest: the exposure is cigarette advertising, not e-cigarette advertising
15.	Booth P, Albery IP, Frings D. Effect of e-cigarette advertisements and antismoking messages on explicit and implicit attitudes towards tobacco and e-cigarette smoking in 18-65-year-olds: a randomised controlled study protocol. *BMJ Open* 2017;7(6):e014361. doi: 10.1136/bmjopen-2016-014361	Wrong study design: study is a protocol of Booth 2019
16.	Bunnell RE, Agaku IT, Arrazola RA, Apelberg BJ, Caraballo RS, Corey CG, et al. Intentions to smoke cigarettes among never-smoking US middle and high school electronic cigarette users: National Youth Tobacco Survey, 2011-2013. Nicotine Tob Res. 2015 Feb;17(2):228-35.	Wrong outcome of interest: measures only intention to smoke cigarettes and not e-cigarettes

No.	Citation	Reason for exclusion
17.	Camenga DR, Fiellin LE, Pendergrass T, et al. Adolescents' perceptions of flavored tobacco products, including E-cigarettes: A qualitative study to inform FDA tobacco education efforts through videogames. *Addict Behav* 2018;82:189-94. doi: 10.1016/j.addbeh.2018.03.021	Study does not explore the phenomenon of interest (not related to advertisement, promotion, or marketing)
18.	Carey FR, Wilkinson AV, Harrell MB, et al. Measurement and predictive value of susceptibility to cigarettes, e-cigarettes, cigars, and hookah among Texas adolescents. *Addictive Behaviors Reports* 2018;8:95-101. doi: 10.1016/j.abrep.2018.08.005	Wrong exposure of interest: advertising/promotions not included as an exposure variable
19.	Cen Chen-Sankey J, Unger JB, Bansal-Travers M, Niederdeppe J, Bernat E, Choi K. E-cigarette Marketing Exposure and Subsequent Experimentation Among Youth and Young Adults. Pediatrics. 2019;144(5):1-11	Duplicate of the study by same authors published in the same year
20.	Cheney MK, Dobbs PD, Dunlap C, et al. Young Adult JUUL Users' Beliefs About JUUL. *Journal of Adolescent Health* 2021;68(1):138-45. doi: 10.1016/j.jadohealth.2020.05.039	Study does not explore the phenomenon of interest (not related to advertisement, promotion, or marketing)

No.	Citation	Reason for exclusion
21.	Collins L, Glasser AM, Abudayyeh H, et al. E-Cigarette Marketing and Communication: How E-Cigarette Companies Market E-Cigarettes and the Public Engages with E-cigarette Information. *Nicotine Tob Res* 2019;21(1):14-24. doi: 10.1093/ntr/ntx284	Wrong type of publication: systematic review
22.	Cranwell J, Murray R, Lewis S, et al. Adolescents' exposure to tobacco and alcohol content in YouTube music videos. *Addiction* 2015;110(4):703-11. doi: 10.1111/add.12835	Wrong type of analysis: content analysis not measuring any outcomes
23.	Czoli CD, Goniewicz M, Islam T, Kotnowski K, Hammond D. Consumer preferences for electronic cigarettes: results from a discrete choice experimentTobacco Control 2016;25:e30-e36.	Exposure of interest unclear. The participants were shown a choice set with e-cigarette product images that featured different combinations of attributes: flavour, nicotine content, health warnings and price.
24.	Day K, Bhandari N, Payakachat N, Franks A, McCain K, Ragland D. Knowledge and use of electronic cigarettes among pregnant women. Journal of the American Pharmacists Association. 2016;56(3):e40-e1.	Conference abstract. Published in abstract form only, with no full-length publication available
25.	Dhuliawala S, Kathe N, Payakachat N. PNS69 FACTORS ASSOCIATED WITH INITIATION OF E-CIGARETTE AMONG MIDDLE SCHOOL VS. HIGH SCHOOL CHILDREN. Value in Health. 2019;22:S297-S8.	Published in abstract form only, with no full-length publication available

No.	Citation	Reason for exclusion
26.	Duan Z, Abdullah AS, Tong W, Xiaoxiao C, Xia X, Zixian P, et al. Perceptions of e-cigarettes among smokers and non-smokers in households with children in rural China: A cross-sectional study. Tobacco Induced Diseases. 2021;19:1-11	Wrong setting of interest: the study was conducted in China
27.	Fallin-Bennett A, Aleshire M, Scott T, Lee YO. Marketing of e-cigarettes to vulnerable populations: An emerging social justice issue. Perspectives in Psychiatric Care. 2019;55(4):584-91.	Wrong publication type: a review article that described the history and some strategies to reduce e-cigarette use mong vulnerable populations
28.	Flint SW, Hennessy M. Are e-cigarette product advertisements on public transport driving public misunderstanding and potentially increased use? Perspect Public Health. 2020;140(2):91-2.	Wrong publication type: brief opinion and review article
29.	Ford A, MacKintosh AM, Bauld L, Moodie C, Hastings G. Adolescents' responses to the promotion and flavouring of e-cigarettes. Int J Public Health. 2016;61(2):215-24.	The study does not measure the exposure and outcomes of interest
30.	Fraser D, Weier M, Keane H, Gartner C. Vapers' perspectives on electronic cigarette regulation in Australia. Int J Drug Policy. 2015;26(6):589-94.	It is not clear whether the study assessed the influence of regulations on advertising

No.	Citation	Reason for exclusion
31.	Gaiha SM, Epperson A, Halpern-Felsher B. 108. Youth Perceptions about the Relationship Between E-Cigarette Use and COVID-19. Journal of Adolescent Health. 2021;68(2):S57	Exposure of interest not assessed: The survey focussed on the participants' use of and access to e-cigarettes before and during the COVID 19 pandemic and did not focus on marketing or advertising-related questions
32.	Gaiha SM, Lempert LK, Halpern-Felsher B. Underage Youth and Young Adult e-Cigarette Use and Access Before and During the Coronavirus Disease 2019 Pandemic. JAMA Network Open. 2020;3(12):e2027572-e.	Published in abstract form only, with no full-length publication available
33.	Gambaryan M, Kalinina A, Popovich M, Startovoytov M, Drapkina O. Exposure to E-cigarettes advertisement and product use in Russian population: results from Russian Tobacco Control Policy evaluation survey. European Respiratory Journal. 2020;56.	Conference abstract. Published in abstract form only, with no full-length publication available. Additionally, the abstract did not include any reference to exposure to advertising or marketing
34.	Gambaryan M, Kalinina AM, Popovich MV, Starovoytov ML, Drapkina OM, Boytsov SA. Electronic cigarettes in Russia: Time for an action. Results from Russian Tobacco Control policy evaluation survey. European Journal of Preventive Cardiology. 2019;26:S113.	Conference poster abstract. Published in abstract form only, with no full-length publication available

No.	Citation	Reason for exclusion
35.	Gambaryan M, Popovich M, Starovoytov M, Kalinina A, Drapkina O, Boytsov S. Electronic nicotine delivery systems-new challenge for tobacco control policy: Results from Russian tobacco control policy evaluation study. European Respiratory Journal. 2018;52.	Conference abstract. Published in abstract form only, with no full-length publication available
36.	Getachew B, Payne JB, Vu M, et al. Perceptions of Alternative Tobacco Products, Anti-tobacco Media, and Tobacco Regulation among Young Adults: A Qualitative Study. *American Journal of Health Behavior* 2018;42(4):118-30. doi: 10.5993/AJHB.42.4.11	Wrong phenomena of interest: measures attitudes towards anti - tobacco media aimed at educating people about the harms from vaping and not about advertising, marketing or sponsorship
37.	Giachello AL, Vu TH, Payne TJ, Robertson RM, Rodriguez C, Groom A, et al. Use of tobacco products among LGBTQ: Results from 2016 surveys & focus groups. Circulation. 2017;135.	Conference poster abstract. Published in abstract form only, with no full-length publication available
38.	Gowin M, Cheney MK, Wann TF. Knowledge and Beliefs About E-Cigarettes in Straight-to-Work Young Adults. *Nicotine Tob Res* 2017;19(2):208-14. doi: 10.1093/ntr/ntw195	Study does not explore the phenomenon of interest (not related to advertisement, promotion, or marketing)

No.	Citation	Reason for exclusion
39.	Gurram N, Thomson G, Wilson N, Hoek J. Electronic cigarette online marketing by New Zealand vendors. New Zealand Medical Journal. 2019;132(1506):20-33.	Wrong outcome of interest: no outcomes of interest were assessed nor were participant's or audience's behaviours, perceptions and reactions. Study examined the characteristics of the online marketing environment and on the impact of this on the behaviour of the population
40.	Hall MG, Pepper JK, Morgan JC, Brewer NT. Social Interactions as a Source of Information about E-Cigarettes: A Study of U.S. Adult Smokers. Int J Environ Res Public Health. 2016;13(8).	Wrong exposure of interest: study compared the impact of pictorial versus text-only warnings, which is not a part of tobacco advertisement, promotion and sponsorships (TAPS)
41.	Hammond D, White CM, Czoli CD, et al. Retail availability and marketing of electronic cigarettes in Canada. *Canadian Journal of Public Health* 2015;106(6):e408-e12. doi: 10.17269/CJPH.106.5105	Wrong outcome of interest: no relevant outcomes measured
42.	Harrell M, Jackson C, Delk J, Opara S, Perry C. Youth who initiate tobacco use with e-cigarettes only differ from those who start with cigarettes only or both products concomitantly. Tobacco Induced Diseases. 2018;16:211.	Conference abstract. Published in abstract form only, with no full-length publication available
43.	Heckman BW, Fong GT, Borland R, et al. The impact of vaping and regulatory environment on cigarette demand: behavioral economic perspective across four countries. *Addiction* 2019;114:123-33. doi: 10.1111/add.14538	Wrong exposure of interest: measured receptivity to pricing changes, no mention of advertising or promotions

No.	Citation	Reason for exclusion
44.	Herold R, Boykan R, Eliscu A, Alcalá HE, Goniewicz ML. Association between Friends' Use of Nicotine and Cannabis and Intake of both Substances among Adolescents. Int J Environ Res Public Health. 2021;18(2).	Wrong exposure of interest: the study focussed on influence of friends in e-cigarette initiation and use
45.	Hong H, McConnell R, Liu F, Urman R, Barrington-Trimis JL. The impact of local regulation on reasons for electronic cigarette use among Southern California young adults. Addict Behav. 2019;91:253-258.	Wrong exposure of interest: the study talked about the impact of local regulation on reasons for e-cigarette use. However, these local tobacco control policies were not related to advertising and promotion
46.	Hongying D, Jianqiang H. Flavored Electronic Cigarette Use and Smoking Among Youth. Pediatrics. 2016;138(6):43-.	Wrong exposure of interest: the study talked about the use of flavoured e-cigarettes but was unclear whether this was related to advertising and promotion
47.	Huh J, Meza L, Galstyan E, Galimov A, Yu S, Unger JB, et al. Signs and customer behaviors at vape shops: Multivariate multilevel model analysis. Addictive Behaviors Reports. 2020;12.	Wrong study type: this is a modelling study.
48.	Ickes M, Hester JW, Wiggins AT, et al. Prevalence and reasons for Juul use among college students. *Journal of American College Health* 2020;68(5):455-59. doi: 10.1080/07448481.2019.1577867	Wrong exposure of interest: did not focus on e-cigarette advertising or promotions

No.	Citation	Reason for exclusion
49.	Jayakumar N, O'Connor S, Diemert L, Schwartz R. Predictors of E-Cigarette Initiation: Findings From the Youth and Young Adult Panel Study. Tobacco Use Insights. 2020;13:1-9.	Wrong exposure of interest: the study was focussed on friends' use and peer influence of e-cigarettes. It was unclear whether there was any promotion or advertising, or marketing involved
50.	Jeong M, Kurti MK, Hrywna M, Ackerman C, Delnevo CD. Changes in Tobacco Product Advertising at Point of Sale: 2015-2018. Pediatrics. 2020;145(6).	Outcomes of interest not assessed. The study focussed on trends in changes in point-of-sale advertisements but did not report on the outcomes of interest
51.	Jo CL, Noar SM, Southwell BG, Ribisl KM. Effects of E-cigarette Advertising Message Form and Cues on Cessation Intention: An Exploratory Study. J Health Commun. 2019;24(5):570-580. doi:10.1080/10810730.2019.1639857	Wrong outcome of interest: the study reported on intention to quit smoking
52.	Johnson AC, Mays D, Hawkins KB, et al. A qualitative study of adolescent perceptions of electronic cigarettes and their marketing: Implications for prevention and policy. *Children's Health Care* 2017;46(4):379-92. doi: 10.1080/02739615.2016.1227937	Wrong study design: study was qualitative, but analysis was not done using qualitative methods
53.	Jongenelis MI, Brennan E, Slevin T, Kameron C, Jardine E, RuD'Angelozky D, et al. Factors associated with intentions to use e-cigarettes among Australian young adult non-smokers. Drug Alcohol Rev. 2019;38(5):579-87.	Wrong exposure/s of interest: the study assessed the role of sociodemographic factors and their impact on e-cigarette use

No.	Citation	Reason for exclusion
54.	Jongenelis MI, Jardine E, Kameron C, Rudaizky D, Pettigrew S. E-cigarette use is associated with susceptibility to tobacco use among Australian young adults. Int J Drug Policy. 2019;74:266-73.	Wrong exposure/s of interest: the study assessed the role of social and individual factors and their impact on e-cigarette use
55.	Jongenelis MI, Jongenelis G, Alexander E, Kennington K, Phillips F, Pettigrew S. A content analysis of the tweets of e-cigarette proponents in Australia. Health Promot J Austr. 2021.	The study included content analysis of tweets of e-cigarette proponents but there was no analysis of the target audience behaviours or reactions
56.	Jongenelis MI, Kameron C, Brennan E, et al. E-cigarette product preferences among Australian young adult e-cigarette users. *Australian & New Zealand Journal of Public Health* 2018;42(6):572-74. doi: 10.1111/1753-6405.12842	Wrong exposure of interest: no mention of e-cigarette advertising or promotions
57.	Keamy-Minor E, McQuoid J, Ling PM. Young adult perceptions of JUUL and other pod electronic cigarette devices in California: a qualitative study. *BMJ Open* 2019;9(4):e026306. doi: 10.1136/bmjopen-2018-026306	Wrong exposure of interest: no mention of e-cigarette advertising or promotions
58.	Keller-Hamilton B, Roberts ME, Slater MD, et al. Adolescent males' responses to blu's fake warnings. *Tob Control* 2019;28(e2):e151-e53. doi: 10.1136/tobaccocontrol-2018-054805	Wrong outcome of interest: only measured recall of advertising/fake warning labels

No.	Citation	Reason for exclusion
59.	Kim M, Popova L, Halpern-Felsher B, Ling PM. Effects of e-Cigarette Advertisements on Adolescents' Perceptions of Cigarettes. Health Commun. 2019;34(3):290-297. doi:10.1080/10410236.2017.1407230	Wrong outcome of interest: study reports outcomes related to knowledge, attitudes and beliefs related to combustible cigarettes
60.	Klein EG, Czaplicki L, Berman M, et al. Visual Attention to the Use of #ad versus #sponsored on e-Cigarette Influencer Posts on Social Media: A Randomized Experiment. *Journal of Health Communication* 2020;25(12):925-30. doi: 10.1080/10810730.2020.1849464	Wrong outcome of interest: outcome measured is attention paid to different e-cigarette advertisements on social media
61.	Kong G, Bold KW, Morean ME, et al. Appeal of JUUL among adolescents. *Drug Alcohol Depend* 2019;205:107691. doi: 10.1016/j.drugalcdep.2019.107691	Wrong exposure of interest: advertising/promotions not included as an exposure variable
62.	Kreitzberg DS, Herrera AL, Loukas A, Pasch KE. Exposure to tobacco and nicotine product advertising: Associations with perceived prevalence of use among college students. Journal of American College Health. 2018;66(8):790-8.	Outcome data not relevant
63.	Kreitzberg DS, Pasch KE, Marti CN, Loukas A, Perry CL. Bidirectional associations between young adults' reported exposure to e-cigarette marketing and e-cigarette use. Addiction. 2019;114(10):1834-41.	Wrong study type: this is a modelling study

No.	Citation	Reason for exclusion
64.	Kreitzberg DS, Hinds JT, Pasch KE, et al. Exposure to ENDS advertising and use of marijuana in ENDS among college students. Addict Behav 2019; 93: 9-13. 2019/01/25. DOI: 10.1016/j.addbeh.2019.01.012	Wrong outcome of interest: outcome measured is use of marijuana in an ENDS device
65.	Krishnan-Sarin S, Kong G, Camenga DR, Cavallo DA, Simon P, Connell C, et al. Predictors of e-cigarette use among adolescents. Drug & Alcohol Dependence. 2015;156:e119-e20.	Published in abstract form only, with no full-length publication available. Also, the abstract did not include any reference to exposure to advertising or marketing
66.	Krishnan-Sarin S, Morean ME, Camenga DR, et al. E-cigarette use among high school and middle school adolescents in Connecticut. *Nicotine & Tobacco Research* 2015;17(7):810-18. doi:	Wrong exposure of interest-advertising/promotions not included as an exposure variable
67.	Kristjansson AL, Mann MJ, Sigfusson J, Sarbu EA, Grubliauskiene J, Daily SM, et al. Prevalence of e-cigarette use among adolescents in 13 Eastern European towns and cities. Public Health (Elsevier). 2017;147:66-8.	Exposure/s of interest not assessed: the study only focussed on the prevalence of e-cigarette use and did not assess marketing or advertising
68.	Laestadius LI, Wahl MM, Pokhrel P, et al. From Apple to Werewolf: A content analysis of marketing for e-liquids on Instagram. *Addict Behav* 2019;91:119-27. doi: 10.1016/j.addbeh.2018.09.008	Wrong type of analysis: content analysis with no analysis of the target audience behaviours or reactions.

No.	Citation	Reason for exclusion
69.	Laverty AA, Vardavas CI, Filippidis FT. Design and marketing features influencing choice of e-cigarettes and tobacco in the EU. *European Journal of Public Health* 2016;26(5):838-41. doi: 10.1093/eurpub/ckw109	Wrong type of analysis: content analysis with no analysis of the target audience behaviours or reactions
70.	Lee YO, Hebert CJ, Nonnemaker JM, Kim AE. Youth tobacco product use in the United States. Pediatrics. 2015 Mar;135(3):409-15	Wrong exposure of interest: the responses were 'likely and unlikely', which indicated hypothetical exposure to advertising
71.	Link AR, Cawkwell PB, Shelley DR, et al. An exploration of online behaviors and social media use among hookah and electronic-cigarette users. *Addictive Behaviors Reports* 2015;2:37-40. doi: 10.1016/j.abrep.2015.05.006	Wrong outcome of interest: doesn't measure any of the outcomes relevant to the study
72.	Liozidoul A, Dimou N, Lioupa A, Behrakis P. Experimentation With Cigarettes and e-Cigarettes Among Greek Adolescents. CHEST. 2016;149:A594-A. U.S.? An Eye-Tracking Approach. Nicotine Tob Res. 2021;23(5):815-22.	Conference poster abstract. Published in abstract form only, with no full-length publication available
73.	Lisha NE, Jordan JW, Ling PM. Peer crowd affiliation as a segmentation tool for young adult tobacco use. *Tob Control* 2016;25(Suppl 1):i83-i89. doi: 10.1136/tobaccocontrol-2016-053086	Wrong exposure of interest: no mention of e-cigarette advertising or promotions

No.	Citation	Reason for exclusion
74.	Lisha NE, Thrul J, Ling PM. Latent Class Analysis to Examine Patterns of Smoking and Other Tobacco Products in Young Adult Bar Patrons. *J Adolesc Health* 2019;64(1):93-98. doi: 10.1016/j.jadohealth.2018.06.022	Wrong exposure of interest: no mention of e-cigarette advertising or promotions
75.	Liu J, Phua J, Krugman D, Xu L, Nowak G, Popova L. Do Young Adults Attend to Health Warnings in the First IQOS Advertisement in the	Wrong type of e-cigarette (IQOS) assessed
76.	Loukas A, Marti CN, Creamer MR, Perry CL. Does use of electronic nicotine delivery systems predict current cigarette use among young adults? Tobacco Induced Diseases. 2018;16:88.	Conference abstract. Published in abstract form only, with no full-length publication available. Also, the abstract did not include any reference to exposure to advertising or marketing
77.	Mackey TK, Miner A, Cuomo RE. Exploring the e-cigarette e-commerce marketplace: Identifying Internet e-cigarette marketing characteristics and regulatory gaps. Drug Alcohol Depend. 2015;156:97-103.	Wrong type of analysis: the studies only analysed the content of advertisements with no analysis of target audience behaviours or reactions
78.	Mamudu H, Wang L, Owusu D, et al. Prospective study of dual use of e-cigarettes and other tobacco products among school-going youth in rural Appalachian Tennessee. 2019;14(2):127-33.	Outcome of interest- Study did not report disaggregated data for e-cigarette and other tobacco products. Other tobacco product comprised of smokeless tobacco and combustible tobacco

No.	Citation	Reason for exclusion
79.	Mamudu HM, Nwabueze C, Weierbach FM, Yang J, Jones A, McNabb M, et al. Exploring Associations between Susceptibility to the Use of Electronic Nicotine Delivery Systems and E-Cigarette Use among School-Going Adolescents in Rural Appalachia. Int J Environ Res Public Health. 2020;17(14).	Wrong exposure of interest: the study reported on several social factors that influenced the susceptibility to use e-cigarettes; however, there was no reference to marketing or advertising
80.	Mantey DS, Creamer MR, Pasch KE, Perry CL. Marketing Exposure Recall is Associated With Past 30-Day Single, Dual, Polytobacco Use Among US Adolescents. Nicotine Tob Res. 2018;20(suppl_1):S55-S61.	The outcomes of interests are not disaggregated for e-cigarettes only or e-cigarettes and/or combustible cigarettes
81.	McCabe SE, Veliz P, McCabe VV, et al. Smoking behaviors and intentions among current e-cigarette users, cigarette smokers, and dual users: A national survey of U.S. high school seniors. *Preventive Medicine* 2017;99:228-35. doi: 10.1016/j.ypmed.2017.02.025	Wrong exposure of interest: no mention of e-cigarette advertising or promotions
82.	McKelvey K, Halpern-Felsher B. Youth say flavored E-cigarette ADS are for them. Journal of Adolescent Health. 2018;62(2):S136-S7.	Wrong exposure of interest: the study related to the youths' perceptions of various e-cigarette flavours
83.	Moran MB, Villanti AC, Johnson A, et al. Patterns of Alcohol, Tobacco, and Substance Use Among Young Adult Peer Crowds. *Am J Prev Med* 2019;56(6):e185-e93. doi: 10.1016/j.amepre.2019.02.010	Wrong exposure of interest: no mention of e-cigarette advertising or promotions

No.	Citation	Reason for exclusion
84.	Nguyen HV. Association of Canada's Provincial Bans on Electronic Cigarette Sales to Minors With Electronic Cigarette Use Among Youths. *JAMA Pediatrics* 2020;174(1):e193912-e12. doi: 10.1001/jamapediatrics.2019.3912	Wrong exposure of interest: no mention of e-cigarette advertising or promotions
85.	Noar SM, Rohde JA, Prentice-Dunn H, et al. Evaluating the actual and perceived effectiveness of E-cigarette prevention advertisements among adolescents. 2020; 109:106473.	Wrong outcome of interest:\study tested whether perceived message effectiveness (PME) served as a proxy for ad impact
86.	Opazo Breton M, Britton J, Bogdanovica I. Effect of UK plain tobacco packaging and minimum pack size legislation on tobacco and nicotine product switching behaviour. *Addiction* 2020;115(10):1913-23. doi: 10.1111/add.15050	Wrong exposure of interest: study exposure is cigarette plain packaging
87.	Osman A, Kowitt SD, Ranney LM, et al. Risk factors for multiple tobacco product use among high school youth. *Addict Behav* 2019;99:106068. doi: 10.1016/j.addbeh.2019.106068	Did not report disaggregated data for e-cigarette and combustible cigarettes. Combined outcome data was reported for e-cigarette and other tobacco products
88.	Owusu D, Aibangbee J, Collins C, et al. The Use of E-cigarettes Among School-Going Adolescents in a Predominantly Rural Environment of Central Appalachia. *Journal of Community Health* 2017;42(3):624-31. doi: 10.1007/s10900-016-0297-0	Wrong exposure of interest: no mention of e-cigarette advertising or promotions

No.	Citation	Reason for exclusion
89.	Park E, Kwon M, Gaughan MR, et al. Listening to Adolescents: Their Perceptions and Information Sources About E-cigarettes. *Journal of Pediatric Nursing* 2019;48:82-91. doi: 10.1016/j.pedn.2019.07.010	Study does not explore the phenomenon of interest (not related to advertisement, promotion, or marketing)
90.	Pierce JP, Sargent JD, White MM, Borek N, Portnoy DB, Green VR, et al. Receptivity to Tobacco Advertising and Susceptibility to Tobacco Products. Pediatrics. 2017;139(6).	The study measures intention to use cigarettes, which is not the review's outcome of interest
91.	Printz C. E-cigarette advertising linked to increased tobacco craving. Cancer. 2015;121(15):2479.	Referred to another article, the full text of which was retrieved
92.	Ramo DE, Thrul J, Delucchi KL, Hall S, Ling PM, Belohlavek A, et al. A randomized controlled evaluation of the tobacco status project, a Facebook intervention for young adults. Addiction. 2018;113(9):1683-95.	Exposure/s of interest not assessed. The study only focussed on smoking cessation strategies
93.	Research News. E-cigarette adverts 'could make smoking seem safer'. Community Practitioner. 2016;89(10):9-.	Wrong publication type: letter
94.	Robertson L, Hoek J, Blank ML, et al. A qualitative exploration of information-seeking by electronic nicotine delivery systems (ENDS) users in New Zealand. *BMJ Open* 2018;8(10):e023375. doi: 10.1136/bmjopen-2018-023375	Study does not explore the phenomenon of interest (not related to advertisement, promotion, or marketing)

No.	Citation	Reason for exclusion
95.	Rousu MC, O'Connor R, Corrigan J. Effect of brand and advertising medium on demand for e-cigarettes: Evidence from an experimental auction. *Prev Med Rep* 2017;7:11-15. doi: 10.1016/j.pmedr.2017.04.013	Wrong outcome of interest: the article only measured demand in an experimental setting
96.	Sanders-Jackson A, Tan ASL, Yie K. Effects of health-oriented descriptors on combustible cigarette and electronic cigarette packaging: An experiment among adult smokers in the United States. Tobacco Control: An International Journal. 2018;27(5):534-41.	Wrong exposure of interest. The effects of health-oriented descriptors on packaging was assessed
97.	Scheier LM, Komarc M. Are E-cigarette Users a Unique Group of Smokers? Latent Class Analysis of the National Youth Tobacco Survey. Journal of Drug Education. 2020;49(3/4):87-114.	Wrong study type: the study used latent class analysis type of modelling, and the study design was not relevant. methodology.
98.	Sears CG, Walker KL, Hart JL, Lee AS, Siu A, Smith C, et al. Perceptions and use of electronic cigarettes among middle and high school students in appalachia. Circulation. 2016;134.	Published in abstract form only, with no full-length publication available
99.	Segura LE, Maldonado A, Santaella J, Storr C, Martins SS. Greater curiosity about smoking cigarettes among 6th and 12th grade students using alternative tobacco-smoking products. Drug and Alcohol Dependence. 2017;171:e186.	Published in abstract form only, with no full-length publication available. Also, the abstract did not include any reference to exposure to advertising or marketing

No.	Citation	Reason for exclusion
100.	Shang C, Weaver SR, Zahra N, Huang J, Cheng KW, Chaloupka FJ. The Association between Potential Exposure to Magazine Ads with Voluntary Health Warnings and the Perceived Harmfulness of Electronic Nicotine Delivery Systems (ENDS). Int J Environ Res Public Health. 2018;15(4).	Wrong exposure of interest: study examined the association of e-cigarette magazine ads with voluntary warnings with perceived harmfulness of e-cigarette Ads with warnings did not belong to advertisement, promotion and sponsorship category. Outcomes of interest were not relevant. The study focussed on outcomes related to perceptions of harms of e-cigarettes
101.	Simon P, Camenga DR, Morean ME, Kong G, Bold KW, Cavallo DA, et al. Socioeconomic status and adolescent e-cigarette use: The mediating role of e-cigarette advertisement exposure. Prev Med. 2018;112:193-8.	Wrong exposure of interest: e-cigarette advertising exposure was assessed as a mediator for socioeconomic status
102.	Soares R, Aguiar P, Ravara SB. Smoking behaviour among medical students and tobacco marketing at college parties: A cross-sectional study in Portugal. European Respiratory Journal. 2017;50.	Published in abstract form only, with no full-length publication available
103.	Sontag J, Manderski MTB, Hammond D, et al. US young adults' perceived effectiveness of draft pictorial e-cigarette warning labels. *Tob Control* 2019;28(e1):e49-e51. doi: 10.1136/tobaccocontrol-2018-054802	Wrong exposure of interest: focusing on warning labels determined by the FDA

No.	Citation	Reason for exclusion
104.	Sontag JM, Wackowski OA, Hammond D. Baseline assessment of noticing e-cigarette health warnings among youth and young adults in the United States, Canada and England, and associations with harm perceptions, nicotine awareness and warning recall. *Prev Med Rep* 2019;16:100966. doi: 10.1016/j.pmedr.2019.100966	Wrong exposure of interest: focusing on warning labels determined by the FDA
105.	Sussman S, Allem J-P, Garcia J, Unger JB, Cruz TB, Garcia R, et al. Who walks into vape shops in Southern California?: a naturalistic observation of customers. Tobacco Induced Diseases. 2016;14:1-5.	It was unclear from the study if the exposure in retail stores was associated with the review's outcomes of interest
106.	Tamulevicius N, Martinasek MP, Moss SJ, et al. An Analysis of Associations Between Electronic Nicotine Delivery System Users. *Respiratory Care* 2020;65(3):355-61. doi: 10.4187/respcare.07172	Wrong exposure of interest: no mention of e-cigarette advertising or promotions
107.	Tan AS, Bigman CA, Sanders-Jackson A. Sociodemographic correlates of self-reported exposure to e-cigarette communications and its association with public support for smoke-free and vape-free policies: results from a national survey of US adults. *Tob Control* 2015;24(6):574-81. doi: 10.1136/tobaccocontrol-2014-051685	Wrong outcome of interest- Study examined support for vaping restrictions and smoking in public venues
108.	Tan AS, Bigman CA, Mello S, Sanders-Jackson A. Is exposure to e-cigarette communication associated with perceived harms of e-cigarette secondhand vapour? Results from a national survey of US adults. BMJ Open. 2015;5(3):e007134.	Wrong outcome of interest: \the outcomes reported are related perceptions of harms

No.	Citation	Reason for exclusion
109.	Tattan-Birch H, Jackson SE, Ide C, et al. Evaluation of the Impact of a Regional Educational Advertising Campaign on Harm Perceptions of E-Cigarettes, Prevalence of E-Cigarette Use, and Quit Attempts Among Smokers. *Nicotine Tob Res* 2020;22(7):1148-54. doi: 10.1093/ntr/ntz236	Wrong exposure of interest: study is about social marketing initiatives aimed at reducing use of combustible cigarettes or switching to e-cigarettes
110.	Todea D, Coman A. Factors Affecting Cigarette Smoking and Electronic Cigarette Consumption Among Teenagers From Cluj-Napoca Area, Romania. CHEST. 2016;149:A597-A.	Conference abstract. Published in abstract form only, with no full-length publication available. Also, the abstract did not include any reference to exposure to advertising or marketing
111.	Tompkins LK, Sears CG, Walker KL, Hart JL. Factors associated with e-cigarette use in appalachian youth. Circulation. 2017;136.	Published in abstract form only, with no full-length publication available.
112.	Tully LK, Correa JB, Doran N. The relationship between family history of tobacco use and progression to tobacco use among young adult e-cigarette users. *Prev Med Rep* 2019;15:100914. doi: 10.1016/j.pmedr.2019.100914	Wrong exposure of interest: measures family history of tobacco use
113.	Unger JB, Urman R, Cruz TB, et al. Talking about tobacco on Twitter is associated with tobacco product use. *Prev Med* 2018;114:54-56. doi: 10.1016/j.ypmed.2018.06.006	No exposure of interest: the study did not focus on advertising or promotions on Twitter

No.	Citation	Reason for exclusion
114.	Wackowski OA, Sontag JM, Hammond D, O'Connor RJ, Ohman-Strickland PA, Strasser AA, et al. The Impact of E-Cigarette Warnings, Warning Themes and Inclusion of Relative Harm Statements on Young Adults' E-Cigarette Perceptions and Use Intentions. Int J Environ Res Public Health. 2019;16(2).	Wrong exposure of interest: study examined the impact of e-cigarette warning themes on perceived harmfulness of e-cigarettes. E-cigarette warnings did not belong to advertisement, promotion, and sponsorship category
115.	Wada P, Lam CN, Burner E, et al. Exposure to and Use of Electronic Cigarettes: Does Language Matter? *Ethn Dis* 2017;27(3):217-22. doi: 10.18865/ed.27.3.217	No outcome/s of interest
116.	Wada P, Lam CN, Burner E, Terp S, Menchine M, Arora S. Exposure to and Use of Electronic Cigarettes: Does Language Matter? Ethn Dis. 2017;27(3):217-22.	The study reported purely descriptive results, with no associations reported
117.	Wadsworth E, McNeill A, Li L, et al. Reported exposure to E-cigarette advertising and promotion in different regulatory environments: Findings from the International Tobacco Control Four Country (ITC-4C) Survey. *Prev Med* 2018;112:130-37. doi: 10.1016/j.ypmed.2018.04.022	No outcome/s of interest
118.	Wan N, Siahpush M, Shaikh RA, et al. Point-of-sale e-cigarette advertising among tobacco stores. *Journal of Community Health: The Publication for Health Promotion and Disease Prevention* 2017;42(6):1179-86. doi: http://dx.doi.org/10.1007/s10900-017-0368-x	Wrong outcome of interest: measures association between POS marketing and demographic characteristics

No.	Citation	Reason for exclusion
119.	Wan N, Siahpush M, Shaikh RA, et al. The Association of Point-of-Sale E-cigarette Advertising with Socio-Demographic Characteristics of Neighborhoods. *J Prim Prev* 2018;39(3):191-203. doi: 10.1007/s10935-018-0506-y	Wrong outcome of interest: measures association between POS marketing and demographic characteristics
120.	Wang TW, Gentzke AS, Creamer MR, et al. Tobacco Product Use and Associated Factors Among Middle and High School Students -- United States, 2019. *MMWR Surveillance Summaries* 2019;68(12):1-22. doi: 10.15585/mmwr.ss6812a1	Wrong exposure of interest: no mention of effect of e-cigarette advertising or promotions on tobacco use. Wrong study design: descriptive study
121.	Wang Y, Laestadius L, Stimpson JP, Wilson FA. Association Between E-Cigarette Use and Acculturation Among Adult Immigrants in the United States. Substance Abuse: Research & Treatment. 2019;13:N.PAG-N.PAG.	Study does not explore the phenomenon of interest (not related to advertisement, promotion, or marketing)
122.	Westling E, Rusby JC, Crowley R, et al. Electronic Cigarette Use by Youth: Prevalence, Correlates, and Use Trajectories From Middle to High School. *Journal of Adolescent Health* 2017;60(6):660-66. doi: 10.1016/j.jadohealth.2016.12.019	Wrong exposure of interest: no mention of e-cigarette advertising or promotions

No.	Citation	Reason for exclusion
123.	Williams T, White V. What Factors are Associated with Electronic Cigarette, Shisha-Tobacco and Conventional Cigarette Use? Findings from a Cross-Sectional Survey of Australian Adolescents? Substance Use & Misuse. 2018;53(9):1433-43.	Exposure of interest not relevant. The study focussed on the association between sociodemographic factors and e-cigarette use. The only reference to advertisements was in the discussion section of the study
124.	Wood GG, Waselewski ME, Bryant AC, et al. Youth Perceptions of Juul in the United States. *JAMA Pediatrics* 2020;174(8):800-02. doi: 10.1001/jamapediatrics.2020.0491	Wrong exposure of interest: no mention of e-cigarette advertising or promotions
125.	Wylie BJ, Hauptman M, Hacker MR, Hawkins SS. Understanding Rising Electronic Cigarette Use. Obstetrics & Gynecology. 2021;137(3):521-7.	Wrong publication type: this article was a commentary piece
126.	Yang Y, Lindblom EN, Salloum RG, Ward KD. Perceived health risks associated with the use of tobacco and nicotine products during the COVID-19 pandemic. Tob Induc Dis. 2021;19:46.	Wrong exposure of interest: study examined exposure to e-cigarette modified risk messages (MRMs) with a nicotine warning. Ads with warnings did not belong to advertisement, promotion and sponsorship category.
127.	Zhan Y, Zhang Z, Okamoto JM, Zeng DD, Leischow SJ. Underage JUUL Use Patterns: Content Analysis of Reddit Messages. J Med Internet Res. 2019;21(9):e13038.	Wrong type of analysis: the studies only analysed the content of Reddit measures related to demographics, methods of access, product characteristics and underage use of JUUL, with no analysis of target audience behaviours or reactions. No relevant exposure included

Appendix 4 of technical report: Rationale for RCT risk of bias judgements

Contents

Farrelly 2015

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random assignment was done via an online panel provided through a least-filled quota methodology.
Allocation concealment (selection bias)	Low risk	Participants were assigned to arms though an online panel provider
Blinding of participants and personnel (performance bias)	High risk	Participants had knowledge of allocated interventions because those in the treatment arm saw advertisements and then completed the survey whereas those in the control arm completed the survey before viewing the same advertisements.
Blinding of outcome assessment (detection bias)	High risk	Personnel had knowledge of allocated interventions because those in the treatment arm saw advertisements and then completed the survey whereas those in control arm completed the survey before viewing the same advertisements.
Incomplete outcome data (attrition bias)	Low risk	Missing outcome data were balanced in numbers across intervention groups, with similar reasons for missing data across groups
Selective reporting (reporting bias)	Low risk	No reporting bias was detected
Other bias	Low risk	The study appears to be free of other sources of potential bias. No other biases detected

Mays 2016

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random sequence generation was done using an algorithm in the online survey
Allocation concealment (selection bias)	Unclear risk	An algorithm implemented in the online survey randomly allocated participants.
Blinding of participants and personnel (performance bias)	Unclear risk	Insufficient information on blinding of participants and personnel
Blinding of outcome assessment (detection bias)	Unclear risk	Insufficient information on blinding of outcome assessment to make an assessment
Incomplete outcome data (attrition bias)	Low risk	Reasons for attrition/exclusions are reported and are balanced
Selective reporting (reporting bias)	Low risk	No reporting bias was detected
Other bias	Low risk	The study appears to be free of other sources of potential bias

Padon 2018

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Study only mentions random allocation without any further information on methods of randomisation to permit assessment
Allocation concealment (selection bias)	Unclear risk	The method of concealment is not described to permit assessment
Blinding of participants and personnel (performance bias)	Unclear risk	Insufficient information on blinding to permit assessment
Blinding of outcome assessment (detection bias)	Unclear risk	Insufficient information on blinding of outcome to permit assessment
Incomplete outcome data (attrition bias)	Low risk	Missing outcome data was balanced in numbers across intervention groups, and similar reasons for missing data across groups
Selective reporting (reporting bias)	Low risk	No reporting bias was detected
Other bias	Low risk	The study appears to be free of other sources of bias

Petrescu 2017

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	A pre-established random sequence generated by the statistical package R was used
Allocation concealment (selection bias)	High risk	Personnel were aware of the allocation as they handed over materials based on allocations.
Blinding of participants and personnel (performance bias)	Unclear risk	Insufficient information on blinding to permit assessment
Blinding of outcome assessment (detection bias)	Unclear risk	Insufficient information on blinding to permit assessment
Incomplete outcome data (attrition bias)	Low risk	Number of withdrawals reported and although reasons for withdrawals were not reported it appears balanced.
Selective reporting (reporting bias)	Low risk	No reporting bias was detected
Other bias	Low risk	The study appears to be free of other sources of potential bias

Pokhrel 2019

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Only mentioned that participants were randomly assigned but no other information on method of sequence generation was reported so cannot assess
Allocation concealment (selection bias)	Unclear risk	The method of concealment is not described adequately to permit assessment
Blinding of participants and personnel (performance bias)	Unclear risk	Insufficient information on blinding to permit assessment
Blinding of outcome assessment (detection bias)	Unclear risk	Insufficient information on blinding to permit assessment
Incomplete outcome data (attrition bias)	Unclear risk	Insufficient reporting of attrition and withdrawals to permit assessment
Selective reporting (reporting bias)	Low risk	No reporting bias was detected
Other bias	Low risk	The study appears to be free of other sources of potential bias

Rath 2017

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation was done through software
Allocation concealment (selection bias)	Low risk	Randomisation process was not accessible to investigators or participants thus maintaining allocation concealment
Blinding of participants and personnel (performance bias)	Low risk	Participants and personnel blinded
Blinding of outcome assessment (detection bias)	Low risk	Participants were blinded and outcomes were self-reported.
Incomplete outcome data (attrition bias)	Unclear risk	Insufficient information reported to permit assessment
Selective reporting (reporting bias)	Low risk	No reporting bias was detected
Other bias	Low risk	The study appears to be free of other sources of bias

Vasiljevic 2016

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Only mentioned participants were randomly assigned but no other information on method of sequence generation was reported so cannot assess.
Allocation concealment (selection bias)	High risk	Study mentioned that experimenters assigned participants to arms and the process is likely to be biased.
Blinding of participants and personnel (performance bias)	Unclear risk	Participants were blinded but personnel were probably not. How performance bias overall might be affected was assessed as not clear by reviewers
Blinding of outcome assessment (detection bias)	Low risk	Participants were blinded and outcomes were self-reported, so djudged as low risk of bias.
Incomplete outcome data (attrition bias)	Unclear risk	Insufficient reporting of attrition provided
Selective reporting (reporting bias)	Low risk	No reporting bias detected
Other bias	Low risk	The study appears to be free of other sources of potential bias

Vasiljevic 2017

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Participants were randomly assigned using a pre-established random sequence generated by a statistical package
Allocation concealment (selection bias)	Low risk	Both experimenters and participating children were blinded to allocation of randomisation
Blinding of participants and personnel (performance bias)	Low risk	Blinding of both participants and personnel was achieved. Participants t aware that they were seeing an advertisement but were not aware of other kind of advertisements seen by other children.
Blinding of outcome assessment (detection bias)	Low risk	Outcome assessment was blinded
Incomplete outcome data (attrition bias)	Unclear risk	No information on loss to follow up or attrition
Selective reporting (reporting bias)	Low risk	No reporting bias detected
Other bias	Low risk	The study appears to be free of other sources of potential bias

Villanti 2016

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation was completed using a computer generated sequence within the survey software
Allocation concealment (selection bias)	Low risk	Central allocation was used
Blinding of participants and personnel (performance bias)	Low risk	Allocation sequence concealed from investigators and participants
Blinding of outcome assessment (detection bias)	Low risk	All analyses were conducted by original assigned groups and analysts were not blinded to study condition when running outcome analyses. However, the outcome measurement is not likely to be influenced
Incomplete outcome data (attrition bias)	Low risk	The proportion of missing data was minimal, missing data were handled with listwise deletion per Stata's survey procedures. All analyses were conducted by original assigned groups
Selective reporting (reporting bias)	Low risk	The study reported on all expected outcomes mentioned in the methods
Other bias	Low risk	The study appears to be free of other sources of potential bias

Vogel 2020

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Only mentioned participants were randomly assigned but no other information on method of sequence generation was reported so cannot assess
Allocation concealment (selection bias)	Low risk	Allocation concealment was achieved
Blinding of participants and personnel (performance bias)	Low risk	The participants were blinded and no personnel were involved to influence performance bias as the study was completed at participants' homes
Blinding of outcome assessment (detection bias)	Low risk	Participants were blinded and outcome was self-reported
Incomplete outcome data (attrition bias)	Unclear risk	No information on loss to follow up or attrition
Selective reporting (reporting bias)	Low risk	No reporting bias detected
Other bias	Low risk	The study appears to be free of other sources of potential bias

Appendix 5 Technical Report Risk of bias of cohort, cross-sectional and quasi-experimental studies

This is presented as a Microsoft Excel Sheet for ease of reporting.

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Appendix 5 of technical report: JBI Critical Appraisal Checklist for Cohort Studies

Study ID	1. Were the two groups similar and recruited from the same population?	2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?	3. Was the exposure measured in a valid and reliable way?	4. Were confounding factors identified?	5. Were strategies to deal with confounding factors stated?	6. Were the groups/ participants free of the outcome at the start of the study (or at the moment of exposure)?	7. Were the outcomes measured in a valid and reliable way?	8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?	9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	10. Were strategies to address incomplete follow up utilized?	11. Was appropriate statistical analysis used?	Overall judgement	Support for all judgements
Agaku 2017	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	Yes	Yes	Unclear	Yes	Moderate	Potential confounder identified was tips from former smokers (page 2); however, strategy to address this was not reported clearly. The measures for exposures and outcomes were not reported clearly. Exposure to advertisements was based on a single question (page 2).
Beleva 2019	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Moderate	The study did not identify confounding factors. Strategies to deal with confounding variables were not mentioned but a multilevel Poisson regression was used. Questionnaire adapted from previous research and a previously validated drug use questionnaire were used to measure exposures and outcomes respectively.
Camenga 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Good	Data from longitudinal surveys were used and follow up time was reported.
Cavazos 2021	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Moderate	It was not clearly specified whether confounders were identified. Covariates were identified. It was unclear whether confounders were adjusted for in the analysis. The study reported that there was a 7% loss to follow up but did notexplicitly mention the strategy used to deal with this.
Chen-Sankey 2019	Yes	Yes	yes	Unclear	Yes	Yes	Unclear	Yes	Yes	Unclear	Yes	Moderate	Confounders were not reported but appear to have been adjusted in the statistical analysis. The exposure and outcome measures were unclear. The survey instrument did not include questions related to advertisement exposure.
D'Angelo 2020	Yes	Yes	yes	Unclear	Unclear	Yes	yes	Yes	Unclear	Unclear	Yes	Moderate	It was unclear whether confounders were addressed. Strategies to deal with confounding variables were not mentioned
Etim 2020	Yes	Yes	yes	Unclear	Unclear	Yes	Unclear	Yes	Yes	Unclear	Yes	Moderate	Covariates were reported. It was unclear whether confounders were addressed. Follow up was complete but a certain number of participants were lost to follow up, for which reasons were provided.

Study ID	1. Were the two groups similar and recruited from the same population?	2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?	3. Was the exposure measured in a valid and reliable way?	4. Were confounding factors identified?	5. Were strategies to deal with confounding factors stated?	6. Were the groups/ participants free of the outcome at the start of the study (or at the moment of exposure)?	7. Were the outcomes measured in a valid and reliable way?	8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?	9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	10. Were strategies to address incomplete follow up utilized?	11. Was appropriate statistical analysis used?	Overall judgement	Support for all judgements
Hansen 2020	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Good	Exposure and outcome measurements were based on findings from previous studies (page 3). Confounding factors were identified and were adjusted in statistical analysis. The smoking status of participants is not provided in the methods section to determine if they were free of the outcome. Follow up time was 12 months. Follow up was complete but a certain number of participants were lost to follow up, for which reasons were provided. Tests were conducted to analyse attrition between baseline and follow up sample.
Lee 2019	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Moderate	The Population Assessment of Tobacco and Health (PATH) survey was utilised. Exposure and outcomes measurements were based on previous research findings. Confounders were not identified but covariates were. It was unclear whether confounding factors were adjusted for in statistical analysis. Follow-up assessments every one year for two years.
Loukas 2019	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Moderate	Exposure and outcomes measurements were based on previous research findings. Sociodemographics and past tobacco use were adjusted for. Details on follow-up completeness or incompleteness were not clear.
Mantey 2019	Yes	Yes	Unclear	unclear	yes	No	Unclear	Yes	Yes	Yes	Yes	Moderate	Exposure and outcome measures not based on previous studies, validated scales or large population studies. All participants were smokers so not free of the outcome. The study did not provide sufficient details on confounders, however, they were adjusted in regression models. Study reported reasons for loss to follow-up and strategies to address incomplete follow up (attrition analysis was performed).
Nagelhout 2016	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Moderate	Outcome present at the start of the study (all smokers). International Tobacco Control (ITC) Netherlands Survey is a national survey. The questions used for the ITC Netherlands Survey were adapted from the conceptual model and questionnaire of the ITC Four Country Survey. Confounders were adjusted in regression models. Study reported reasons for loss to follow-up however no strategies were mentioned to address incomplete follow up.

Study ID	1. Were the two groups similar and recruited from the same population?	2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?	3. Was the exposure measured in a valid and reliable way?	4. Were confounding factors identified?	5. Were strategies to deal with confounding factors stated?	6. Were the groups/ participants free of the outcome at the start of the study (or at the moment of exposure)?	7. Were the outcomes measured in a valid and reliable way?	8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?	9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	10. Were strategies to address incomplete follow up utilized?	11. Was appropriate statistical analysis used?	Overall judgement	Support for all judgements
Nicksic 2017a	Yes	Yes	Yes	Unclear	yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Moderate	Sample were recruited from a rapid response surveillance system. Baseline and follow-up data were collected from the same cohort of students in 2014–2015,
Pierce 2018	Yes	Yes	Yes	unclear	Yes	No	Yes	Yes	No	No	Yes	Moderate	The study did not provide sufficient details on confounders however, they were adjusted for in regression models. Study did not report reasons for loss to follow-up and no strategies mentioned to address incomplete follow-up. Exposure and outcome measures from nationally representative, longitudinal US study. It was unclear if confounders were identified, but covariates adjusted for in analysis. Outcome present at the start of the study (all smokers).
Pike 2019	Yes	Yes	Yes	unclear	yes	Yes	Yes	Yes	Yes	No	Yes	Moderate	The study did not provide sufficient details on confounder, however, they were adjusted for in regression models. Study did not report reasons for loss to follow-up and no strategies mentioned to address incomplete follow-up.

JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies

Study ID	1. Were the criteria for inclusion in the sample clearly defined?	2. Were the study subjects and the setting described in detail?	3. Was the exposure measured in a valid and reliable way?	4. Were objective, standard criteria used for measurement of the condition?	5. Were confounding factors identified?	6. Were strategies to deal with confounding factors stated?	7. Were the outcomes measured in a valid and reliable way?	8. Was appropriate statistical analysis used?	Overall judgement	Support for all judgements
Ali 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Good	Data were obtained from US NATS survey. The study included exogenous measures of exposure to e-cigarette advertising in magazines and TV.
Ashford 2017	Yes	Yes	Yes	Yes	Unclear	Yes	Unclear	Yes	Moderate	A 10-item instrument was used to assess degree of exposure to advertising and information about e-cigarettes in media, adapted from the National Institute on Drug Abuse. For strategies to deal with confounding variables, regression was used and goodness of fit was assessed.
Auf 2018	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Good	Data were obtained from NYTS survey that included valid questions related to exposure to advertisements.
Booth 2019	Yes	Yes	Yes	Yes	No	No	Unclear	Yes	Moderate	The study did not identify confounding factors. Strategies to deal with confounding variables were not mentioned. Outcomes related to attitudes were assessed using Likert type scale.
Case 2020	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes	Moderate	Recall of e-cigarette marketing and reasons to use JUUL were measured using single questions that included Likert scale responses. Confounding factors were not identified and reported, and it was unclear whether any confounding factors were addressed in the statistical analysis. The Texas Adolescent Tobacco and Marketing Surveillance System (TATAMS) survey was used which did not consist of questions related to advertising exposure.
Cho 2019	Yes	Yes	Unclear	yes	Unclear	Yes	Unclear	Yes	Moderate	The exposure was measured based on a single question that used Likert type scale, and the outcome measurement was unclear. The study did not identify confounding factors.
Cho 2020	Yes	Yes	Yes	Yes	Unclear	Yes	Unclear	Yes	Moderate	The International Tobacco Control (ITC) Four Country Smoking and Vaping survey was utilised. Confounding factors were not identified. Although adjusted OR was calculated, it was unclear whether confounders were controlled.
Dai 2016	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Moderate	Confounders were not identified but covariates were. It was unclear if confounders were adjusted for in the analysis. The NYTS was utilised that included items related to exposure and outcome measurements.
Dai 2017	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Good	NATS survey was utilised. Inclusion criteria clearly defined, confounders identified and adjusted for in analysis, and appropriate statistical analysis used.
Do 2020	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	Yes	Moderate	Unclear if exposure and outcome measures were valid and reliable.

Study ID	1. Were the criteria for inclusion in the sample clearly defined?	2. Were the study subjects and the setting described in detail?	3. Was the exposure measured in a valid and reliable way?	4. Were objective, standard criteria used for measurement of the condition?	5. Were confounding factors identified?	6. Were strategies to deal with confounding factors stated?	7. Were the outcomes measured in a valid and reliable way?	8. Was appropriate statistical analysis used?	Overall judgement	Support for all judgements
Donaldson 2017	Yes	yes	Yes	Yes	Unclear	Yes	Unclear	Yes	Moderate	The study adjusted for different variables in the models. It was unclear whether the outcomes measurements were valid and reliable.
Du 2020	Yes	Yes	Yes	Yes	Unclear	yes	Yes	Yes	Moderate	Nationwide, state-based, large-scale health survey of US adults used to measure the outcome. Confounding factors were not identified or described but were adjusted for in statistical analysis. Covariates were identified.
Ebrahimi 2020	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Moderate	Exposure and outcome measure questions were based on previous studies. NYTS survey was utilised. Confounders were not identified and it was unclear whether they were adjusted in statistical analysis.
Filippidis 2017	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Good	National survey so exposure and outcome measures likely valid and reliable. Inclusion criteria clearly defined, confounders identified and adjusted for in analysis, appropriate statistical analysis used.
Ford 2016	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Moderate	Prior research was conducted to inform the development and refinement of the e-cigarette measures. Confounding variables were not stated.
Giovenco 2016	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Moderate	The New Jersey Youth Tobacco Survey was utilised that included items related to exposure and outcome measurements. The survey instrument was extensively piloted. Confounders were not identified but covariates were adjusted for in the analysis.
Hammig 2016	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Good	Goodness of fit of the logistic model was used. The NYTS survey was utilised that included exposure and outcome assessments.
Hammond 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Good	The ITC survey was used that included questions related to exposure and outcome measurements. Confounding factors were identified and adjusted for in the analysis.
Hansen 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Good	The exposure and outcome measures were based on a previous research. Control variables were identified and were adjusted in statistical analysis.
Hébert 2017	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes	Moderate	Confounding variables were not stated. Strategies to deal with confounding variables were not stated but authors standardised the data based on age and weighted logistic regression models were used. The Texas Adolescent Tobacco and Marketing Surveillance System (TATAMS) survey was used which did not consist of questions related to advertisement exposure.
Herrera 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Good	The exposure and outcome measures were based on a previous research. Control variables were identified and were adjusted in statistical analysis.

Study ID	1. Were the criteria for inclusion in the sample clearly defined?	2. Were the study subjects and the setting described in detail?	3. Was the exposure measured in a valid and reliable way?	4. Were objective, standard criteria used for measurement of the condition?	5. Were confounding factors identified?	6. Were strategies to deal with confounding factors stated?	7. Were the outcomes measured in a valid and reliable way?	8. Was appropriate statistical analysis used?	Overall judgement	Support for all judgements
Kim 2015	Yes	Yes	Yes	Yes	No	No	Unclear	Yes	Moderate	There was a lack of information on confounders.
Kinnunen 2015	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Good	National survey so exposure and outcome measures likely valid and reliable. Inclusion criteria clearly defined, unclear if confounders identified. Adjusted for in regression analysis, appropriate statistical analysis used.
Lienemann 2019	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Good	The Population Assessment of Tobacco and Health (PATH) survey was utilised. No information pertaining to confounders is provided however they were adjusted using regression models. Inclusion criteria defined, study subjects and settings described
Little 2016	Yes	Yes	Unclear	Yes	Unclear	yes	Unclear	Yes	Moderate	No information on confounders or strategies to deal with them is reported. A self reported survey questionnaire is used to measure outcome and exposure. No information is provided on its validity and reliability.
Majmundar 2021	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Moderate	Exposure and outcome assessment measures appeared to be informed by previous work. Confounders were not identified but covariates and were adjusted in statistical analysis.
Mantey 2016	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Moderate	Insufficient information on confounders but adjusted for in data analysis. A national survey data is used to measure the exposure. Inclusion criteria defined, study subjects and settings described.
Marion 2020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Good	The NYTS survey was utilised which includes questions related to exposures and outcomes of interest. Ordinal logistic regression was used for controlling sociodemographics.
Nicksic 2017	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Good	Covariates were controlled and adjusted in data analysis. The exposure and outcome measures are validated and reliable. Inclusion criteria and study setting clearly defined.
Papaleontiou 2020	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Moderate	The NYTS survey was utilised which includes questions related to exposures and outcomes of interest. Confounders were not identified but covariates and were adjusted in statistical analysis.
Pesko 2017	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Moderate	The NYTS survey was utilised which includes questions related to exposures and outcomes of interest. Confounders were not identified but covariates were, which were adjusted in statistical analysis.
Pierce 2017	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Moderate	The Population Assessment of Tobacco and Health (PATH) survey was utilised. Exposure and outcomes measurements were based on previous research findings. Confounders were not identified but covariates were, which were adjusted in statistical analysis.

Study ID	1. Were the criteria for inclusion in the sample clearly defined?	2. Were the study subjects and the setting described in detail?	3. Was the exposure measured in a valid and reliable way?	4. Were objective, standard criteria used for measurement of the condition?	5. Were confounding factors identified?	6. Were strategies to deal with confounding factors stated?	7. Were the outcomes measured in a valid and reliable way?	8. Was appropriate statistical analysis used?	Overall judgement	Support for all judgements
Pokhrel 2015	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes	Moderate	It was unclear if the study identified confounders but covariates were adjusted. It was unclear whether the survey instruments used to measure exposure and outcome were valid and reliable.
Pokhrel 2017	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes	Moderate	Confounders were not identified but covariates were. It was unclear if confounders were adjusted for in the analysis. Inclusion criteria were briefly reported. It was unclear whether the survey instruments used to measure exposure and outcome were valid or reliable.
Pu 2017	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Good	National survey so exposure and outcome measures likely valid and reliable. Inclusion criteria clearly defined, confounders identified and adjusted for in analysis, appropriate statistical analysis used.
Ratneswaran 2019	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Moderate	Measures for exposure and outcome from NYTS national survey. Some confounders identified but not controlled for in analysis. Inclusion criteria defined, appropriate statistical analysis used
Reinhold 2017	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	Yes	Moderate	Measures for exposure and outcome not from previous studies, validated measures or large national surveys. Confounders identified and controlled for in analysis. Inclusion criteria defined, appropriate statistical analysis used
Sanders-Jackson 2015	Yes	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes	Moderate	Measures for exposure and outcome not from previous studies, validated measures or large national survey. Unclear if confounders identified but controlled for in analysis. Inclusion criteria defined, appropriate statistical analysis used
Sawdey 2017	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Good	Confounders identified and controlled for in analysis. Exposure and outcome measures adapted from large US studies or validated measures. Inclusion criteria and study setting clearly defined.
Shadel 2020	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Moderate	Insufficient information on confounders but adjusted in data analysis. A self reported survey questionnaire is used to measure outcome and exposure. No information is provided on its validity and reliability.
Singh 2016	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Moderate	National survey so exposure and outcome measures were valid and reliable. Inclusion criteria clearly defined, unclear if confounders identified but covariates adjusted for in analysis, appropriate statistical analysis used.
Smith 2015	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	Moderate	Unclear if confounders identified and controlled for in analysis. Inclusion criteria defined, appropriate statistical analysis used.

Study ID	1. Were the criteria for inclusion in the sample clearly defined?	2. Were the study subjects and the setting described in detail?	3. Was the exposure measured in a valid and reliable way?	4. Were objective, standard criteria used for measurement of the condition?	5. Were confounding factors identified?	6. Were strategies to deal with confounding factors stated?	7. Were the outcomes measured in a valid and reliable way?	8. Was appropriate statistical analysis used?	Overall judgement	Support for all judgements
Stroup 2018	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	Moderate	National survey so exposure and outcome measures likely valid and reliable. Inclusion criteria clearly defined, unclear if confounders identified and adjusted for in analysis, appropriate statistical analysis used.
Tan 2015a	Yes	Yes	Unclear	Yes	Unclear	Yes	Yes	Yes	Moderate	Exposure measured not adapted from past studies or national survey. Inclusion criteria clearly defined. Study subjects and setting described in detail. Outcome measured based off past validated measures. Confounders not identified, covariates adjusted for in analysis.
Trumbo 2015	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Moderate	Age only covariate identified, no confounders identified or controlled for in analysis. Measures for exposure and outcome based on past studies or previously validated measures. Inclusion criteria defined, appropriate statistical analysis used.
Unger 2018	Yes	Yes	Yes	Yes	No	Unclear	Yes	Yes	Moderate	Confounding factors not identified and unclear if controlled for in analysis. Data comes from national study so exposure and outcomes measured in valid and reliable way.

JBI Critical Appraisal Checklist for Quasi-Experimental Studies (non-randomised experimental studies)

Study ID	1. Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)?	2. Were the participants included in any comparisons similar?	3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	4. Was there a control group?	5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?	6. Was follow up complete and if not, were differences between group;s in terms of their follow up adequately described and analysed?	7. Were the outcomes of participants included in any comparisons measured in the same way?	8. Were outcomes measured in a reliable way?	9. Was appropriate statistical analysis used?	Overall judgement	Support for all judgements
Maloney 2016	Yes	Yes	Yes	Yes	No	Unclear	Yes	Yes	Yes	Moderate	There was only measurement pre- and post-test. Follow up was not reported clearly. Outcome measures were based on previous research findings.

Appendix 6 of technical report: rationale for risk of bias assessments of qualitative studies

Study ID	Was there a clear statement of the research?	Is a qualitative methodology appropriate?	Was the research design appropriate to address the aims of the research?	Was the recruitment strategy appropriate to the aims of the research?	Was the data collected in a way that addressed the research issue?	Has the relationship between researcher and participants been adequately considered?	Have ethical issues been taken into consideration?	Was the data analysis sufficiently rigorous?	Is there a clear statement of findings?	How valuable is the research?	Key limitation and comment on richness from quality appraisal	Notes on critical appraisal
Kim 2020	Yes	Yes	Yes	Unclear	Yes	Unclear	Yes	Yes	Yes	Yes	All participants young adult poly-tobacco users from California so results cannot be extrapolated to other groups u. All advertisements were from magazines or online,nable to examine other forms of marketing.	No discussion around why certain people didn't take part in the study, and little detail on the social media recruitment approach. Researchers do not address relationship between researchers and participants.
Alpert 2020	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	A limitation of this study is that all participants resided in the same geographic area and may have had similar attitudes. Furthermore, only a select few examples of branded e-cig posts were used to gauge reactions.	No mention of the relationship between the researcher and participants.
Chen 2020	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	This study focused on young adolescent non-users; therefore, the current results may not be applicable to other populations and users of e-cigarette. There was a gender imbalance in the study, with more women than men participating.	No mention of the relationship between the researcher and participants.

Study ID	Was there a clear statement of the research?	Is a qualitative methodology appropriate?	Was the research design appropriate to address the aims of the research?	Was the recruitment strategy appropriate to the aims of the research?	Was the data collected in a way that addressed the research issue?	Has the relationship between researcher and participants been adequately considered?	Have ethical issues been taken into consideration?	Was the data analysis sufficiently rigorous?	Is there a clear statement of findings?	How valuable is the research?	Key limitation and comment on richness from quality appraisal	Notes on critical appraisal
Cogwill 2020	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Small number of schools and students included. All participants located in California due to funding requirements, where there is a relatively low level of tobacco use amongst young people compared to the rest of the US	No mention of the relationship between the researcher and participants.
Laestadius 2020	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Qualitative sampling approaches were used, and given the focus group format, not all participants engaged with each question equally. Sample size differed across smoking status groups, so the perceptions of certain groups may not be as well represented. Transferability of results to other populations difficult	No mention of the relationship between the researcher and participants.
Amin 2020	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Challenges to generalizability, as participants surveyed not a representative population	No mention of the relationship between the researcher and participants.
Park 2019	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Challenges to generalizability as all participants from one geographical area. More never-users than ever-users and a relatively small number of participants had used e-cigarettes. Both interviewers female and non-smokers which may have introduced bias.	